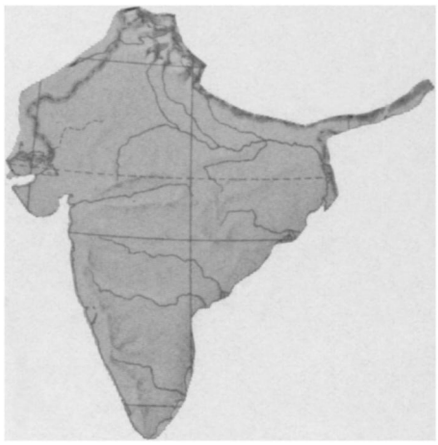
letter from Bombay



the atom in India

Investment begins to pay off in farm and factory

With three commercial nuclear power plants due to come on line in the next few years, India is pushing toward the next generation of reactors, and looking optimistically toward the prospect of huge, agroindustrial complexes that combine industrial power with water desalination for crops.

Other profits from the country's $80 million investment in atomic energy research are being reaped in biology, where mutants of rice and wheat stimulated by irradiation are beginning to revolutionize the country's agriculture (SN: 5/18, p. 486).

Focus of the Atomic Energy Department is the Bhabha Atomic Research Center (BARC) at Trombay, some 15 miles north of Bombay, employing over 8,000 persons, of whom nearly 65 percent are scientists and technicians. Today BARC is engaged in an all-out effort to develop industry, medicine, agriculture and power generation.

Commercial power reactors are currently being built at Tarapur, Rana Pratap Sagar and Kalpakkam. The first, a 380-megawatt station, is scheduled for operation in October 1968; the 400-megawatt Rana Pratap Sagar station will be ready by early 1970 and the third, at Kalpakkam, with the same capacity, will be ready by 1971. The share of nuclear power in the country's aggregate output of electricity should rise from five percent in 1970/71 to 6.6 percent in 1975/76, and come to nine percent by the early 1980's. Overall nuclear power generation by then should reach 5,000 megawatts.

To complement these and future power plants, the Atomic Energy Department is pushing development of uranium fuel resources and electronic control equipment. The Uranium Corporation of India, Ltd., with a capital of $20 million, will be responsible for the development of uranium mines and mills at Jaduguda in Bihar, and Electronics Corporation of India Ltd. will produce electronic equipment and components, computers and controls for nuclear power stations built in the country.

In addition, a $13.33 million Nuclear Fuel Complex is being set up at Hyderabad in southern India, near the Electronics Corporation. It will have a capacity of 125 tons per year of uranium oxide, and 50 tons of zircalloy products from Indian zircon, to be used for containing uranium oxide in fuel elements and structural elements in reactor assemblies. The complex will also have a 100-ton ceramic fuel fabrication plant, where uranium oxide power will be made into pellets and then sealed into zircalloy tubes to be used in fuel element bundles.

In the long term, the department aims to set up at Tarapur a facility for the extracting, on a commercial scale, of plutonium and other fissile materials from irradiated uranium rods. India's first plutonium plant was set up at Trombay in 1965 at a cost of $5 million. The Tarapur facility, 20 times as large, will cost just $7.5 million. Plutonium is a key element in reactors that use thorium.

Since India possesses large thorium reserves, some 500,000 tons, the department is pushing thorium technology. Thorium is not a fissionable material, but when it is bombarded by neutrons, it changes into uranium 233, which will split. The technology involves combining thorium with plutonium; the plutonium fissions and gives off the neutrons necessary to convert the thorium.

The first step in the development is a 10-megawatt experimental reactor at Kalpakkam nuclear power station. It will cost $27 million and will be used to experiment with different types of rods, fissile materials and coolant systems using thorium and plutonium. Generation of power commercially may be possible by the early eighties.

Nuclear powered agroindustrial complexes are being planned to take advantage of low cost nuclear energy for major power-consuming industries such as the manufacture of ammonia via electrolytic hydrogen and phosphorous in electric furnaces. This is of particular interest to India where the present power capacity is small.

The potentialities of such complexes in the Indo-Gangetic Plains in the north, and Kutch Saurashtra area in the west, are being seriously studied. In this connection a proposal has been made by Tata Institute of Fundamental Research to invest $270 million in the next 8 to 10 years to establish a fertilizer unit to feed a giant agroindustrial complex to be centered on a 1,200-megawatt nuclear seawater desalination plant near Okha on the west coast.

In agricultural research, scientists from the Bhabha center played a key role in developing a mutant variety of rice called TR-1, prepared by induced radiation after four years of research. Grown with normal inputs of water and fertilizer, TR-1 has yielded 21 percent more grain than the parent variety.

The center played an equally key role in successfully developing mutant wheat strains (SN: 7/6, p. 19).

The Bhabha center is also directing the fabrication of equipment for a new isotope dispensing center in Kabul, Afganistan. And in India itself, radio tracer studies have been usefully integrated with engineering projects as in plugging of seepage in dams, repairing the lining of blast furnaces and detecting cracks in heavy castings.

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