

continuing, with the United States trying to restrict the spread of "sensitive" technologies and materials and Brazil insisting on the right to include nuclear energy in its development strategy. In the words of Brazil's chief delegate to the International Nuclear Fuel Cycle Evaluation (INFCE), Ambassador Carlos Augusto Proenca Rosa: "the use of nuclear energy in developing countries was treated by INFCE in a restrictive and limited way; there are insinuations, at times, that the major contribution that developing countries could offer in the field of nuclear energy should be to increase the prospection and extraction of their uranium resource to benefit the importing developed countries. . . . We firmly believe that any effective policy of non-proliferation must be non-discriminatory and must bring about measures which are universally applicable, in order not only to guarantee the correct use of nuclear energy by countries which do not possess nuclear weapons, but also to put a stop to the arms race between countries which possess them."

The suspicions repeatedly raised about the Brazilian military government's intentions to develop a bellicose nuclear capacity rely upon past aggression towards Argentina, which led to wars in the 19th century. Today, however, both countries' harsh military regimes are much more interested in signing agreements on exchange of technology, and common ventures, than fomenting regional tensions. Numerous official visits and meetings of the heads of the nuclear programmes of each country have taken place. Each time the peaceful purpose of both countries' nuclear involvement was reaffirmed. Argentina possesses the only nuclear plant operating in Latin America — Atucha I — which functions with natural uranium. It is also negotiating with West Germany's KWU to buy a new nuclear plant similar to the ones being built in Brazil. As the Brazilian programme meets with increasing delays but the industrial capacity for nuclear components develops in both countries, the two countries have entered an era of increasing commercial cooperation, and no-one talks now of any potential enemy to use nuclear weapons against.

But even if Latin America remains free of nuclear weapons, it will not remain free of nuclear waste. To a question about where nuclear waste from the Brazilian programme would be stored, Rex Nazare, acting director of CNEN, the National Commission for Nuclear Energy, responded: "this is not yet defined. But up to six months before the first plant starts operating there is still time to define the location where to deposit waste."

Finding the sites may be difficult, because Brazilian public opinion is becoming aware of the concern that this issue has raised in developed countries. The only site proposed so far is in the mountains

behind Rio de Janeiro, a place with abundant surface water and where a large proportion of the vegetables consumed in Rio are grown. With the modest redemocratization of the military regime an amount of discussion has taken place, which has led the government to abandon the site.

The government presented its justifications for the agreement with Germany as a white paper in 1977. It claimed that nuclear power was "a necessity in view of Brazil's energy needs" and because the price of oil was increasing. It claimed that, between 1940 and 1973, the proportion of imported energy rose from 15 to 40%, and that "the hydroelectric option is approaching its natural economic limit". Paulo Nogueira Batista, director of NUCLEBRAS, the state nuclear corporation, declared that the

German view

● Many of the Brazilian nuclear opposition's calculations on hydropower are "erroneous and foolish", a spokesman for the West German federal ministry for science and technology claimed in a telephone interview last week.

There are no engineers in the opposition group, said the spokesman, and so the costs and difficulty of transporting current from distant hydro stations have been underestimated. Moreover, the Brazilian government had told Germany that by 1995 all available water resources will have been exhausted. "That's why they want to go nuclear."

The contract with Brazil allows for the supply of two reactors, Angra II and III, with options for an additional six. West German participation would decrease in the later reactors, with Brazilian participation rising to 70-90%. "But we would be happy if Brazil approves the Angra III reactor later this year." The deal was important for Germany because "if the nuclear industry wants to be economic they have to produce something", and with nuclear opposition strong in Germany deals with countries such as Brazil and Argentina were attractive. Nuclear opposition in Brazil was decreasing, the spokesman believed.

Pilot plant design for a gas nozzle enrichment plant was nearly complete, and construction has begun on site, but it will proceed at a leisurely pace. For reprocessing used fuel, Brazilian chemists and engineers are in training in Germany and working on the design of a pilot plant.

Safeguards against the diversion of nuclear materials for weapons building are included in a February 1976 agreement between the International Atomic Energy Agency and the Brazilian and West German governments. The safeguards are not "full scope", but apply only to nuclear materials and technology supplied by or derived from West Germany.

Robert Walgate

hydroelectric potential would be used up by 1990.

This technocratic argument was accompanied by reassuring declarations about the safety of nuclear energy. Technical reliability was proven from the "perfect and uninterrupted operation of close to 150 plants in 18 countries with more than 900 reactor-years of commercial service. Thus nuclear energy is the only functional alternative in view of its level of technical confidence and its competitive cost of production." The first two plants to be built with German technology (Angra II and Angra III) were promised for 1982 and 1983 respectively.

In 1974 FURNAS, the electricity supply company, had elaborated a Plan 1990 for electrical energy needs. The data presented formed the basis for the technical justifications of the agreement. It posed a growth rate of the demand for electrical energy of 11.4% per year, linked with the growth of GNP. It estimated an investment cost per plant of \$500/kW and claimed a load factor of 80% for nuclear plants, while the hydroelectric load factor in Brazil is only 50%, due to seasonal variations in rainfall.

In 1979, however, FURNAS presented a revised Plan 1992, which estimated a demand growth rate of only 7.5% a year. Considering that Plan 1990 itself had stated that "nuclear plant participation would be reduced to zero" for a growth rate below 8.7%, the revised figure becomes equivalent to proposing abandoning the whole programme. It revised the investment cost up to \$1,700/kW. The load factor of nuclear plants was brought down to 65.5% based on plants operating in the West.

During the intervening five years Brazil's "economic miracle" had come to a brutal halt: GNP grew only by 4.1% in 1977, compared to 11.8% in 1975. As censorship slackened, various sectors of the Brazilian technocracy started questioning publicly the economics of the agreement. In 1979, General Dirceu Coutinho, who headed NUCLEI, the subsidiary of NUCLEBRAS which will produce isotopes, resigned and denounced the expense of the programme.

Although criticisms of the programme had been voiced by scientists as early as 1975 at the annual meeting of SBPC, the Brazilian Society for the Progress of Science, and by the Brazilian Society for the Progress of Science, and by Brazilian scientists in exile, the defection of those locally referred to as "nucleocrats" has occurred only during the past two years. As the National Congress started functioning again, it set up a Commission of Inquiry to investigate the programme. David Simon, who had headed the Angra I project and was advisor for nuclear affairs to the president of FURNAS, resigned and collaborated with the Congressional Commission, presenting detailed testimony as a technical expert. He wrote: "apart from a reduced minority of experts — mainly to be found in the world of nucleocrats — there exists a quasi unanimity in the scientific