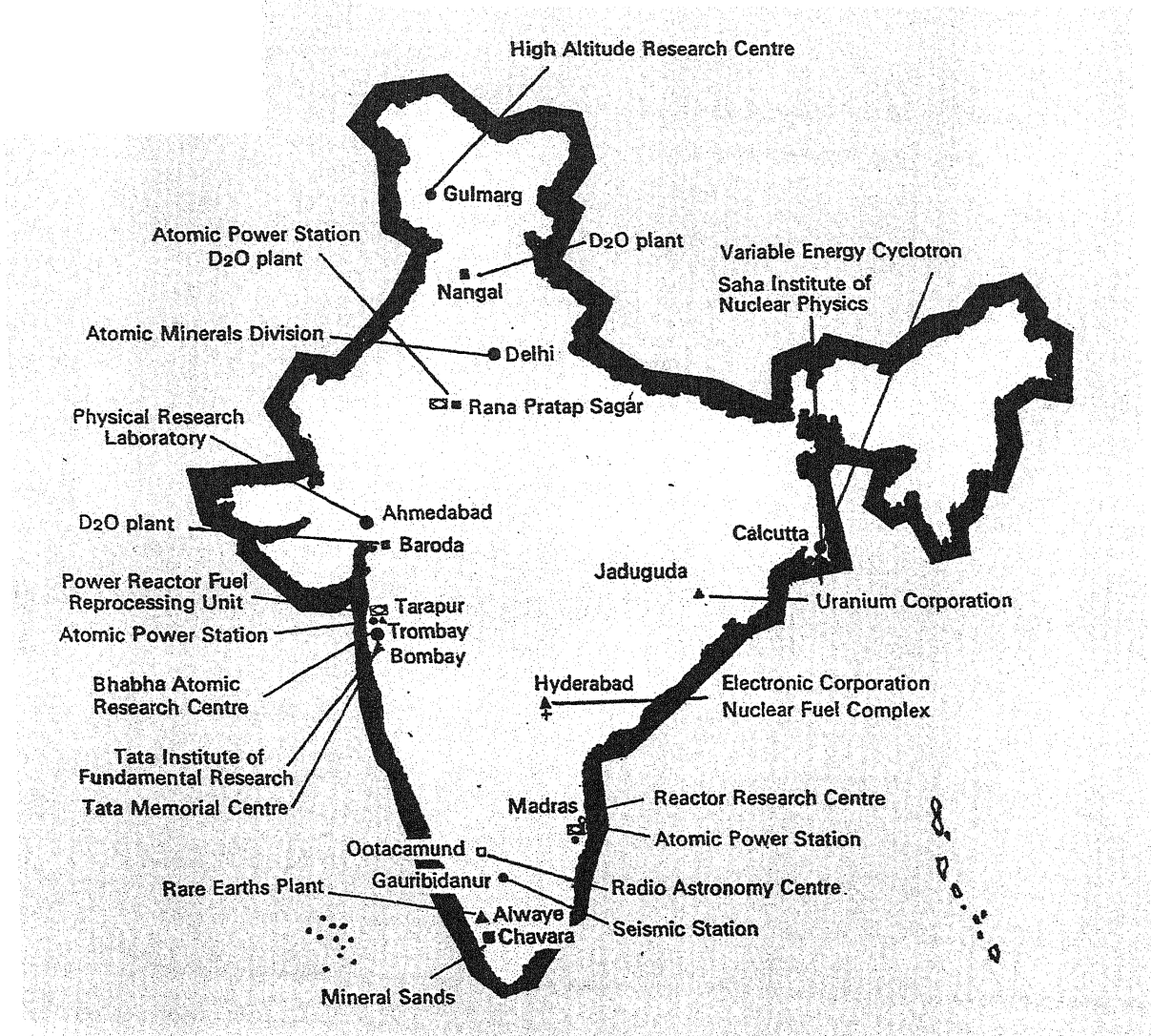
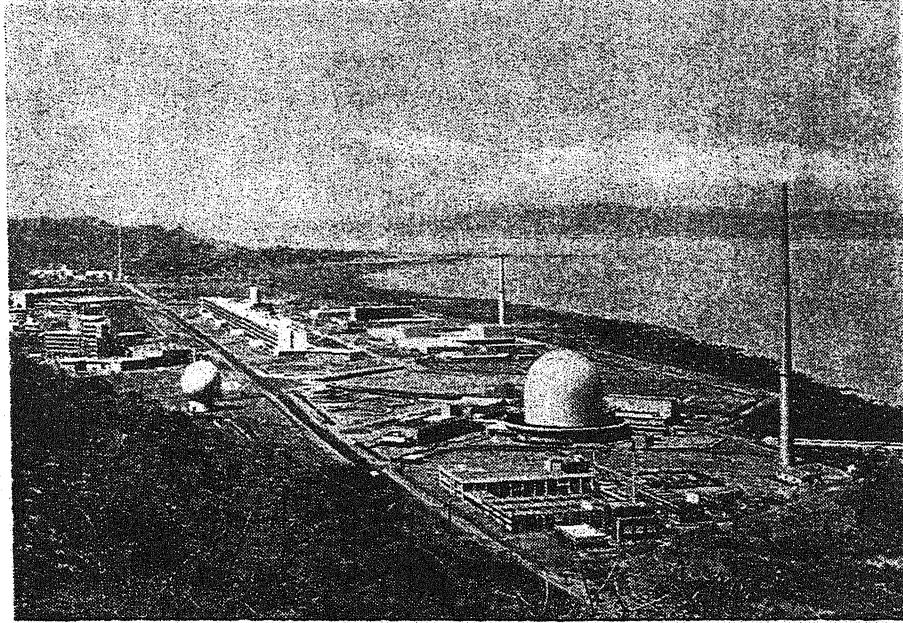


DHE (4)

ESTABLISHMENTS FOR ATOMIC ENERGY IN INDIA





The Bhabha Atomic Research Centre, Trombay

The Tata Institute of Fundamental Research, Bombay



ESTABLISHMENTS FOR ATOMIC ENERGY IN INDIA

BHABHA ATOMIC RESEARCH CENTRE, Trombay

National centre for research and development work in nuclear energy. Set up as Atomic Energy Establishment, Trombay in 1957. Work here is organized under five scientific and technical groups, namely: Physics, Electronics, Engineering, Metallurgy and Bio-Medical. There is also a Directorate of Radiation Protection. Facilities include three reactors viz. Cirus (40 MW), Apsara (1 MW) and Zerlina (100 W); a 5.5 MeV Van de Graaf accelerator; a H-400 computer; special laboratories. Other facilities include a uranium metal plant, a fuel element fabrication plant, a plutonium plant etc.

ATOMIC MINERALS DIVISION, Delhi

Is responsible for survey, prospecting and exploratory development of atomic minerals which are required for the atomic energy programme. The Division carries out various types of surveys such as air-borne, jeep, ground, and off-shore sub-marine surveys. These field activities are supported by well-equipped petrology, mineral technology, chemistry and physics laboratories, which not only provide the necessary aid by way of study and analysis of samples but are also responsible for the development of new instrumentation and methods.

REACTOR RESEARCH CENTRE

Being set up near the Madras atomic power station. Will be a centre for studies in fast breeder reactor technology. Will also have a Pulsed Fast Reactor.

GAURIBIDANUR SEISMIC STATION

80 km. north of Bangalore. Set up towards the end of 1965 in collaboration with the U.K. Atomic Energy Authority. Has a full array of 20 sensors, deployed over an area of 25 km. x 25 km. Helps in detecting and identifying underground nuclear explosions. Also facilitates research in seismology.

TARAPUR ATOMIC POWER STATION

100 km. north of Bombay. First atomic power station in India and biggest operating atomic power station in Asia. Has two Boiling Water type reactors, which generate a total of 400 MW of electricity. Output equally distributed to the States of Maharashtra and Gujarat.

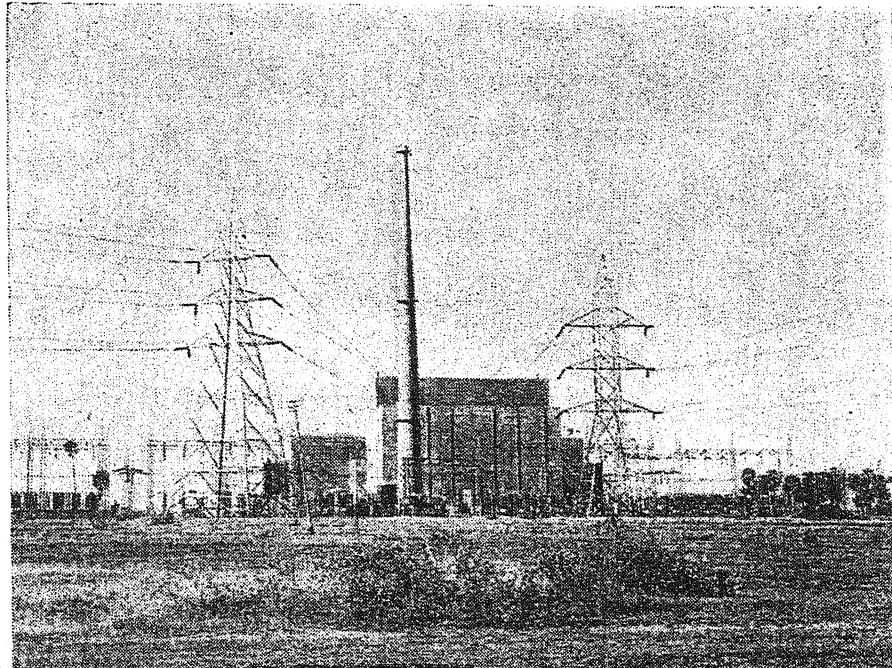
RAJASTHAN ATOMIC POWER PROJECT

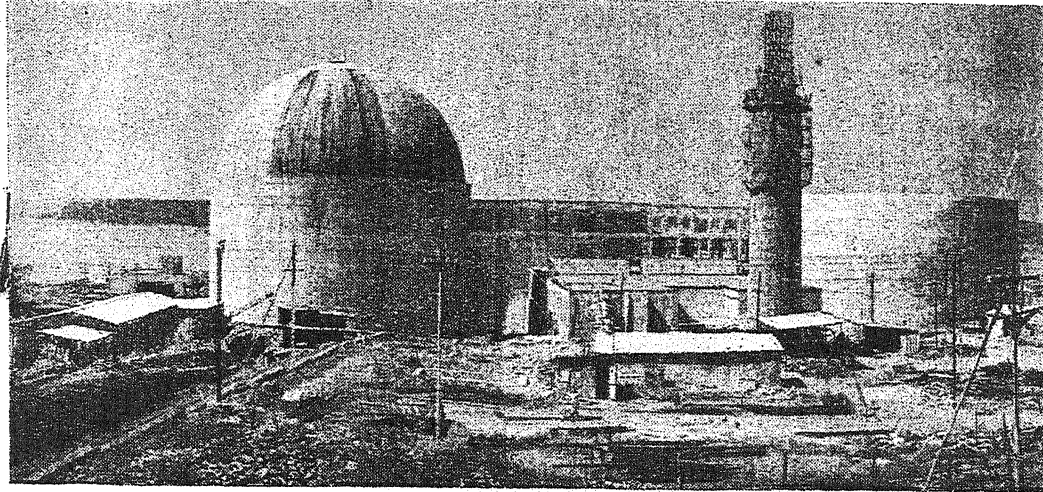
At Rana Pratap Sagar in the State of Rajasthan. Under construction with Canadian assistance. Will have two natural uranium fuelled and Heavy Water moderated Candu-type reactors with total net output of 400 MW of electricity.

MADRAS ATOMIC POWER PROJECT

About 80 km. south of Madras. Third atomic power station in India. Work on one unit of 200 MWe in hand. Proposal to add another unit of equal capacity later. Will have Candu-type reactors similar to the Rajasthan station. Almost 80 per cent of content will be indigenous. No foreign collaboration in design, construction etc.

Tarapur Atomic Power Station





Rajasthan Atomic Power Station under construction

HEAVY WATER (D₂O) PLANTS

NANGAL, Punjab. Heavy water plant being operated in conjunction with the Nangal Plant of the Fertilizer Corporation of India. Commissioned in August 1962. Capacity about 14 tonnes per year.

RANA PRATAP SAGAR. Being built next to the Rajasthan Atomic Power Station. Will utilize surplus steam and electricity from the station. Capacity 100 tonnes per year.

BARODA. Being built by a consortium of French firms. Will be run in conjunction with the Fertilizer Plant at Baroda belonging to the Gujarat Fertilizer Corporation. Expected to go into production in 1973. Capacity 67.2 tonnes per year.

POWER REACTOR FUEL REPROCESSING PLANT, Tarapur

Being set up by the Bhabha Atomic Research Centre on the basis of experience gained with the design, construction and operation of the Plutonium Plant at Trombay. This plant will process the irradiated fuel from Tarapur and other atomic power stations under construction.

NUCLEAR FUEL COMPLEX, Hyderabad

Being built close to the Electronics Corporation of India Ltd. Will consist of a Uranium Oxide Plant, a Zirconium Plant, a Ceramic Fuel Fabrication Plant and a Special Materials Plant. Together the complex will meet the fuel requirements of the nuclear power reactors under construction and those planned.

URANIUM CORPORATION OF INDIA LTD., Jaduguda

Formed in October 1967. Is responsible for development of the Uranium Mine and operation of the Uranium Mill at Jaduguda.

INDIAN RARE EARTHS LTD.

Government of India company functioning since 1950. Responsible for the operation of the mineral sands industry in Manavalakurichi and Chavara and production of rare earths at Alwaye. Also produces thorium at Trombay on behalf of the Government.

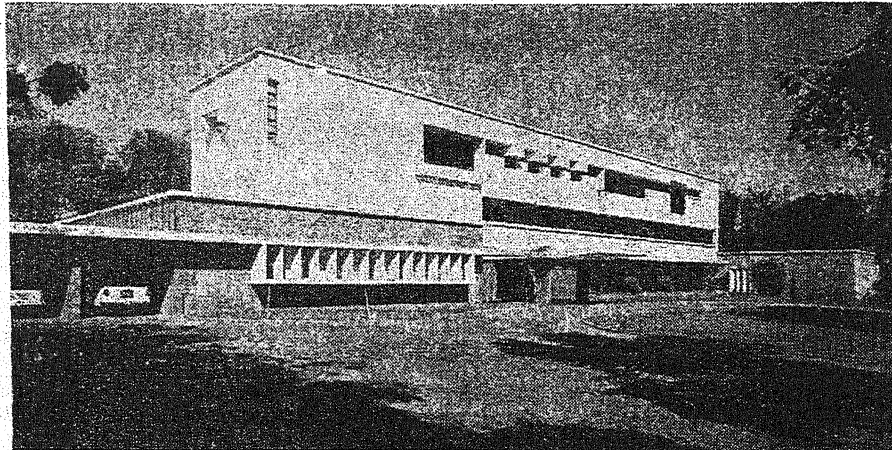
ELECTRONICS CORPORATION OF INDIA LTD., Hyderabad

Formed in April 1967. Took over the work of the Electronics Production Unit of the Bhabha Atomic Research Centre. Produces on commercial scale a large variety of nuclear instruments, control panels, electronic components etc. developed by BARC and the TIFR.

TATA INSTITUTE OF FUNDAMENTAL RESEARCH, Bombay

Founded June 1945. National Centre of the Government of India for Nuclear Science and Mathematics. Has two schools: School of Mathematics and School of Physics (Experimental Physics, Theoretical Physics, Astrophysics, Geophysics, Computer Science, Molecular Biology). Special facilities include a National Computation Centre (with a CDC 3600-160A computer system), a Balloon Fabrication and Flying Facility, a Radiocarbon Dating Laboratory for Archaeology, a Tritium Laboratory for Hydrological Studies, an Electron Microscope 1 MeV Cascade Generator, a 3.5 MeV Electron Linear Accelerator, X-ray Units, an Electromagnetic Mass Separator and Liquid Nitrogen and Liquid Helium Plants.

Physical Research Laboratory, Ahmedabad.



PHYSICAL RESEARCH LABORATORY, Ahmedabad

Established in 1948. Fields of research include: Aeronomy and Geomagnetism — Atmospheric ozone, Airglow, Stratosphere, Mesosphere, Ionosphere and Magnetosphere; Cosmic rays — Astrophysics, Radio and X-ray astronomy and Solar-terrestrial relationship; Space physics; Theoretical physics — Elementary particles, Nuclear physics and Plasma physics.

Special facilities include a Super Neutron Monitor, a Computing Centre, an Electronics Laboratory, a Techniques Laboratory, a Satellite Tracking Station.

HIGH ALTITUDE RESEARCH LABORATORY, Gulmarg

Established in 1963. Built by the Department of Atomic Energy to provide facilities for high altitude research to all scientific institutions and universities in the country.

SAHA INSTITUTE OF NUCLEAR PHYSICS, Calcutta

Formally opened in January 1950. Fields of research include: Electron microscopy; EPR Spectroscopy; Mass separation; Microwave absorption spectroscopy; Molecular biology; NMR Spectroscopy; NQR Spectroscopy; Nuclear activation; Nuclear reaction, Nuclear spectroscopy; Radio chemistry; Solid State physics; Structural crystallography; Technical physics; and Theoretical nuclear physics.

VARIABLE ENERGY CYCLOTRON, Calcutta

Being set up in the Salt Lake Township area near Calcutta by the Bhabha Atomic Research Centre, Trombay and the Saha Institute of Nuclear Physics. Will be a national facility for advanced work in nuclear physics and for the controlled direct irradiation of biological and agricultural products.

TATA MEMORIAL CENTRE, Bombay

Comprises two institutions: the Tata Memorial Hospital and the Cancer Research Institute. In addition to being one of the foremost cancer treatment centres in the country, also conducts extensive research on cancer.

TARAPUR ATOMIC POWER STATION

Technical Details

GROSS STATION OUTPUT	(KWe)	...	400,000 (Two units)
NET OUTPUT	(KWe)	...	380,000
NET STATION HEAT RATE	(Btu/kwh)	...	11,860
REACTOR VESSEL (identical both units)			
Length (inside)	(ft.-in.)	...	53-10
Diameter (inside)	(ft.)	...	12
Weight (with head on)	(tons)	...	268
Weight (fully loaded)	(tons)	...	748
REACTOR CORE (identical both units)			
Thermal Output	(MWt)	...	660.9
Fuel Assemblies		...	284
Control Rods		...	69
Incore Monitors		...	13
Active Fuel length	(in.)	...	144
Core Diameter	(circumscribed in.)	...	103
Fuel Material	(pellets)	...	UC ₂
			slightly enriched
Cladding		...	Zircaloy-2.
Initial Fuel Charge	(lbs.U)	...	87,000
Average Exposure at Discharge	(MWD/STU)	...	15,000
BOILER SYSTEM			
Steam Flow (lb./hr.)	Primary	...	1,900,000
	Secondary	...	790,000
Cycle		...	Dual
External Circulation Loops		...	2
Steam Generators		...	2
TURBINE			
Type			Tandem compound impulse type with a dual admission single flow high pressure unit and a single admission dual flow low pressure unit.
Name plate rating	(kW)	...	210,000
Exhaust pressure (in Hg absolute)		...	2.5
Make up	(%)	...	0.5
Speed	(rev/min)	...	1500
Primary Steam inlet pressure (dry and saturated)	(psig)	...	960
Secondary Steam inlet pressure	(psig)	...	460
GENERATOR			
Rating at 0.85 p.f. 0.64 SCR and 30 psig Hydrogen Pressure	(kVA)	...	248,500
Voltage	(kV)	...	12
Speed	(rev/min)	...	1500

Construction Details

Quality Concrete	(cubic yards)	...	110,000
Reinforcement Steel	(tons)	...	12,000
Cement	(tons)	...	44,000
Aggregates	(cubic yards)	...	105,000
Sand	(cubic yards)	...	52,000
Piping	(miles)	...	40
Cables	(miles)	...	250
Valves		...	3,800

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