DEPARTMENT OF ATOMIC ENERGY

DEMAND NO. 4

Atomic Energy

(In ₹ crores)

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
Gross	13305.12	6762.46	20067.58	13929.15	7589.23	21518.38	13372.38	9964.71	23337.09	14758.52	9409.37	24167.89
Recoveries	*-113.12*	*-1159.16*	*-1272.28*	*-163.14*	*-1452.20*	*-1615.34*	*-176.19*	*-1301.27*	*-1477.46*	*-180.22*	*-1302.81*	*-1483.03*
Receipts	*-3713.63*	*...*	*-3713.63*	*-5931.63*	*...*	*-5931.63*	*-4894.38*	*...*	*-4894.38*	*-5959.35*	*...*	*-5959.35*
Net	**9478.37**	**5603.30**	**15081.67**	**7834.38**	**6137.03**	**13971.41**	**8301.81**	**8663.44**	**16965.25**	**8618.95**	**8106.56**	**16725.51**
A. The Budget allocations, net of recoveries and receipts, are given below:												
CENTRE'S EXPENDITURE												
Establishment Expenditure of the Centre												
1. Secretariat	52.04	...	52.04	56.69	...	56.69	56.69	...	56.69	58.05	...	58.05
2. Atomic Energy Regulatory Board	70.57	...	70.57	76.30	...	76.30	76.30	...	76.30	80.00	...	80.00
3. Atomic Research Centres												
3.01 Bhabha Atomic Reseach Centre	2327.44	...	2327.44	2446.27	...	2446.27	2498.45	...	2498.45	2560.91	...	2560.91
	-27.66	...	-27.66	...	...	...	...	...	...	...	...	...
Net	*2299.78*	*...*	*2299.78*	*2446.27*	*...*	*2446.27*	*2498.45*	*...*	*2498.45*	*2560.91*	*...*	*2560.91*
3.02 Indira Gandhi Centre for Atomic Reseach, Kalpakkam	454.92	...	454.92	476.20	...	476.20	467.00	...	467.00	496.67	...	496.67
3.03 Raja Ramana Centre for Advanced Technology, Indore	309.99	...	309.99	311.43	...	311.43	303.80	...	303.80	324.83	...	324.83
3.04 Variable Energy Cyclotrone Centre, Kolkata	120.51	...	120.51	117.39	...	117.39	115.35	...	115.35	121.94	...	121.94
3.05 Atomic Minerals Directorate for Exploration and Research, Hyderabad	307.97	...	307.97	310.22	...	310.22	306.92	...	306.92	319.39	...	319.39
Total- Atomic Research Centres	*3493.17*	*...*	*3493.17*	*3661.51*	*...*	*3661.51*	*3691.52*	*...*	*3691.52*	*3823.74*	*...*	*3823.74*
4. Fuel Cycle Facility (Nuclear Regulatory Board)	532.70	...	532.70	532.82	...	532.82	500.00	...	500.00	544.15	...	544.15
5. Service Units	416.50	...	416.50	390.51	...	390.51	374.98	...	374.98	396.65	...	396.65
	-32.73	...	-32.73	...	...	...	...	...	...	...	...	...
Net	*383.77*	*...*	*383.77*	*390.51*	*...*	*390.51*	*374.98*	*...*	*374.98*	*396.65*	*...*	*396.65*
6. Board of Radiation and Isotope Technology (BRIT)	83.08	...	83.08	92.87	...	92.87	149.83	...	149.83	97.85	...	97.85
7. Management Services Group	0.67	...	0.67	0.68	...	0.68	0.67	...	0.67	0.70	...	0.70
8. Nuclear Fuel Complex												
8.01 Gross Budgetary Support	2432.10	...	2432.10	2156.34	...	2156.34	2523.60	...	2523.60	2551.83	...	2551.83
8.02 Less Receipts	-1205.93	...	-1205.93	-2417.80	...	-2417.80	-1735.36	...	-1735.36	-2286.29	...	-2286.29

(In ₹ crores)

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
8.03 Less Recoveries	-48.57	...	-48.57	-70.00	...	-70.00	-70.00	...	-70.00	-70.00	...	-70.00
Net	*1177.60*	*...*	*1177.60*	*-331.46*	*...*	*-331.46*	*718.24*	*...*	*718.24*	*195.54*	*...*	*195.54*
9. Heavy Water Production Facility												
9.01 Gross Budgetary Support	47.24	1024.35	1071.59	52.43	1048.89	1101.32	52.85	1034.30	1087.15	67.43	1183.95	1251.38
9.02 Less - Recovery	...	-1136.78	-1136.78	...	-1356.78	-1356.78	...	-1206.00	-1206.00	...	-1201.00	-1201.00
Net	*47.24*	*-112.43*	*-65.19*	*52.43*	*-307.89*	*-255.46*	*52.85*	*-171.70*	*-118.85*	*67.43*	*-17.05*	*50.38*
Total-Establishment Expenditure of the Centre	**5840.84**	**-112.43**	**5728.41**	**4532.35**	**-307.89**	**4224.46**	**5621.08**	**-171.70**	**5449.38**	**5264.11**	**-17.05**	**5247.06**
Central Sector Schemes/Projects												
Research and Development												
10. R and D Basic Science and Engineering	...	835.69	835.69	...	880.00	880.00	...	1000.00	1000.00	...	1320.00	1320.00
11. R and D for Fast Reactor Science and Technology	...	270.98	270.98	...	210.00	210.00	...	210.00	210.00	...	271.00	271.00
12. Advanced Technologies for Laser, Synchrotron and Accelerator	...	153.71	153.71	...	130.16	130.16	...	130.16	130.16	...	150.99	150.99
13. R and D in Exploration and Mining	...	103.42	103.42	...	108.42	108.42	...	108.42	108.42	...	138.00	138.00
14. Grants to other Institutions	133.33	...	133.33	124.49	...	124.49	100.00	...	100.00	154.00	...	154.00
Total-Research and Development	**133.33**	**1363.80**	**1497.13**	**124.49**	**1328.58**	**1453.07**	**100.00**	**1448.58**	**1548.58**	**154.00**	**1879.99**	**2033.99**
15. Backend Fuel Cycle Projects	...	343.96	343.96	...	580.00	580.00	...	240.00	240.00	...	440.00	440.00
Housing and Neighbourhood Development Projects												
16. Housing Projects	...	144.25	144.25	...	151.07	151.07	...	115.17	115.17	...	169.01	169.01
17. Neighbourhood Development Project (in Kudankulam)	130.00	...	130.00	...	...	...	...	...	...	...	...	...
Total-Housing and Neighbourhood Development Projects	**130.00**	**144.25**	**274.25**	**...**	**151.07**	**151.07**	**...**	**115.17**	**115.17**	**...**	**169.01**	**169.01**
Heavy Water Facilities												
18. Heavy Water Board	...	37.14	37.14	...	56.89	56.89	...	36.89	36.89	...	53.00	53.00
19. Feedstock												
19.01 Gross Budgetary Support	...	1130.91	1130.91	...	1242.48	1242.48	...	1200.00	1200.00	...	1200.00	1200.00
19.02 Less Recoveries	...	-22.38	-22.38	...	-95.42	-95.42	...	-95.27	-95.27	...	-101.81	-101.81
Net	*...*	*1108.53*	*1108.53*	*...*	*1147.06*	*1147.06*	*...*	*1104.73*	*1104.73*	*...*	*1098.19*	*1098.19*
20. Heavy Water Pool Management												
20.01 Gross Budgetary Support	1355.00	...	1355.00	1355.00	...	1355.00	1300.00	...	1300.00	1300.00	...	1300.00
20.02 Less Receipts	-1355.00	...	-1355.00	-1355.00	...	-1355.00	-1300.00	...	-1300.00	-1300.00	...	-1300.00
Net	*...*	*...*	*...*	*...*	*...*	*...*	*...*	*...*	*...*	*...*	*...*	*...*
Total-Heavy Water Facilities	**...**	**1145.67**	**1145.67**	**...**	**1203.95**	**1203.95**	**...**	**1141.62**	**1141.62**	**...**	**1151.19**	**1151.19**
21. Radiation and Isotopes Project	...	55.64	55.64	...	107.91	107.91	...	30.00	30.00	...	110.00	110.00
22. Nuclear Power Projects	54.90	1.22	56.12	84.99	2.10	87.09	62.15	2.10	64.25	107.00	3.42	110.42
23. Nuclear Fuel Projects	...	144.14	144.14	...	164.50	164.50	...	164.50	164.50	...	170.00	170.00

(In ₹ crores)

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
24. Atomic Energy Regulatory Board Expansion Project	1.80	15.43	17.23	...	9.45	9.45	...	15.00	15.00	...	40.00	40.00
25. Advanced Technology for Acclerator	...	44.83	44.83	...	64.17	64.17	...	64.17	64.17	...	75.00	75.00
26. Research and Development Projects	6.06	153.83	159.89	7.69	250.00	257.69	15.30	120.00	135.30	10.00	160.00	170.00
27. Industries and Material Projects	45.00	9.00	54.00	45.00	55.89	100.89	45.00	34.00	79.00	45.00	20.00	65.00
28. Fuel Cycle Projects (Fast Reactor Fuel Cycle Fascility)	...	419.96	419.96	...	610.00	610.00	...	650.00	650.00	...	750.00	750.00
29. Nuclear Fuel Inventory												
29.01 Gross Budgetary Support	2180.60	...	2180.60	3154.71	...	3154.71	2276.55	...	2276.55	3122.06	...	3122.06
29.02 Less Receipts	-1152.70	...	-1152.70	-2158.83	...	-2158.83	-1859.02	...	-1859.02	-2373.06	...	-2373.06
Net	*1027.90*	*...*	*1027.90*	*995.88*	*...*	*995.88*	*417.53*	*...*	*417.53*	*749.00*	*...*	*749.00*
Total-Central Sector Schemes/Projects	**1398.99**	**3841.73**	**5240.72**	**1258.05**	**4527.62**	**5785.67**	**639.98**	**4025.14**	**4665.12**	**1065.00**	**4968.61**	**6033.61**
Other Central Sector Expenditure												
Autonomous Bodies												
30. Other Autonomous Bodies	2213.99	...	2213.99	2000.00	...	2000.00	2000.00	...	2000.00	2249.84	...	2249.84
Public Sector Undertakings												
31. Nuclear Power Corporation of India Limited (NPCIL)	...	1435.00	1435.00	...	1665.00	1665.00	...	4665.00	4665.00	...	3000.00	3000.00
32. Uranium Corporation of India Limited	...	439.00	439.00	...	122.30	122.30	...	15.00	15.00	...	15.00	15.00
33. Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI)	...	...	...	...	130.00	130.00	...	130.00	130.00	...	140.00	140.00
Total-Public Sector Undertakings	**...**	**1874.00**	**1874.00**	**...**	**1917.30**	**1917.30**	**...**	**4810.00**	**4810.00**	**...**	**3155.00**	**3155.00**
Others												
34. Contribution to International Atomic Energy Agency	24.55	...	24.55	43.98	...	43.98	40.75	...	40.75	40.00	...	40.00
Total-Other Central Sector Expenditure	**2238.54**	**1874.00**	**4112.54**	**2043.98**	**1917.30**	**3961.28**	**2040.75**	**4810.00**	**6850.75**	**2289.84**	**3155.00**	**5444.84**
Grand Total	***9478.37***	***5603.30***	***15081.67***	***7834.38***	***6137.03***	***13971.41***	***8301.81***	***8663.44***	***16965.25***	***8618.95***	***8106.56***	***16725.51***
B. Developmental Heads												
Economic Services												
1. Power	1219.57	...	1219.57	1088.24	...	1088.24	489.74	...	489.74	874.12	...	874.12
2. Industries	2420.41	...	2420.41	977.29	...	977.29	2051.57	...	2051.57	1622.64	...	1622.64
3. Atomic Energy Research	5786.35	...	5786.35	5712.16	...	5712.16	5703.81	...	5703.81	6064.14	...	6064.14
4. Secretariat-Economic Services	52.04	...	52.04	56.69	...	56.69	56.69	...	56.69	58.05	...	58.05
5. Capital Outlay on Power Projects	...	687.68	687.68	...	949.20	949.20	...	949.20	949.20	...	603.42	603.42
6. Capital Outlay on Atomic Energy Industries	...	2647.27	2647.27	...	2734.82	2734.82	...	2311.58	2311.58	...	2964.14	2964.14
7. Capital Outlay on Atomic Energy Research	...	1518.35	1518.35	...	1603.01	1603.01	...	1552.66	1552.66	...	1939.00	1939.00
8. Loans for Power Projects	...	750.00	750.00	...	850.00	850.00	...	3850.00	3850.00	...	2600.00	2600.00

(In ₹ crores)

	Actual 2017-2018			Budget 2018-2019			Revised 2018-2019			Budget 2019-2020		
	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total	Revenue	Capital	Total
Total-Economic Services	**9478.37**	**5603.30**	**15081.67**	**7834.38**	**6137.03**	**13971.41**	**8301.81**	**8663.44**	**16965.25**	**8618.95**	**8106.56**	**16725.51**
Grand Total	**9478.37**	**5603.30**	**15081.67**	**7834.38**	**6137.03**	**13971.41**	**8301.81**	**8663.44**	**16965.25**	**8618.95**	**8106.56**	**16725.51**

	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total	Budget Support	IEBR	Total
C. Investment in Public Enterprises												
1. Electronics Corporation of India Limited	...	59.81	59.81	...	15.00	15.00	...	15.00	15.00	...	15.00	15.00
2. Indian Rare Earths Limited	...	57.85	57.85	...	27.90	27.90	...	28.70	28.70	...	13.00	13.00
3. Uranium Corporation of India Limited	439.00	24.83	463.83	122.30	79.70	202.00	15.00	73.00	88.00	15.00	80.30	95.30
4. Bharatiya Nabhikiya Vidyut Nigam Limited	...	...	...	130.00	...	130.00	130.00	10.00	140.00	140.00	...	140.00
5. Nuclear Power Corporation of India Limited	1435.00	6446.00	7881.00	1665.00	5656.00	7321.00	4665.00	7683.00	12348.00	3000.00	8110.00	11110.00
Total	**1874.00**	**6588.49**	**8462.49**	**1917.30**	**5778.60**	**7695.90**	**4810.00**	**7809.70**	**12619.70**	**3155.00**	**8218.30**	**11373.30**

1. **Secretariat:** Secretariat of Deptt. of Atomic Energy has the responsibility of administering the constituent units, PSUs and aided institutions spread all over the country carrying out the various activities of the Department. There are six R&D Units, including Global Centre for Nuclear Energy Partnership (GCNEP) Haryana, three industrial units, three service organizations and five PSUs apart from nine aided institutions in the Department. DAE also has a Branch Secretariat in New Delhi.

2. **Atomic Energy Regulatory Board:** Atomic Energy Regulatory Board (AERB) enforces radiological safety stipulations. It 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.

3.01. **Bhabha Atomic Reseach Centre:** Bhabha Atomic Research Centre (BARC), a multidisciplinary organisation, pursues comprehensive Research and Development (R&D) programmes for harnessing nuclear energy and also its utility for the benefit of the society.BARC gives R&D support to all other units of DAE and provide necessary support for national security.

3.02. **Indira Gandhi Centre for Atomic Reseach, Kalpakkam:** The Centre has R&D activities, encompassing hydraulic studies and reactor engineering studies of reactor components, sodium instrumentation, material development and characterization. The centre has undertaken various strategically important projects to develop mature fast breeder fuel cycle technologies with international standards.

3.03. **Raja Ramana Centre for Advanced Technology, Indore:** Raja Ramanna Centre for Advanced Technology (RRCAT), Indore, is engaged in development of technology and applications of particle accelerators and lasers.

3.04. **Variable Energy Cyclotrone Centre, Kolkata:** The Variable Energy Cyclotron Centre (VECC) at Kolkata is operating the nation's largest and the first indigenously built Cyclotron and has delivered energetic Neon 20 and Argon 40 beams first time in India. A series of experimental run were accomplished for a national facility Indian Gamma Ray Array (INGA) by a large nuclear physics community.

3.05. **Atomic Minerals Directorate for Exploration and Research, Hyderabad:** Atomic Minerals Directorate for Exploration & Research (AMD) carries out survey, prospecting and exploration of atomic minerals required for the nuclear power programme of the country.

4. **Fuel Cycle Facility (Nuclear Regulatory Board):** NRB has been created to carry out activities relating to Nuclear Fuel Reprocessing.

5. **Service Units:** Comprises of three Service Organisations: (i) Directorate of Purchase & Stores (DPS), Mumbai, with the objective to ensure availability of quality material at right time, at right place and at right price, (ii) Directorate of Construction, Services and Estate Management (DCSEM), Mumbai is also responsible for operation, maintenance and up-gradation of residential flats, shops, public buildings and estate management including allotment and the security for the DAE Estate in Mumbai, (iii) General Services

Organisation (GSO), Kalpakkam is one of the service organisations providing services such as residential accommodation, health services at Kalpakkam.

6. **Board of Radiation and Isotope Technology (BRIT):** Board of Radiation and Isotope Technology (BRIT) is responsible for Production and supply of a variety of radioisotope products including radiopharmaceutical and associated products, radio immunoassay kits, radiochemicals, radiolabeled compounds and nucleotides and also sealed radiation sources such as Cobalt-60, Iridium-192, Caesium-137 etc. Radiation technology equipment such as gamma radiography cameras, blood irradiators and laboratory gamma irradiators, promoting radiation processing technology for use in healthcare, food processing and agriculture and rendering radiation processing services for medical products, spices, condiments and other products, propagating radiation technology and providing facilitation services to private entrepreneurs to set up commercial gamma radiation processing plants.

7. **Management Services Group:** Responsible for coordination in implementation of various activities.

8. **Nuclear Fuel Complex:** Nuclear Fuel Complex (NFC) is responsible for manufacturing zirconium alloy clad, natural and enriched uranium oxide fuel assemblies for all the Pressurised Heavy Water Reactors (PHWRs) and the Boiling Water Reactors (BWRs) 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.

9. **Heavy Water Production Facility:** HWB operates two Heavy Water Plants (HWPs) located at Kota and Manuguru based on Hydrogen Sulphide-Water Exchange Process and two plants at Thal and Hazira based on Ammonia-Hydrogen Exchange Process.

10. **R and D Basic Science and Engineering:** R&D efforts are concentrated in the fields of nuclear sciences, engineering & technology, basic sciences and allied fields and geared up for exploitation of atomic energy for power generation and application of radiation technology in the areas of agriculture, health care and industry.

11. **R and D for Fast Reactor Science and Technology:** Indira Gandhi Centre for Atomic Research (IGCAR) is engaged in 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. Fast Breeder Test Reactor (FBTR), a prelude to the FBR programme, has been in operation with indigenously developed Uranium-Plutonium carbide fuel.

12. **Advanced Technologies for Laser, Synchrotron and Accelerator:** The design and installation of electron 10 MeV Linac system, isolation shielding and the ozone containment in the accelerator wall is being developed for the agricultural radiation processing facilities.

13. **R and D in Exploration and Mining:** 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.

14. **Grants to other Institutions:** DAE through Board of Research in Nuclear Sciences (BRNS), National Board for Higher Mathematics (NBHM) and Homi Bhabha National Institute (HBNI) promotes research in nuclear and allied fields and mathematics, respectively.

15. **Backend Fuel Cycle Projects:** Construction of Integrated Nuclear Recycle Project to improve supply of fuel to 2nd stage of Nuclear Power Programme.

16. **Housing Projects:** Housing projects look after the construction activities of the Department including housing for its employees. The Directorate is also responsible for operation, maintenance and up-gradation of residential flats, shops, public buildings and estate management including allotment. In addition, Directorate executes construction works for constituent units.

17. **Neighbourhood Development Project (in Kudankulam):** Creation of network for need based social outreach activities in and around DAE facilities and set up awareness programmes for target audience.

18. **Heavy Water Board:** Works in the area of non-nuclear applications of Deuterium (D) and HW in the field of medicines, life sciences, communication and micro-electronics, HWB has undertaken synthesis of various D-labeled compounds.

19. **Feedstock:** Value of Heavy Water aquisition/production during the financial year.

20. **Heavy Water Pool Management:** Interest of Government Capital deployed for Heavy Water held in Pool Management.

21. **Radiation and Isotopes Project:** Construction of Fission moly project for enhancement in capacity for storing irradiated Co-60.

22. **Nuclear Power Projects:** Includes projects which are jointly executed by the constituent units in Power sectors or by Public Sector Units on behalf of the Department.

23. **Nuclear Fuel Projects:** Setting up of Fuel Fabrication Facility along with Zircaloy Fabrication Facility for producing fuel bundles to meet the requirement of PHWR reactors.

24. **Atomic Energy Regulatory Board Expansion Project:** Construction of new building at Headquarter and Regional Regulatory Centers for capacity building of AERB for effective monitoring.

25. **Advanced Technology for Acclerator:** Installation of medical cyclotron, advance computing, design of ANURIB and development of superconducting accelerator components will lead to future research in nuclear physics.

26. **Research and Development Projects:** Includes projects which are jointly executed by the constituent units in R&D sectors or by Public Sector Units on behalf of the Department.

27. **Industries and Material Projects:** Includes projects which are jointly executed by the constituent units in I&M sectors or by Public Sector Units on behalf of the Department.

28. **Fuel Cycle Projects (Fast Reactor Fuel Cycle Fascility):** Fuel Cycle Projects FRFCF of IGCAR is an integrated facilty to close the fuel cycle of the Prototype Fast Breeder Reactor (PFBR).

29. **Nuclear Fuel Inventory:** It is inventory management of Heavy water Production from various Heavy Water Production Facilities.

30. **Other Autonomous Bodies:** Saha Institute of Nuclear Physics (SINP), Kolkata, Institute of Physics (IOP), Bhubaneswar, National Institute of Science Education and Research (NISER), Bhubaneswar, Harish-Chandra Research Institute (HRI), Allahabad, Institute of Mathematical Sciences (IMSc), Chennai, Ahmedabad, Homi Bhabha National Institute, Mumbai and Atomic Energy Education Society (AEES), Mumbai.

31. **Nuclear Power Corporation of India Limited (NPCIL):** NPCIL is nodal agency to undertake the design, construction, operation and maintenance of the Atomic Power Stations for generation of electricity under the provisions of the Atomic Energy Act, 1962.

32. **Uranium Corporation of India Limited:** Uranium Corporation of India Limited was set up wtih the specific objective of mining and processing of uranium ore to produce uranium concentrate.

33. **Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI):** The objective of BHAVINI is to plan execute, and operate an integrated programme of Fast Breeder Technology based Nuclear Power Stations for generating electricity on a commercial basis, comencing with PFBR.

34. **Contribution to International Atomic Energy Agency:** India has been a member of the Board of Governors of the International Atomic Energy Agency (IAEA) since its inception, making available the services of the departmental scientists for expert assignments besides participation in international symposia and other fellowship exchange programmes. The provision under IAEA takes care of the contribution made by the Department to the international body.