



Republic Day January 26, 2022 Address
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Good morning and greetings to colleagues of the DAE family on the occasion of the 73rd Republic Day of our nation.

Dear colleagues, as you are all aware, the year gone by has been a rather turbulent one, with the country being struck by two waves of the Covid-19 pandemic and we are in the midst of the third wave even as we speak. On behalf of the entire DAE family, I would first like to offer my condolences to all those who have suffered irretrievable losses. I would also like to salute the frontline personnel such as the health care workers, paramedical staff, sanitation workers, civic administration and many other agencies, for their tireless efforts, which has helped the nation withstand this unprecedented onslaught from nature and kept the show going against all odds. My special thanks are due to all the DAE personnel involved in various frontline activities as well as other operations requiring their continuous presence, despite the raging pandemic.

Much blood, sweat and tears have gone into the creation of the republic of India. We owe it to all our freedom fighters, founding fathers and the builders of the Indian republic, to live by their ideals, dreams and visions for the nation. On this solemn occasion today, we have assembled against the backdrop of this exquisite

heritage building to celebrate our achievements in the previous year and pledge our commitments for our future programmes.

The Department of Atomic Energy is one of the earliest scientific organisations of independent India, founded by our visionary leader, Dr Homi Jehangir Bhabha. It has grown and delivered much that the nation can be proud of over the decades, making India self-reliant in the field of nuclear science and technology. The development has played an important role in shaping the direction of several spheres of basic and applied research and cutting-edge technologies. We continue our march forward to meet our mandates, as will become evident from the major achievements of our department during the last one year which I shall now proceed to present.

DAE is a conglomerate of Industrial Units, Research Centres, Medical Centres, Aided Institutes, Academic Institutions and service organisations. I shall present salient achievements in each of these spheres in the following paragraphs

Let me start with describing some of the salient achievements of our Industrial Units

NPCIL, the nuclear power generating unit of DAE, has generated 43,918 MUs of clean power in the calendar year 2021, at a Plant Load factor of 82%. NPCIL has achieved the distinction of cumulative safe operation of about 561 reactor-years till date. Continuing with the trend of setting records in continuous operation of our nuclear power reactors, RAPS-4 has been operating uninterrupted for 644 days. The construction of Units 5 & 6 at Kudankulam (KKNPP-5&6) has commenced with the placement of First Pour of Concrete (FPC) on 29.06.2021.

AMD, the unit responsible for prospecting and exploration, has continued to augment the in-situ uranium oxide (U₃O₈) resources and a total of 23,680 tonne of U₃O₈ was added during the current year. The Rare Metal and Rare Earth (RMRE) stockpile has been enhanced by 2.375 tonne of Columbite-Tantalite (Nb-Ta mineral), 7.85 tonne of Xenotime bearing poly-mineral concentrate, 0.90 tonne of beryl and 2.45 tonne of spodumene, which is a Lithium mineral. An indigenously developed Certified Reference Material (CRM) of dolomite from Tummalapalle area, jointly developed by NCCCM (BARC) and AMD was released by DAE on 9th November, 2021 for utilisation by various research and academic institutions in the country.

IREL, the atomic minerals processing entity of DAE has an established plant capacity of about 6 lakhs tons per annum. IREL has entered into an MoU with BARC and a private entity for scaling up the BARC technology for production of Neodymium-Praseodymium metal from indigenous Neodymium-Praseodymium Oxide produced by IREL. An MoU has also been signed with the Ministry of Energy & Minerals in the Sultanate of Oman for sharing its mining expertise, particularly for rare minerals.

UCIL, the unit responsible for Uranium production in the country, has met the U₃O₈ production targets up to the third quarter of FY 2021-22. To sustain production, mine development and operation of Bhatin mine has commenced and upgradation of Jaduguda Mill for better Uranium recovery from the leached slurry has been completed.

NFC, which caters to the fuel requirements of our nuclear power reactors, is the only organization in the world today to have a comprehensive manufacturing cycle from ore to core, involving processing of both Uranium & Zirconium streams under the same roof. Some of its salient achievements are as follows:

- Manufacture of SG tubes from indigenous material produced by Midhani & delivery of 2 sets of Steam Generator Tubes to BHEL for the upcoming 700 MWe PHWR at GHAVP.
- Manufacture of Inner Guide Tube Assembly (IGTA) of Zircaloy-4 alloy, for the first time, for 700 MWe PHWR of KAPS-3.
- Design, development, fabrication & assembly of 19 element type Cobalt Natural Uranium (Co-NU) fuel bundle in collaboration with BARC and NPCIL for large scale production of low specific activity ^{60}Co for medical and industrial applications.

BRIT has continued to play a vital role for the products and services based on radiation & isotopes for applications in healthcare, agriculture, research and industry. Some noteworthy points to mention are as follows:

- IT enabled logistics services for door delivery of radiopharmaceutical products and radiography camera have helped in increasing the sales of BRIT products. It processed 6.7 million Curies of ^{60}Co , which is more than double of its last 5-year average. 1.25 million Curies of ^{60}Co Irradiator sources were exported to Sri Lanka and Malaysia.

- RC-BRIT, Kolkata continued its regular production and supply of ^{18}F -FDG radiopharmaceutical throughout the year, even during extreme lockdown conditions. Medical Cyclotron, Kolkata launched one new radiopharmaceutical in the market namely, ^{201}Tl Thallous Chloride, meant for Myocardial Perfusion & Parathyroid Imaging by SPECT.

HWB is the largest global producer of heavy water. It is also exploring the potential of Deuterium and its constituents in the area of non-nuclear applications in life sciences & pharmaceuticals and has made major progress on its extended mandate on development, demonstration and deployment of technologies for Indian Nuclear Program such as:

- Development of solvents for front and back-end hydrometallurgical operations of nuclear fuel cycle.
- Demonstration of Solvent Extraction technologies for recovery of rare metal.
- Production of ^{18}O for societal applications. India is now the fifth country in the world capable of supplying H_2^{18}O liquid of >95% concentration for PET applications, at par with global suppliers from US, UK, China and Israel.

ECIL is the DAE unit responsible for development and manufacture of electronics and instrumentation systems for DAE, ISRO and defence sectors of India. Several systems have been developed and deployed by ECIL during this period, such as:

- A fully indigenous 18 m Monopulse earth station antenna to operate in S/X band for Aditya Mission of ISRO has been commissioned at Bylalu (ISTRAC site) in Nov 2021. This earth station antenna is an integral part of Deep Space Network of ISRO.
- Development and supply of various types of ultra-stable power convertors to FAIR, Germany as part of in-kind contribution by Govt of India for the international science programme. ECIL and RRCAT are working on design and development of higher current rating power convertors to meet the future requirements of FAIR.
- BARC and ECIL have jointly established Advanced Rear End Development (ARED) Facilities for Electronics and Instrumentation aimed to meet the strategic requirements of DAE. As part of this, indigenous sensors and detectors are being manufactured, thus reducing import dependency.

I shall now dwell upon some of the noteworthy contributions of the premier research centres of DAE.

BARC, which is the mother institute of DAE, continued its excellent contribution to the development of advanced technologies and societal applications in several areas. Some of them are as follows:

- In the field of Nuclear Agriculture, six new varieties for grains, pulses and oilseeds were gazette notified for commercial cultivation. These include two

rice varieties Trombay Chhattisgarh Sonagathi Mutant (TCSM) & Trombay Chhattisgarh Vishnubhog Mutant (TCVM) for Chhattisgarh; three mustard varieties Trombay Akola Mustard 108-1 (TAM-108-1) for Maharashtra, Birsa Bhabha Mustard-1 (BBM-1) for Jharkhand & Trombay Himachal Pradesh Mustard-1 (THPM-1) for Himachal Pradesh and one groundnut variety, Trombay Akola Groundnut-73 (TAG-73) for Maharashtra. The total Seed varieties gazette notified till date are fifty-five.

- Technology for production of Cobalt and Nickel from secondary resources comprising hydro and pyro-metallurgical unit operations has been developed. It has demonstrated a recovery of >99% pure cobalt and nickel metal powders from alloy steel scrap. Technical know-how has been transferred to Heavy Water Board for setting up a plant for large scale processing of the scrap.
- The Full scale ISMRAN (Indian Scintillator Matrix for Reactor Anti-Neutrinos) commissioned in October 2021 is continuously measuring data of antineutrinos with higher statistics from the Dhruva reactor and has been utilized to map the varying power levels of reactor.

IGCAR is the hub for R&D on fast breeder reactor technology. The U^{233} fuelled Kalpakkam Mini Reactor (KAMINI) continued to be operated for neutron radiography and activation analysis.

RRCAT, the centre at the helm of R&D in the field of lasers and accelerators has the following salient deliverables during this period:

- Three 650 MHz high-beta SCRF cavities along with dressing components were developed and shipped to Fermi lab, USA.
- Development of Titanium Coated Alumina Ceramic UHV Chamber was completed for pinger magnet in Indus-2 Storage Ring.
- Synchrotron radiation sources Indus-1 and Indus-2 were operated with beam availability of around 5900 hours and 4400 hours respectively for the users in spite of lockdown periods.

VECC, Kolkata is another premier research institute of DAE. Irradiation of Reactor Pressure Vessel (RPV) Steel samples supplied by BARC was successfully carried out using proton beam with energy up to 7.5 MeV and beam current up to 3.9 micro-ampere from K130 Cyclotron Facility at VECC.

The aided institutions of DAE - TIFR, IPR, SINP, TMC, HCRI, IOP, IMSc, HBNI, NBHM, UM-DAE CEBS, and NISER - have continued to pursue advanced and cutting-edge fundamental research in the field of basic sciences, astronomy, astrophysics, and education. Some of the accomplishments and milestones worthy of mention are the following:

- TIFR scientists have gained new insights into actions of insulin and their potential impact in treating diabetes
- Scientists from the National Centre for Radio Astrophysics, Pune used the upgraded Giant Metrewave Radio Telescope (uGMRT) to determine that AT 2018cow, the first of a newly discovered class of cosmic explosions, has an extremely patchy environment.
- NISER has added 21 new research projects and has entered into MOUs with All India Institute for Medical Sciences (AIIMS) Bhubaneswar and Acharya Harihar Post Graduate Institute of Cancer (AHPGIC), Cuttack for course related activities.
- UM-DAE-CEBS has developed an Ultrafast Spectroscopy Lab including a clean room to serve as a research aid for researchers in the country.
- HBNI signed an MoU with IIM-Ahmedabad to offer a custom-designed Management Development Programme for senior executives of DAE and conducted a week-long program. It has also released a book on Physics of Nuclear Reactors and English- Hindi Glossary of terms related to nuclear science and technology.
- IPR has developed an In-Vessel Inspection System (IVIS) to perform remote in-service inspection inside a toroidal vacuum vessel.
- A new accelerator-based 14 MeV D-T neutron source facility has recently been commissioned at IPR. During early testing, it has already yielded 7×10^{11} n/sec, which can go up to 5×10^{12} n/sec during full operation. This

source will permit a variety of fusion reactor neutronics and blanket studies.

- IPR has developed a state-of-the-art computer code suite for nuclear activation analysis called ACTYS. ACTYS is faster than existing codes with its own first level material optimization module and better visualization capabilities. It has been validated against internationally-available benchmarks and has been approved by the Nuclear Integration Unit of ITER for all ITER-related nuclear activation calculations.
- The Oncology Journal 'Annals of Oncology Research and Therapy' was launched by BBCT, to celebrate Azadi Ka Amrit Mohatsav. This is first of its kind from the entire North East India.

Our service organisations, DPS and DCSEM have lived up to their mandate in an efficient manner despite the challenges imposed by the pandemic. Roof top Solar photovoltaic systems of total capacity of 250 kWp, generating around 3.5 lakh units per year at various locations of Anushaktinagar have been installed by DCSEM.

Dear colleagues, it would not be possible to mention each and every success and achievement on this occasion and I have merely presented glimpses of some of our salient achievements.

Success is always a team effort and I thank every member of the DAE family for their whole hearted contributions. I would like to congratulate them all for these achievements and urge them to continue to strive hard in bringing laurels to the department as well as the country.

At the end, I would like to thank all the members of our Scientific, Technical, Administrative and Security Staff who have worked hand in hand in making the programmes of the Department a great success.

Once again wishing you all a very Happy Republic Day.

Thank you

Jai Hind
