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Brazil: Economics of the Nuclear Alternative

Brazil is laying the foundation for a nuclear industry to meet its electric power needs when hydroelectric sources are being fully used toward the turn of the century. Brazil hopes to achieve nuclear self-sufficiency by establishing a complete nuclear fuel cycle. The large investments needed may worsen Brazil's balance-of-payments situation over the next decade or so, but in the long run, establishment of a nuclear industry would bring substantial savings of foreign exchange.

Imported energy accounts for nearly 30 percent of Brazil's total import bill and is the largest single component of its huge current-account deficits in recent years. Imported energy, almost entirely petroleum, met about 47 percent of total energy requirements in 1976, up from 43 percent in 1970.

Hydroelectric power, the major domestic energy source, meets one third of Brazil's energy needs; most of the remainder is met by oil, more than 80 percent of which is imported.

Requirements

Demand for electricity will continue to grow rapidly. Brazil could require as much as 180 million kilowatts of electric power capacity by the turn of the century, up from 21.8 million kilowatts at the end of 1976. Hydroelectric capacity is expected to reach only 110 million kilowatts by the year 2000, as potential near the main consumption centers approaches full development.

Only about one third of potential hydroelectric power is in south-central Brazil where nearly three fourths of all electricity consumption takes place. About two fifths of Brazil's power potential is in the Amazon region, too remote for economic transmission to major consumption centers.

Brazil plans to have only 15 million kilowatts of conventional thermal capacity by the turn of the century unless large petroleum reserves are found. The country's large coal reserves have been neglected because of their low heat and high sulfur and ash content.

The government has increased oil exploration, spending $400 million on domestic exploration last year, compared with only $140 million in 1973. Brazil has broken a long-standing policy by bringing foreign oil companies back into domestic oil exploration.

The Nuclear Option

Policy makers are turning to nuclear energy against the contingency that oil discoveries will fall far short of requirements.

The nuclear agreement signed in 1975 with West Germany is designed to meet Brazil's requirements through 1990, the first stage of the current nuclear development program. Under the accord, Brazil will buy four 1,300 megawatt reactors with an option on four more. Brazil will also receive a pilot uranium enrichment plant that can be expanded to commercial scale, a fuel fabrication plant, and a fuel reprocessing plant. If the agreement is fully carried out, Brazil will have 10,000 megawatts of nuclear capacity by 1990, enough to meet 5 percent of the economy's energy needs.

Reported cost estimates for the West German agreement range from $4 billion to $10 billion. Assuming that Brazil acquires the full package—eight reactors and a complete fuel cycle large enough to support them—we believe the total cost will approach $13 billion.

Brazil's known uranium resources cannot support its nuclear development plans. Official reserves are estimated at about 26,000 tons of U308, little more than the amount needed to provide the first core and 10 annual reloads for the 8 reactors. Undiscovered uranium may exist in significant amounts, however, and exploration now under way has turned up evidence of uranium deposits at a number of sites.

Balance of Payments

During its early years, the nuclear energy program could add slightly more to Brazil's foreign-exchange expenditures than would thermal power. Over the longer term, however, a nuclear program should greatly ease energy import expenditures.

Including capital costs for the fuel cycle, for example, total foreign-exchange expenditures required for the first 1,300 megawatt reactor—scheduled for completion in 1983—would be approximately $1.6 billion, almost all of which would be spent during the first five years of its expected 30-year life. Unless large uranium reserves are found, an expanding nuclear power industry would require growing fuel imports. Barring a radical change in uranium prices compared with those of other fuels, however, uranium import costs would be relatively small.

If an equivalent conventional power plant fired with imported oil were built instead of a nuclear reactor, foreign-exchange costs over the 30-year period probably would exceed $4.5 billion. Although conventional plants cost less than nuclear plants, and Brazilian industry could supply more than 90 percent of an oil-fired plant, fuel imports would cost about $150 million annually. These costs, moreover, probably would continue indefinitely.

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Foreign-exchange savings per unit will increase as additional reactors are built and as Brazilian industry expands its ability to supply reactor components. By the late 1980s or early 1990s, Brazil probably will be able to manufacture 80 to 90 percent of the components for its new reactors.

Imported enriched uranium fuel for a 1,300 megawatt reactor operating 70 percent of capacity would cost about $40 million annually. Domestic enrichment would cut this cost in half, and recycling the uranium and plutonium contained in the spent fuel could reduce it to as little as $14 million per year—about one tenth the cost of the oil imports needed to generate an equal amount of power.

Despite large foreign-exchange savings per reactor, Brazil's nuclear program may have little beneficial impact on the balance of payments until after the year 2000, when the growth of hydroelectric capacity levels off. If nuclear power were not available to replace hydroelectricity, however, the cost of energy imports by the year 2010 would be nearly twice the cost of fuel imports with a self-sufficient nuclear industry—and perhaps considerably more.

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Security and control abbreviations used in this publication:

TSU—Top Secret UMBRA
SS—Secret SPOKE
S—Secret
C—Confidential
U—Unclassified
NOFORN—Not Releasable to (NF) Foreign Nationals
ORCON—Dissemination and Extraction of Information (OC) Controlled by Originator
REL . . —This Information has been Authorized for Release to . . .

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