June 14, 1968

India Department of Atomic Energy, 'Note on the Development of Fast Breeder Reactor'

Citation:

Summary:

Information on research and development work on breeder reactors in India.

Credits:

This document was made possible with support from Carnegie Corporation of New York (CCNY)

Original Language:

English

Contents:

DEPARTMENT OF ATOMIC ENERGY

Note on the Development of Fast Breeder Reactor.

Research and Development work (1966-69)

Studies on fast breeder technology have been continuing. Efforts are devoted to the training of suitable personnel for the fast breeder programme to be launched in the fourth plan (1969-70 to 1973-74). Experiments for gaining experience in sodium technology are on hand and more experiments are being planned. A small low temperature sodium loop has been commissioned and a larger (500 KW) high temperature loop is under design. Design of a fast test breeder generating electricity is under consideration. Technical features of this reactor have been studied carefully. These include choice of coolant, choice of fuel material, operating temperature levels, power density etc. Development work necessary to back up the design is being planned.

As regards the assumptions made in the original plan, certain changes have become necessary. The major change is the proposed increase in the output of the fast test breeder reactor. This has become necessary to meet technical requirements. It appears today that the electrical output of the said reactor will be 20 MWe instead of 10 MWe. Another change is in schedule Now it appears that the reactor will be operational some time in 1973-74.

Perspective Plan for Research and Development in 1969-79:

The programme is aimed at developing ability to design and construct a commercial fast breeder reactor by 1980. The

first stage of the programme envisages with construction of a fast test breeder reactor by 1974 along with its associated facilities like engineering laboratories for component development and fuel development facilities including reprocessing and refabrication plants for the reference fuel of the breeder. The reactor will be used as a test bed for future development work.

Period beyond 1974 will be devoted to obtaining technological experience for the next step of building a large prototype fast breeder. Current evaluations performed in other countries indicate that fast breeders will be the cheapest power producers and it would be the aim of the programme to introduce these breeders into Indian economy as early as possible.

Details of Research and Development projects/programmes:

1) Design, construction and operation of a fast test breeder reactor:

It is envisaged that a fast test breeder reactor of about 60 MW(th) output would be commissioned by 1973-74 at Kalpakkam. It would be fuelled with plutonium and cooled by liquid sodium. A power density of 0.5 MW/litre and a sodium outlet temperature of 1100°F will be aimed at. This temperature will enable the generation of high grade steam which can give a thermal efficiency of 40% which is comparable to a modern high efficiency conventional station. It is expected that the detailed design of the reactor could be finalised by mid 1970 and preliminary civil works initiated in 1969.

2) Fuel development:

Fuel for this reactor is not available and needs to be developed. Fuel irradiation programme will therefore be started by the end of 1968 or early 1969. Facilities available in BARC will be utilised to develop fabrication processes and

methods of reprocessing the fuel. On the basis of results of these development programme, designs of the facilities to be installed in support of the reactor at Kalpakkam, and also for future development work, will be finalised and executed.

3) Engineering laboratories for component development will be established at the new centre at Kalpakkam. Attention would be devoted to the design, construction and operation of models of intermediate heat exchangers, steam generators, pumps and fuel handling equipment.

Outlay required for implementing the projects upto 1973-74.

As the design output of the fast test breeder is still not finalised, it is not possible to give a correct estimate of the capital cost of the project. Hence a range has been indicated.

	Rs. in crores	
	Total cost	F.E.components
1. Estimated capital cost of the reactor.	20-25.00	2.50
2. Estimated cost of establishing the fast reactor centre.	10.00	1.50
	30-35.00	4.00

It is proposed to establish a new centre on the lines of B.A.R.C. at Kalpakkam. The centre will have various facilities like:

i) Fast Test Breeder Reactor.
ii) Engineering Laboratories.
iii) Fuel Fabrication Facilities.
iv) Reprocessing facilities.
v) Post Irradiation examination facility.

vi) Radiochemistry laboratory.
vii) Administrative Office.
viii) Workshop.
ix) Waste disposal facilities.
x) Housing for the personnel.

Studies in depth need to be undertaken. But the preliminary estimates indicate that about 10.0 crores of rupees will have to be spent in a phased manner. The phasing is indicated in Table 1.0. Only preliminary estimates for the reactor are available today and these only indicate the order of magnitude. It would take about one year before details would be available.

Man Power Requirements:

It is expected that this effort will need about 1000 persons. Out of this 1000 persons, about 300 will be technically qualified persons and the rest would be the supporting staff. The personnel required during the construction phase of the reactor are not included in the above list.

...

TABLE - 1.0

SUMMARY OF EXPENDITURE ON THE FAST REACTOR CENTRE

Sl. No.	Expenditure on	68-69	69-70	70-71	71-72	72-73	73-74	Beyond
A	Site development.	8.75	10.50	11.00	8.50	..	..	..
B	Civil construction.	25.00	59.75	82.50	79.25	27.00	25.00	12.50
C	Machinery & equipment.	27.00	48.00	80.00	67.00	67.00	92.00	35.00
D	Establishment.	5.32	16.78	27.60	41.54	56.60	68.58	..
E	Consultancy and foreign travel.	1.00	5.00	5.00	5.00	5.00	5.00	..
F	Contingency and Miscellaneous.	..	..	10.00	15.00	15.00	20.00	..
		67.07	140.03	216.10	216.29	170.60	210.58	47.50

....

cpd:kjp.
14668.