DEPARTMENT OF ATOMIC ENERGY

DEMAND NO. 5

Atomic Energy

A. The Budget allocations, net of recoveries, are given below:

(In crores of Rupees)

	Major Head	Budget 2005-2006 Plan	Budget 2005-2006 Non-Plan	Budget 2005-2006 Total	Revised 2005-2006 Plan	Revised 2005-2006 Non-Plan	Revised 2005-2006 Total	Budget 2006-2007 Plan	Budget 2006-2007 Non-Plan	Budget 2006-2007 Total
Revenue		237.80	992.61	1230.41	236.76	966.34	1203.10	323.08	1065.33	1388.41
Capital		*1249.63*	*415.39*	*1665.02*	*1013.24*	*491.66*	*1504.90*	*1297.94*	*484.67*	*1782.61*
Total		**1487.43**	**1408.00**	**2895.43**	**1250.00**	**1458.00**	**2708.00**	**1621.02**	**1550.00**	**3171.02**
1. Secretariat-Economic Services	3451	…	12.09	12.09	…	13.19	13.19	…	14.10	14.10
2. Atomic Energy Regulatory Board	3401	1.00	8.41	9.41	1.00	8.44	9.44	1.00	8.81	9.81
	5401	6.05	…	6.05	6.00	…	6.00	3.55	…	3.55
	Total	*7.05*	*8.41*	*15.46*	*7.00*	*8.44*	*15.44*	*4.55*	*8.81*	*13.36*
Atomic Energy Research and Industries										
3. Bhabha Atomic Research Centre, Mumbai	2852	…	161.85	161.85	…	173.69	173.69	…	179.14	179.14
	3401	…	369.23	369.23	…	387.02	387.02	…	413.50	413.50
	4861	188.00	…	188.00	143.00	…	143.00	190.00	…	190.00
	5401	360.00	…	360.00	325.00	…	325.00	370.00	…	370.00
Total - BARC		**548.00**	**531.08**	**1079.08**	**468.00**	**560.71**	**1028.71**	**560.00**	**592.64**	**1152.64**
4. Indira Gandhi Centre for Atomic Research, Kalpakkam	3401	…	90.70	90.70	…	98.43	98.43	…	101.00	101.00
	4861	48.00	…	48.00	31.70	…	31.70	61.92	…	61.92
	5401	73.65	…	73.65	73.65	…	73.65	61.15	…	61.15
Total - IGCAR		**121.65**	**90.70**	**212.35**	**105.35**	**98.43**	**203.78**	**123.07**	**101.00**	**224.07**
5. Raja Ramanna Centre for Advanced Technology, Indore	3401	…	40.40	40.40	…	43.90	43.90	…	45.50	45.50
	5401	76.50	…	76.50	74.20	…	74.20	67.95	…	67.95
Total - RRCAT		**76.50**	**40.40**	**116.90**	**74.20**	**43.90**	**118.10**	**67.95**	**45.50**	**113.45**
6. Variable Energy Cyclotron Centre, Kolkata.	3401	…	22.80	22.80	…	27.04	27.04	…	31.40	31.40
	5401	60.00	…	60.00	74.70	…	74.70	86.65	…	86.65
	Total	*60.00*	*22.80*	*82.80*	*74.70*	*27.04*	*101.74*	*86.65*	*31.40*	*118.05*
7. Directorate of Purchase & Stores, Mumbai	3401	…	14.30	14.30	…	15.70	15.70	…	16.90	16.90
8. General Services Organisation, Kalpakkam	3401	…	25.38	25.38	…	27.90	27.90	…	29.52	29.52
9. Autonomous Bodies										
9.01 Tata Institute of Fundamental Research, Mumbai	3401	57.32	80.14	137.46	54.99	85.22	140.21	58.46	88.65	147.11
9.02 Tata Memorial Centre, Mumbai	3401	33.00	67.30	100.30	33.00	70.30	103.30	70.84	73.60	144.44
9.03 Saha Institute of Nuclear Physics, Kolkata	3401	20.90	20.45	41.35	31.50	22.44	53.94	22.50	24.15	46.65
9.04 Institute of Physics, Bhubneswar	3401	4.90	7.70	12.60	7.06	8.15	15.21	4.96	9.00	13.96
9.05 Harish Chandra Research Institute, Allahabad	3401	2.90	7.52	10.42	1.85	7.31	9.16	3.94	8.30	12.24
9.06 Institute of Mathematical Sciences, Chennai.	3401	1.80	8.70	10.50	0.96	9.22	10.18	2.77	10.50	13.27
9.07 Institute for Plasma Research, Gandhinagar	3401	50.00	43.70	93.70	40.55	36.31	76.86	79.81	30.00	109.81
9.08 Atomic Energy Education Society, Mumbai	3401	7.85	14.62	22.47	7.85	13.45	21.30	13.30	15.00	28.30
Total - Autonomous Bodies		**178.67**	**250.13**	**428.80**	**177.76**	**252.40**	**430.16**	**256.58**	**259.20**	**515.78**
10. Assistance to Universities, etc. (Grants to Other Institutions)	3401	52.63	…	52.63	52.50	…	52.50	60.94	…	60.94

(In crores of Rupees)

	Major Head	Budget 2005-2006 Plan	Budget 2005-2006 Non-Plan	Budget 2005-2006 Total	Revised 2005-2006 Plan	Revised 2005-2006 Non-Plan	Revised 2005-2006 Total	Budget 2006-2007 Plan	Budget 2006-2007 Non-Plan	Budget 2006-2007 Total
11. Directorate of Construction, Services and Estate Management (DCS&EM), Mumbai	3401	…	33.60	33.60	…	37.44	37.44	…	39.65	39.65
12. Housing Projects										
12.01 Projects under DCS&EM	5401	25.00	…	25.00	13.56	…	13.56	29.77	…	29.77
12.02 Other Housing Projects	5401	22.46	…	22.46	17.15	…	17.15	33.16	…	33.16
Total - Housing Projects		**47.46**	**…**	**47.46**	**30.71**	**…**	**30.71**	**62.93**	**…**	**62.93**
13. Atomic Minerals Directorate for Exploration and Research, Hyderabad	3401	…	53.58	53.58	…	57.63	57.63	…	60.00	60.00
	4861	9.65	…	9.65	10.54	…	10.54	12.05	…	12.05
	5401	16.35	…	16.35	16.35	…	16.35	29.00	…	29.00
	Total	*26.00*	*53.58*	*79.58*	*26.89*	*57.63*	*84.52*	*41.05*	*60.00*	*101.05*
Nuclear Fuel										
14. *Nuclear Fuel Complex (NFC), Hyderabad*										
14.01 Fuel Fabrication Facilities: Gross	2852	…	422.55	422.55	…	445.47	445.47	…	455.01	455.01
Less-Receipts	0852	…	-584.12	-584.12	…	-698.70	-698.70	…	-671.64	-671.64
Net		…	*-161.57*	*-161.57*	…	*-253.23*	*-253.23*	…	*-216.63*	*-216.63*
14.02 Common Facilities	2852	…	14.44	14.44	…	17.07	17.07	…	19.18	19.18
14.03 Stainless Steel Tubes Plant	2852	…	15.23	15.23	…	15.16	15.16	…	17.17	17.17
14.04 Capital Outlay on NFC	4861	144.50	…	144.50	87.35	…	87.35	109.98	…	109.98
Total-Nuclear Fuel Complex		**144.50**	**-131.90**	**12.60**	**87.35**	**-221.00**	**-133.65**	**109.98**	**-180.28**	**-70.30**
Heavy Water										
15. *Heavy Water Board*										
15.01 Maintenance of Housing Colonies for Heavy Water Plants	2852	…	8.42	8.42	…	8.42	8.42	…	9.19	9.19
15.02 Central Office (Other Heavy Water Plants)	4861	40.00	6.95	46.95	40.00	8.15	48.15	81.62	8.80	90.42
Total-Heavy Water Projects		**40.00**	**15.37**	**55.37**	**40.00**	**16.57**	**56.57**	**81.62**	**17.99**	**99.61**
16. *Heavy Water Production*										
16.01 Heavy Water Plant, Baroda	4861	…	40.59	40.59	…	38.79	38.79	…	42.77	42.77
16.02 Heavy Water Plant, Kota	4861	…	89.67	89.67	…	92.64	92.64	…	96.54	96.54
16.03 Heavy Water Plant, Tuticorin	4861	…	59.25	59.25	…	74.22	74.22	…	75.61	75.61
16.04 Heavy Water Plant, Talcher	4861	…	7.80	7.80	…	10.80	10.80	…	9.88	9.88
16.05 Heavy Water Plant, Thal	4861	…	70.72	70.72	…	80.58	80.58	…	71.04	71.04
16.06 Heavy Water Plant, Hazira	4861	…	90.86	90.86	…	99.27	99.27	…	94.83	94.83
16.07 Heavy Water Plant, Manuguru	4861	…	129.68	129.68	…	139.56	139.56	…	147.35	147.35
	Total	…	*488.57*	*488.57*	…	*535.86*	*535.86*	…	*538.02*	*538.02*
Less- Loss of Heavy Water	4861	…	-80.13	-80.13	…	-52.35	-52.35	…	-62.15	-62.15
Net		…	*408.44*	*408.44*	…	*483.51*	*483.51*	…	*475.87*	*475.87*
Total - Heavy Water		**40.00**	**423.81**	**463.81**	**40.00**	**500.08**	**540.08**	**81.62**	**493.86**	**575.48**
17. Feed Stock	4861	…	627.24	627.24	…	667.37	667.37	…	670.70	670.70
Less- Heavy Water Production	4861	…	-627.24	-627.24	…	-667.37	-667.37	…	-670.70	-670.70
Total - Feed Stock		**…**	**…**	**…**	**…**	**…**	**…**	**…**	**…**	**…**
18. Board for Radiation and Isotope Technology, Mumbai	2852	…	24.91	24.91	…	25.10	25.10	…	26.00	26.00
	4861	15.64	…	15.64	11.46	…	11.46	19.25	…	19.25
	Total	*15.64*	*24.91*	*40.55*	*11.46*	*25.10*	*36.56*	*19.25*	*26.00*	*45.25*
19. Other Programmes										
19.01 Management Services Group	2852	…	0.25	0.25	…	0.25	0.25	…	0.30	0.30
19.02 International Atomic Energy Agency	3401	…	4.42	4.42	…	7.00	7.00	…	7.00	7.00
Total - Other Programmes		**…**	**4.67**	**4.67**	**…**	**7.25**	**7.25**	**…**	**7.30**	**7.30**

(In crores of Rupees)

	Major Head	Budget 2005-2006 Plan	Budget 2005-2006 Non-Plan	Budget 2005-2006 Total	Revised 2005-2006 Plan	Revised 2005-2006 Non-Plan	Revised 2005-2006 Total	Budget 2006-2007 Plan	Budget 2006-2007 Non-Plan	Budget 2006-2007 Total
20. DAE Projects										
20.01 R & D Projects	3401	...	4.04	4.04	...	3.79	3.79	...	4.40	4.40
	5401	0.43	...	0.43	2.92	...	2.92	3.25	...	3.25
	Total	*0.43*	*4.04*	*4.47*	*2.92*	*3.79*	*6.71*	*3.25*	*4.40*	*7.65*
20.02 I & M Projects	4861	25.30	...	25.30	12.61	...	12.61	29.30	...	29.30
Total - DAE Projects		**25.73**	**4.04**	**29.77**	**15.53**	**3.79**	**19.32**	**32.55**	**4.40**	**36.95**
21. Grants-in-aid to Electronics Corporation of India Limited	2852	5.50	...	5.50	5.50	...	5.50	4.56	...	4.56
22. Investments in Public Enterprises										
22.01 Electronics Corporation of India Ltd.	4859	9.00	...	9.00	9.00	...	9.00	9.34	...	9.34
22.02 Uranium Corporation of India Ltd.	4861	119.10	...	119.10	64.05	...	64.05	100.00	...	100.00
22.03 Indian Rare Earths Ltd.	4861	10.00	...	10.00	...	...	...	...	...	...
Total-Investment in Public Enterprises		**138.10**	**...**	**138.10**	**73.05**	**...**	**73.05**	**109.34**	**...**	**109.34**
Total-Atomic Energy Research and Industries		**1480.38**	**1387.50**	**2867.88**	**1243.00**	**1436.37**	**2679.37**	**1616.47**	**1527.09**	**3143.56**
Grand Total		***1487.43***	***1408.00***	***2895.43***	***1250.00***	***1458.00***	***2708.00***	***1621.02***	***1550.00***	***3171.02***
B. Investment in Public Enterprises	Head of Dev	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
1. Electronics Corporation of India Ltd.	12859	9.00	25.00	34.00	9.00	25.00	34.00	9.34	30.00	39.34
2. Uranium Corporation of India Ltd.	12861	119.10	161.50	280.60	64.05	161.50	225.55	100.00	192.36	292.36
3. Indian Rare Earths Ltd	12861	10.00	75.10	85.10	...	72.80	72.80	...	80.79	80.79
Total		**138.10**	**261.60**	**399.70**	**73.05**	**259.30**	**332.35**	**109.34**	**303.15**	**412.49**
C. Plan Outlay										
1. Telecommunication and Electronics Industries	12859	9.00	25.00	34.00	9.00	25.00	34.00	9.34	30.00	39.34
2. Atomic Energy Industries	12861	605.69	236.60	842.29	406.21	234.30	640.51	608.68	273.15	881.83
3. Atomic Energy Research	13401	872.74	...	872.74	834.79	...	834.79	1003.00	...	1003.00
Total		**1487.43**	**261.60**	**1749.03**	**1250.00**	**259.30**	**1509.30**	**1621.02**	**303.15**	**1924.17**

1. **Secretariat - Economic Services - DAE** Secretariat is the apex body administering the constituent Units, PSUs and Aided Institutions spread all over the country. In the Department of Atomic Energy, there are five R&D Units, three Industrial units, five PSUs, three Service Organizations and eight Aided Institutions. There is a Branch Secretariat at New Delhi.

2. **Atomic Energy Regulatory Board, (AERB) Mumbai - AERB** is an independent body under Atomic Energy Commission and enforces radiological safety stipulations and is assisted by Safety Review Committee for Operating Plants (SARCOP), Safety Review Committee (SRC) for applications for radiation and other committees in carrying out its mandate in prescribing radiological, nuclear and industrial safety regulations.

ATOMIC ENERGY RESEARCH AND INDUSTRIERS

3. **Bhabha Atomic Research Centre (BARC), Mumbai - BARC** is a multi disciplinary organisation, pursuing comprehensive research and development programmes for harnessing nuclear energy and also its utility for the benefit of the society. These R&D efforts are concentrated in the fields of nuclear sciences, engineering & technology, basic sciences and allied fields. The activities are geared for exploitation of atomic energy for power generation and development of radiation technology and its application in the areas of agriculture, medicine, industry and research. For fulfilling the mandate, interaction with academic institutions and international co-operation in related advanced areas of research are being strengthened. BARC continues to provide required R&D support to all other Units of the Department and provide necessary support to ensure national security.

The significant activities and achievements of BARC during the last one year are Commissioning of 1kW Helium Refrigeration Plant. The cold facility of Advanced Reactor Experimental Facility (AREF) has been commissioned and made critical. Indigenously developed Cobalt Teletherapy machine named 'BHABHATRON' installed at ACTREC and treatment of patients commenced. As part of the Advanced Reactor Development Programme (ARDP), Integral Test Loop (ITL) facility, for Simulating AHWR primary and safety systems, was completed and commissioned.

Simulation facilities for U-233 clean-up were set up. Work related to ADS is in progress. System integration for 300 kW EB Evaporator was completed. Assembly and installation of 10 MeV RF LINAC was completed. Advanced telerobotic and automation Laboratory was commissioned. Work related to KALI 5000 was completed and the electron beam has been generated and further experiments on high power microwaves are in progress. As a part of the development of Indus-2 beam lines for various applications, design of experimental station and vacuum system for Beam lines at Indus - 2 has been completed. Installation and commissioning of mechanical testing equipment capable of material evaluation at sub-micron to micron level was completed. Eight hundred Preshower Silicon Detectors (PSDs) were produced and provided to CERN as a part of international collaboration. The construction of Seismic Data Centre, Mumbai is completed and is operational.

The programmes pursued also include the areas of advanced reactors, accelerators, laser and plasma technologies, waste management and nuclear recycle technologies, nuclear fuels and material technologies, electronics and control instrumentation, health and safety. The basic research in the areas of bio-sciences, physics and chemistry is an on-going activity of the research centre.

4. **Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam - IGCAR** is one of the major R&D Units of DAE engaged in the design and development of liquid sodium cooled fast breeder reactors in the country, as a part of the Nuclear Power Programme Stage 2, backed by fuel fabrication and reprocessing. The Centre has established various R&D facilities including closing of the fuel cycle, covering the entire spectrum of Fast Breeder Reactor (FBR) technology. It is planned to convert FBTR core from carbide to MOX fuel gradually. The KAMINI research reactor was utilized for the neutron radiography of pyro devices from VSSC and also for activation analysis of samples. The Centre has created a new international bench mark by successfully reprocessing the mixed carbide FBTR fuel. Prototype Control and Safety Rod Drive Mechanism (CSRDM), manufactured as part of technology development, was tested in air and in Sodium and was qualified for FBTR. The 5.5 MW steam generator test facility was commissioned. The Boron Enrichment Plant (BEP) has achieved an enrichment above 65% which is the requirement for PFBR. Based on the technology demonstrated, a plant is being set up at Manuguru to produce enriched boron requirements of PFBR.

5. **Raja Ramanna Centre for Advanced Technology (RRCAT), Indore - RRCAT** was established in 1987. The Centre has established infrastructure including workshops and R&D laboratories for carrying out development and research in particle accelerators and lasers along with substantial activities in cryogenics and material research. In the Accelerator area, two important projects undertaken by RRCAT are the development of India's first Synchrotron Radiation Source (SRS), the 450 MeV Indus-I and the second SRS, the 2.5 GeV Indus-II. Indus-I has been in operation since 1999. With the experience gained in developing Indus-I, RRCAT has taken up development of industrial and medical accelerators. A 750 KeV DC Accelerator has been fully assembled.

Department of Atomic Energy has entered into a major collaboration with European Council for Nuclear Research (CERN) for contributing to LHC, the world's largest Accelerator under construction. RRCAT is coordinating this collaboration and has developed some of the items namely super conducting sextupole and decapole corrector magnets, precision magnet positioning jacks, software etc.

The main thrust of the laser programme is to develop technologies of important lasers and explore their applications in industry, medicine as well as R&D. RRCAT is developing a 20 KW CO2 laser, which will be used for cutting, welding and cladding applications. Under the programme to develop semi conductor diode solid state lasers, the Unit has obtained 340W of output power in the infrared and more than 50W in the green. A small such laser capable of giving 2 W in the green is being developed for ophthalmic applications. AMO CVD equipment for making semi conductor lasers has been installed and trial growth runs have started.

As part of ongoing physics studies on the optical trap using CW Nd: YAG Laser, the Scientists have carried out new development which are ready for filing two Patents.

Laser cutting of Linear - tube - end fitting the KAPS-2 and irradiated pressure tubes at MAPS has been successfully carried out. A number of laser material processing applications are established. A laser ground leveling system has been developed which levels the land to within a few centimeters over 300 meters radius. For mass production of this system, technology has been transferred to industry.

6. **Variable Energy Cyclotron Centre (VECC), Kolkata - VECC** has been operating the nation's largest and the first indigenously built Cyclotron in the country providing charge particle beams of various energies. Backed by a group of physicists, both in theoretical and experimental research, high speed computing facility and reasonably fast cyber connectivity, VECC has emerged as a national facility for carrying out accelerator based basic and applied research. With the partial commissioning and round the clock operation, a large Superconducting magnet of the K500 Superconducting Cyclotron a large group of physicists, engineers and technicians have built expertise in the Cryogenics and Superconducting technology. A major project on Medical Cyclotron is being pursued for production of SPECT and PET radioisotopes required for medical application as well as R&D activities. Work has already been initiated for the development of Nanobeams for applications in Meiroelectromechanical Systems (MEMS) and Nanoelectromechanical Systems (NEMS). It has also given stress on the collaborative research using National Facility and with the international groups. A 25 acre plot of land is being acquired to pursue major expansion of VECC & SINP activities in the XI th Plan.

7. **Directorate of Purchase and Stores (DPS), Mumbai - DPS** is carrying out the functions of Materials Management relating to the Department. DPS is also entrusted with the work of locating the right sources of supply for manufacture of various complicated precision equipment. DPS is responsible for safe transportation, receipt, accounting, proper storing, safe custody and timely issue of materials to the project authorities. It is also entrusted with indenting, procurement, stocking, issue and accounting of common user items. Besides, it is also responsible for collection, storing and disposal of scrap, and redistribution of surplus materials to the needy Units.

8. **General Services Organisation (GSO), Kalpakkam - GSO** is providing services such as residential accommodation, health services under CHSS, transport services, educational facilities, etc. It is also responsible for the maintenance of buildings, roads within the colony, maintenance of water supply, etc. to all DAE Units located at Kalpakkam.

9. Autonomous Bodies

9.01. ***Tata Institute of Fundamental Research (TIFR), Mumbai - TIFR*** is primarily an Institute for basic research, but in this process it also develops new technologies and creates a pool of scientific and technical manpower. The research activities of the Institute are organized under three Schools: (1) School of Mathematics, (2) School of Natural Sciences and (3) School of Technology and Computer Science. TIFR has also been conferred the status of Deemed University by the University Grants Commission from June 2002.

The School of Natural Sciences has seven departments at Mumbai (Theoretical Physics, Astronomy & Astrophysics, High Energy Physics, Nuclear and Atomic Physics, Condensed Matter Physics & Material Science, Chemical Sciences and Biological Sciences) and three national Centres: (a) The National Centre for Radio Astrophysics (NCRA) at Khodad (near Pune) (b) National Centre for Biological Sciences at Bangalore and (c) Homi Bhabha Centre for Science Education at Mankhurd, Mumbai. The School has also set up several field stations for various research facilities at Hyderabad, Ootacamund (Tamil Nadu), Pachmarhi (MP) and Gauribidnur (Karnataka), etc.

9.02. ***Tata Memorial Centre (TMC), Mumbai -TMC*** comprises Tata Memorial Hospital (TMH) at Mumbai and Advanced Centre for Treatment, Research, and Education in Cancer (ACTREC) at Navi Mumbai. TMH was established in 1941 by Sir Dorabji Tata Trust for the treatment and cure of cancer and allied diseases and was maintained by funds of the Trust and Grants-in-aid received from Govt. of India and the then Govt. of Bombay. To facilitate rapid development and expansion of the facilities for the diagnosis, treatment and research in cancer and other allied diseases with the help of radioactive isotope and radioactive substances, the administrative control of TMH and Indian Cancer Research Centre was transferred from the Ministry of Health to the Dept. of Atomic Energy. TMH is a speciality hospital for services, education & research in cancer. It has the responsibility to set standards of therapy for treatment modalities and a Centre to train doctors, scientists and para-medical staff in the field.

Cancer Research Institute (CRI) established in 1952, is one of the units of Tata Memorial Centre and conducts basic, community-based and clinically oriented research on multiple facets of cancer, focusing on the cancers prevalent in India. These include cancers of oral cavity, cervix, leukemia and lymphomas and tobacco related cancers.

An indigenously developed Cobalt Teletherapy Machine named BHABHATRON for cancer treatment was developed by BARC and installed at ACTREC.

9.03 ***Saha Institute of Nuclear Physics (SINP), Kolkata - SINP*** was established with dual objective of teaching including training for higher researches and conducting research in various aspects on nuclear and bio-physical sciences. In addition to pursuing nuclear physics activities, the Institute is presently engaged in research in diverse fields from string theory to protein structure, from Clover detectors to muon Arm Project in ALICE at CERN, from high temperature superconductivity to high intensity magnetic field, from Tokamak plasma to Quark Gluon Plasma, from surface physics to astrophysics and from biology to cosmology.

9.04 ***Institute of Physics (IOP), Bhubaneshwar - IOP*** is engaged in research and development activities in the frontier areas of physics and allied sciences. The theoretical research at the Institute covers the areas of high energy physics, quantum computing and mathematical physics, nuclear physics, condensed matter physics, bio-physics, astrophysics etc. Many experimental facilities have been established at the Institute giving further fillip to the research in surface and nanomaterial sciences. The Accelerator Mass Spectrometry facility at the 3 MeV Pelletron laboratory was declared operational by the National Accelerator Mass Spectrometry Committee.

9.05 ***Harish Chandra Research Institute (HRI), Allahabad*** - The main objective of HRI is to conduct fundamental research in various fields of Pure Mathematics, Theoretical Physics and allied topics.

9.06 ***Institute of Mathematical Sciences (IMSc.), Chennai - IMSc***. established in 1962 is a National Institute of higher learning whose primary objective is to foster high quality fundamental research in frontier disciplines of Mathematical Sciences. The Institute has dynamic programme for pursuing research in three disciplines: Theoretical Physics, Mathematics and Theoretical Computer Science.

The institute is actively involved in the International collaborative research programmes at ICTP in Italy, CNRS in France and other institutions abroad. The Institute has an outstanding Scientific Library and an excellent computing environment including Teraflops Cluster Computer (KABRU) and a dedicated high speed network. The Institute promotes interaction with the Universities, academic Institutions and other Research Laboratories.

9.07 ***Institute for Plasma Research (IPR), Gandhinagar - IPR*** has a broad charter of objectives to carry out experimental and theoretical research in plasma sciences with emphasis on the physics of magnetically confined plasmas and certain aspects of non-linear phenomena. The Institute also has a mandate to stimulate plasma research and developmental activities in the universities and the industrial sector. It also contributes in the training of plasma physicists and technologists in the country.

India joined as a member of International Thermo Nuclear Experimental Reactors (ITER) and the project is being pursued through IPR.

9.08 ***Atomic Energy Education Society (AEES), Mumbai - AEES*** was established in 1969 to meet the educational needs of the children of employees of the Department working at different centres in the country. It administers 31 schools and junior colleges at 16 centres and provides education to over 27400 students.

The main objectives of AEES are : (a) to impart quality education to the children of the employees of the DAE and its Constituent Units (b) to design innovative programme for

improving the academic standards in AEES schools (c) to formulate institutional development plan in academics, games, sports and co-curricular activities and (d) to assist special schools through charitable organisation for the handicapped children of the constituent and aided Units of the Department.

10. **Assistance to Universities** - Extra-mural funding from DAE to universities, institutions, national laboratories, etc. is channeled through the Board of Research in Nuclear Sciences (BRNS). National Board for Higher Mathematics (NBHM) has initiated several schemes like helping the development of mathematical centres, giving scholarships to research fellows, travel assistance to young mathematicians for attending conferences/seminars, support to libraries, etc. The Department also funds cancer hospitals in the country which support primarily small projects and radiation related equipment for cancer treatment.

To nurture nuclear technology, the endeavor of the Department covers training programme for its scientists/ engineers, programme under the inter-university consortium for utilisation of DAE research facility, enrichment of higher science education through intervention of its experts with university system and training facilities/fellowships extended to countries through IAEA or under the bilateral agreements. As part of human resource development, a number of training courses, seminars, symposia and workshops are regularly conducted by the DAE Units. A National Centre for Clinical Trials has been established to act as a centralised facility providing services both to public and private sectors.

With the objective to deliver the technologies developed in the DAE laboratories to the people around the nuclear establishments, the department has initiated the Neighbourhood Welfare programmes. Welfare activities such as eye camps, health check-ups, renovation of primary schools, providing educational facilities, distribution of high yield seeds and emerging plant visits are carried out by the atomic power stations at different sites.

11. **Directorate of Construction, Services & Estate Management (DCSEM), Mumbai - DCSEM** looks after the construction activities of the Departmental Units and Aided Institutions including housing for the employees. It is also responsible for operation, maintenance and up-gradation of various services of residential flats and utility buildings and estate management for the DAE Estates in Mumbai.

13. **Atomic Minerals Directorate for Exploration & Research (AMD), Hyderabad - AMD** carries out survey, prospecting and exploration of atomic minerals required for the nuclear power programme of the country. The activities include assessment, analysis, evaluation, characterisation and categorisation of atomic minerals, design and fabrication of radiometric instruments and development of ore extraction flow sheets with the aid of state-of-the-art equipment.

NUCLEAR FUEL

14. **Nuclear Fuel Complex (NFC), Hyderabad - NFC** is responsible for manufacturing alloy clad, natural and enriched Uranium Oxide Fuel Assemblies for all the Pressurised Heavy Water Reactors (PHWRs) and the Boiling Water Reactors (BWRs) respectively. It also manufactures Zirconium Alloy structural components for these reactors including Calandria and Pressure Tubes for PHWRs and Square Channels for BWRs. In addition, NFC produces Seamless Stainless Steel and Special Alloy Tubes of international standards for Nuclear and Non-Nuclear applications and Special and High Purity Materials for strategic use.

15. **Heavy Water Board (HWB) - HWB** was set up in 1989 to manage the operation of the Heavy Water Plants (HWPs) of the Department.

HWB is operating six Heavy Water Plants located at Baroda, Tuticorin, Kota, Manuguru, Thal and Hazira with a total designed/ re-rated capacity of 490MT per year. While the four Heavy Water Plants operating at Baroda, Tuticorin, Kota & Manuguru are run departmentally, Heavy Water Plants at Thal and Hazira are operated and maintained by M/s. RCF & M/s. KRIBHCO respectively. The activities of HWP(Talcher) is diversified such as Pilot Plant scale D2EHPA production & setting up of TBP Plant for meeting the requirement of BARC, NFC, etc.

As a part of diversification activities, HWB has undertaken projects such as Heavy Water Cleanup Facility, Sodium Metal Plant, Boric Acid Enrichment Plant, Boron Enrichment, Technology Demonstration Plant for Recovery of Rare Metals from Phosphoric Acid, Centralised Uranium Oxide Conversion Facility, etc.

18. **Board of Radiation and Isotope Technology (BRIT), Mumbai - BRIT** is responsible for production and supply of radioisotope products, radiation technology equipment and rendering radiation processing services for medical products, spices, etc. BRIT is propagating radiation technology and providing facilitation services to private entrepreneurs to set up commercial gamma radiation processing plants. A number of radioisotope products are supplied by BRIT to large number of institutions in the country as well abroad for use in industry, health care, agriculture and supporting research in Life Sciences and Bio-Sciences.

Radiopharmaceutical products and Radio Immuno Assay Kits are being supplied to all nuclear medicine and RIA Centres throughout the country. In addition, BRIT supplies teletherapy sources for treatment of cancer patients. BRIT also supplies kilocurie 60Co sources for use in gamma irradiation plants. BRIT products such as ROLI-1 Radiography Camera, Gamma Chamber, Research Irradiator and Blood Irradiator were supplied to various customer institutions.

Many private entrepreneurs have evinced interest in setting up gamma radiation processing facilities for various end purposes and BRIT is collaborating with them and providing facilitation services. BRIT has been regularly imparting training to scientists from various countries under IAEA fellowship in the field of radiopharmaceuticals, radiation processing, radiation sources etc.

19. **Other Programmes** - Under this head budget provisions are sought for management Services group and contributions to the International Atomic Energy Agency (IAEA).

20. **DAE Projects** - The Department undertakes a few projects which are jointly executed by its Constituent Units and by the PSUs on behalf of the Department.

21. **Grants-in-aid to Electronics Corporation of India Limited (ECIL), Hyderabad - ECIL** was incorporated on 11th

April, 1967. The main objective of the company is to strengthen its status as a valued technological asset to the nation in the area of Strategic Electronics meeting the requirements of Atomic Energy, Defence, Space, Civil Aviation, Security and such other sectors of strategic importance. Budget provision made as Grants-in-aid to this PSU is for R&D support it extends to the Nuclear Power Programme.

22. Investment in Public Enterprises

22.01 ***Electronics Corporation of India Limited (ECIL)***: Provisions are made for investment in equity to support the Plan Schemes.

22.02 ***Uranium Corporation of India Limited (UCIL), Jaduguda - UCIL*** was incorporated in 1967 and operates uranium mines at Jaduguda, Bhatin and Narwapahar and Uranium Mill at Jaduguda in the state of Jharkhand. The company also operates a by-product recovery plant at Jaduguda to recover magnetite. The provision included is for investment in equity against the ongoing Plan Schemes.

22.03 ***Indian Rare Earths Limited (IREL), Mumbai - IREL*** was established in August 1950 mainly for recovering minerals, processing for rare earths compounds and thorium-uranium concentrates. The Company has Rare Earths Plants at Alwaye and also operates two Mineral Sand Separation Plants at Manavalakurichi in Tamil Nadu and Chavara in Kerala. The company has also set up the Orissa Sand Complex (OSCOM) at Chattrapur in Orissa for processing the beach sand on the Orissa Coast.

The objectives of IREL are two fold : (i) to emerge as a leading player in the areas of beach sand mining, separation of contained heavy minerals and value addition thereon and (ii) to carry out production as well as selling in the domestic and international markets having due regard to strategic requirements, resource utilization and safety/environmental protection.

IREL expects to fund most of its projects through IEBR except for minor budgetary support from Govt. of India as equity to meet the debt equity norms of funding industries.