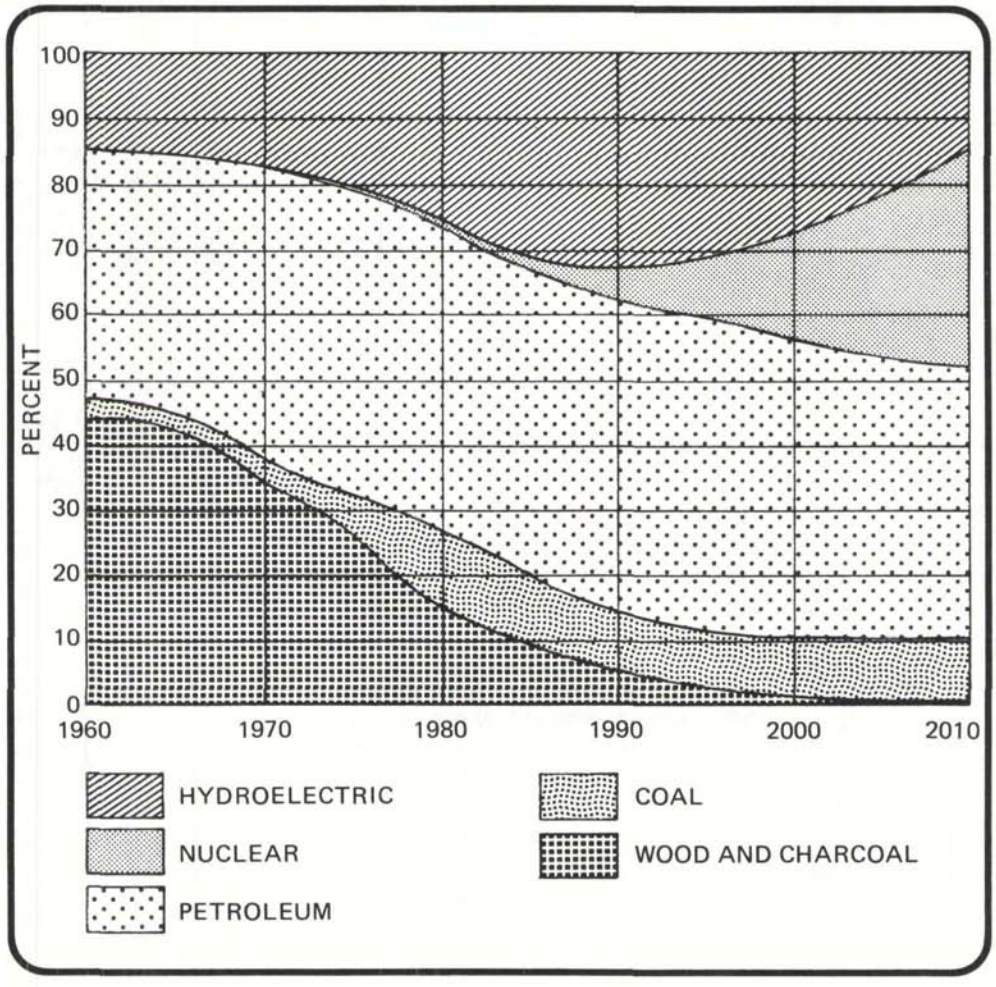
Brazil's Nuclear Power Programme

Government studies of Brazil's energy picture for the next 25 to 30 years indicate that hydroelectric power will provide an increasing share of the country's electrical requirements until about 1990 (Figure 1). By that time, virtually all of the hydroelectric potential near the regions that are the heaviest consumers of electricity will have been developed, and the Government sees nuclear power as the priority alternative source for meeting the additional electrical needs of those regions.

In order to meet the projected demand for nuclear power, Brazil has launched a large nuclear energy programme that calls for an installed nuclear power capacity of about 10 000 MW(e) by the early 1990's (Figure 2). A new infrastructure has been set up to

Fig.1: Primary energy consumption in Brazil, 1960–2010.



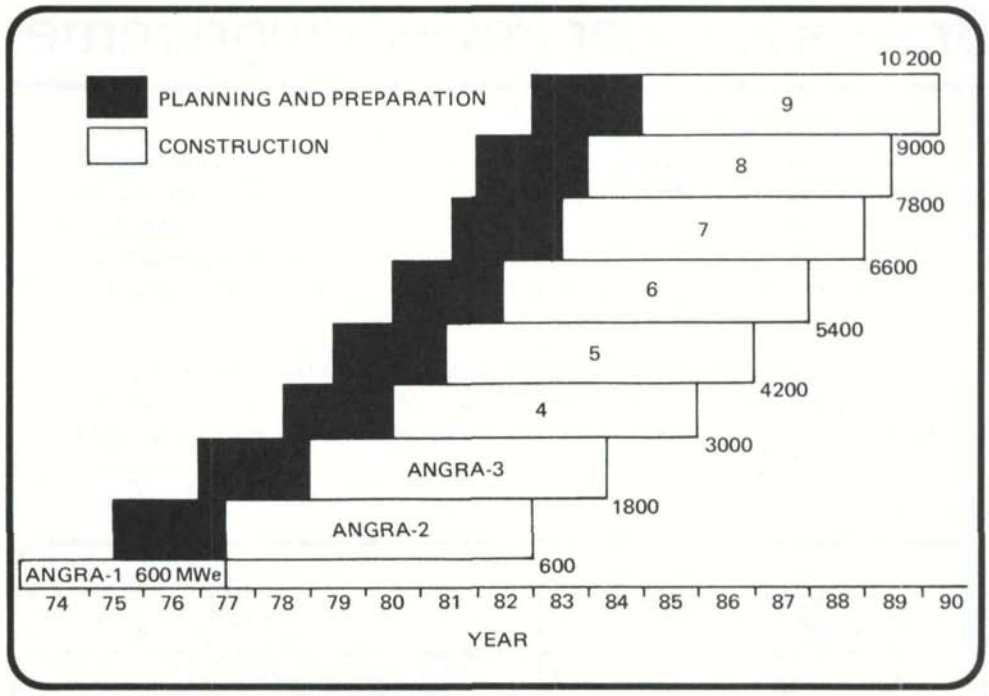


Fig.2: Brazil's programme for constructing eight 1200 MW(e) nuclear power plants.

implement the nuclear power programme (Figure 3). The programme not only calls for the construction of nuclear power plants but also for the development of an integrated nuclear industry, from uranium mining to enrichment and fuel reprocessing.

Brazil's first nuclear power station, Angra I, which has a net capacity of 600 MW(e), is nearing completion and is expected to be ready for testing in 1977. Two 1200 MW(e) units, Angra II and Angra III, are in the planning stages and are seen as the first step in the development programme for creating an integrated nuclear capability in Brazil. These new units will be built by Kraftwerk Union (KWU) of the Federal Republic of Germany, and on completion will be purchased by FURNAS – Centrais Elétricas S.A., a subsidiary of ELETROBRÁS. NUCLEBRÁS – Empresas Nucleares Brasileiras S.A., the State monopoly responsible for the development of the national nuclear energy industry, will supply the fuel and the equipment that is to be manufactured in Brazil.

A bilateral agreement between Brazil and the Federal Republic of Germany provides for co-operation in the development of peaceful uses of nuclear energy, including the construction and design of nuclear reactors, uranium enrichment and reprocessing of irradiated fuel. The agreement also provides for the transfer of technological information and know-how in these fields. A safeguards agreement between Brazil, the Federal Republic of Germany and the IAEA, which was signed in February 1976, reaffirms the important principle that IAEA safeguards do not only apply to the equipment and fuel that is transferred but also to any hardware that derives from the transferred technology and technical know-how. Thus, the safeguards will apply to any facility or equipment designed, constructed or operated on the basis of transferred technology, and as well to any resulting nuclear material.

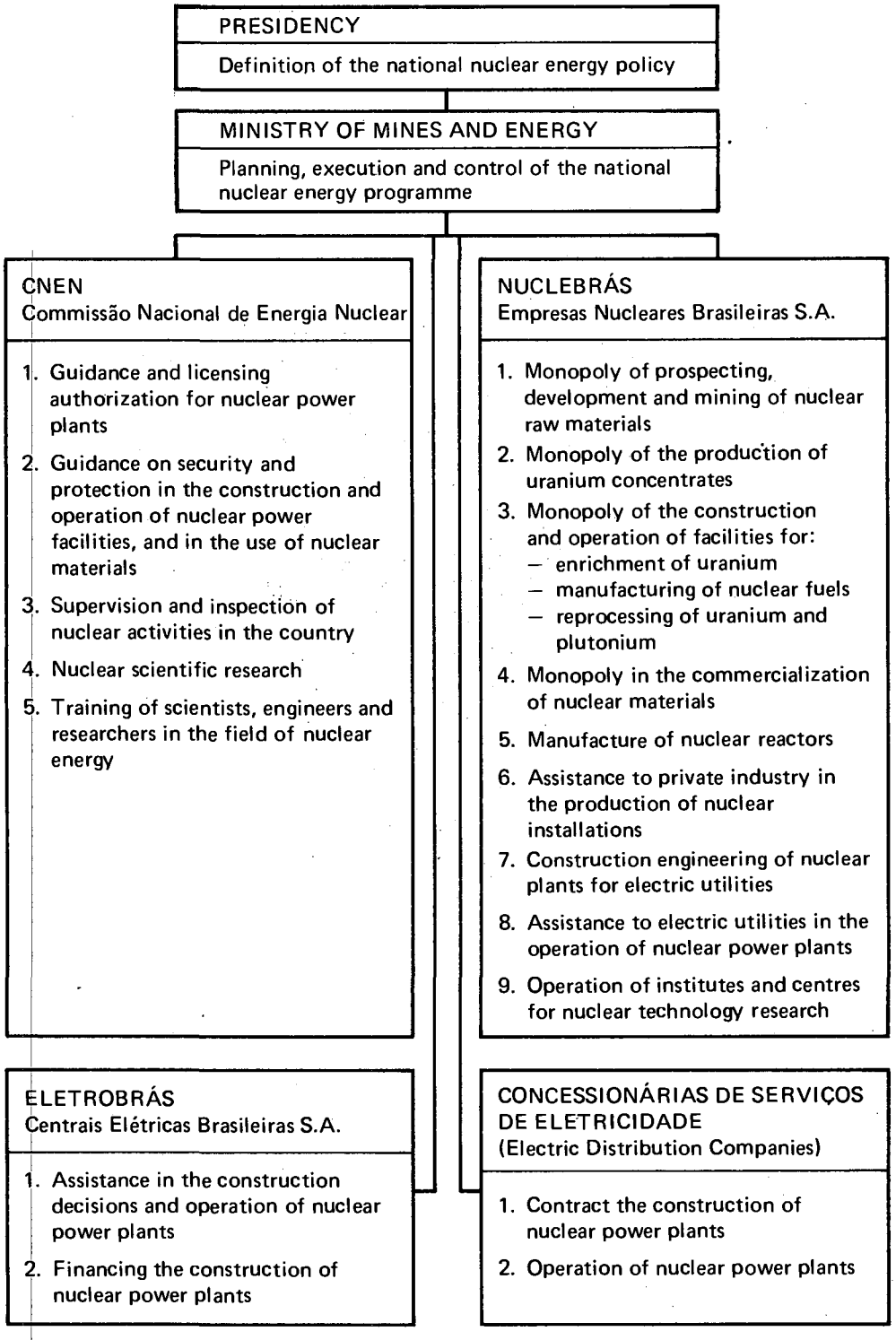


Fig.3: Nuclear Energy Organizations in Brazil.

CONSUMPTION OF ELECTRICAL ENERGY IN 1974 IN BRAZIL

	Population	Consumption of Electricity	Consumption per Capita
1. Southeast Region	44 848 000	46 688 GWh	1041 kWh
2. Northeast Region	31 490 000	6 634 GWh	211 kWh
3. North Region	4 120 000	806 GWh	196 kWh
4. Central West Region	6 027 000	1 364 GWh	226 kWh
5. South Region	18 857 000	6 510 GWh	345 kWh
BRAZIL – Total	105 342 000	62 002 GWh	589 kWh

Brazil plans to build six additional 1200-MW(e) units by 1990. The type of reactor is pressurized light water (PWR), fuelled with 3% enriched uranium. Consideration of the regional energy balances in Brazil indicates that these six units can be installed in stations of two units each, which would reduce the cost of construction. Two of the stations will be required in the Southeast Region and one in the Northeast Region.

Other factors that further limit the location of the nuclear power stations have been taken into consideration. The stations require ample water for cooling, easy road, rail and sea access (for tranportation of heavy equipment) and should be near existing electrical transmission systems. Two other important factors are public safety and environmental protection. The Angra site, for example, is strategically located: it is on the ocean shore in a sheltered bay 130 km from Rio de Janeiro and 220 km from São Paulo, the two largest industrial centres in Brazil. Studies indicate that one of the new stations for the Southeast Region should be located as close as possible to greater São Paulo and the other near Rio or Victoria. The nuclear station for the Northeast should be near Recife or Salvador.

Economic calculations, based on detailed studies by FURNAS, show that in spite of their higher capital costs, nuclear power plants will compare favourably in terms of economics with hydroelectric and thermal power plants. The high productivity of nuclear power stations is expected to compensate for the larger initial investment that they require. The 3000-MW installation at Angra, for instance, will produce annually twice as many kilowatt-hours of electricity as the 3000-MW hydroelectric station at Ilha Solteira.