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EDITORIAL

ATOMS IN THE SERVICE OF THE NATION

The Indian Atomic Energy programme is nearly 60 years old. It all started with the setting up of the Atomic Energy Committee way back in 1945 with Dr. H.J. Bhabha, Dr. M. N. Saha, Dr. D. N. Wadia and Dr. S. S. Bhatnagar as its members. The Committee had the following mandate: explore the availability of raw materials for generating atomic energy, suggest ways and means to harness the materials for production of atomic energy and keep in touch with similar organisations in other countries for coordinating the work on an international basis. These initial efforts culminated in the formation of the Atomic Energy Commission in 1948 with Dr. Homi Bhabha as its Chairman and Dr. K.S. Krishnan and Dr. S. S. Bhatnagar as members. The Department of Atomic Energy (DAE) was created in the year 1954 and placed directly under the charge of the Prime Minister. The two crucial factors responsible for the growth and success of the atomic energy in the country have been the vision of Dr. Bhabha as the Chairman of the AEC and the unstinted support he received from the former Prime Minister Pandit Jawaharlal Nehru.

Over the years DAE has occupied a pride of place in the science and technology map of India. Providing safe, economical and clean nuclear energy in a sustained manner continues to be the main mandate of the Department of Atomic Energy. Out of the twenty nuclear power reactors in operation today, 18 are Pressurised Heavy Water Reactors (PHWRs). India has completely mastered the PHWR technology, with capability ranging from design, manufacture, construction, operation and maintenance reaching the highest level against international benchmark. Our safety record is impeccable. The first indigenously developed prototype fast breeder reactor for electricity generation is at an advanced stage of completion. Currently, this is one of the very few such reactors under construction in the world today. Plans are underway to build the next generation reactor, the Advanced Heavy Water Reactor, which is a technology demonstrator for large scale thorium utilisation as well as application of advanced passive safety features.

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DAE has also initiated R & D towards design and development of Accelerator Driven System as an additionality for the nuclear power programme.

DAE has been making significant contributions to many non-power programmes including those directed towards healthcare, food and agriculture, water, industry, education and national security. The DAE has a comprehensive capability in all aspects of nuclear fuel cycle ranging from basic and applied research to deployment. The DAE operates many major national facilities like the research reactors and the accelerator facilities for basic research and applications. The indigenous development of state-of-the-art instrumentation for various programmes is another major activity of the DAE.

Such success has been attained inspite of the technology denial regime following the 1974 Peaceful Nuclear Explosion (PNE) initiative. Subsequently, vigorous efforts on accelerating indigenous R & D programmes to bridge the gap areas in technology and expertise helped to achieve sustainable self-reliance in all aspects of nuclear technology. The DAE has now mastered the complex nuclear technology and is self-sufficient in designing and building power reactors as well as the entire nuclear fuel cycle facilities. It is a well recognised fact that in the field of nuclear science and technology, India is considered a developed country.

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The DAE has an ambitious programme to increase the quantum of nuclear energy from about 4780 MWe today to nearly 63000 MWe by 2032.This target is realisable and the DAE has the expertise

and the resources to achieve this.

Many spin-off technologies have resulted from the DAE pursuing excellence in frontiers in science and developing cutting edge technologies. While the world class GMRT facility is being upgraded, the installation of another telescope in this category, MACE at Hanle, is in full swing. The indigenously developed INDUS synchrotron is being extensively used by the scientists from the DAE and teaching institutes. Plans are underway to take up the next generation synchrotron source. DAE is a major player in several international collaborations which include the LHC-CERN, ITER, FAIR.

In the field of healthcare, while the indigenously developed Bhabhatron is being increasingly used for cancer therapy, efforts are on to install a hadron therapy system for specialised cancer treatment. Radiation technologies developed by the DAE are widely used in many societal programmes. Trombay produced ground nuts, pulses etc., based on the radiation induced mutants which are high yielding and drought tolerant, are widely deployed in the country. Some other technologies and products are: water desalination, pyrolosis of hospital waste, laser as a tool for medical diagnosis, industrial applications like cable insulation, membrane based water filter, and critical contributions to defence and space programmes. The list only goes to show that the DAE has a prominent place in the science and technology of India. Ensuring nuclear and radiological safety has always remained an area of high priority and radiation protection measures are integrated in all our nuclear pursuits.

The DAE has given great importance to quality education to generate skilled manpower for its programmes. The BARC Training School founded in 1957 has been providing quality manpower to all the DAE programmes for more than 50 years. The Homi Bhabha National Institute of the DAE has come into existence since 2005, as a deemed-to-be University under the UGC. The University of Mumbai - DAE – Centre for Excellence in Basic Sciences (CBS) in Mumbai and NISER (on the lines of IISER) in Bhuvaneshwar are offering 5-year integrated M.Sc. programmes. The Homi Bhabha Centre for Science Education (HBSCE) is the national coordinator for the Olympiad Programmes, thanks to which bright Indian students are well coached and mentored to excel in their performance and bag awards.

Many of these aspects have been covered in the articles in this Special Issue contributed by eminent colleagues and we are grateful to them for their support to this Special Issue. We thank Dr. R. Chidambaram, Principal

Scientific Adviser to the Government of India, and Dr. S. Banerjee, Former Chairman, AEC, for their valuable suggestions regarding the topics and the authors for the lead articles. We thank Dr. N. Ramamoorthy, Senior Advisor to Director, BARC and Dr. C. Srinivas, BARC for their help in bringing out this issue. We also thank Prof. S.C. Roy and Prof. S. Kar of the Science and Culture, who came up with the idea of a Special Issue on Atomic Energy, for the editorial suggestions.

We do hope this Special Issue will enhance the awareness about the DAE's significant contributions and its pre-eminent role in various spheres to make our country self-reliant and self-sufficient in all aspects of nuclear technology. ❐

S. Kailas
R. K. Sinha
Guest Editors

Dr. Swaminathan Kailas, a physics graduate from Madras University, joined Nuclear Physics Division, BARC in the year 1971 after attending BARC training school in 1970. He obtained his Ph.D in nuclear physics from Mumbai University in 1977. At present he is Director, Physics Group, BARC. Dr. Kailas has specialized in accelerator based nuclear physics and has been one of the leading experts in this field. He has made notable contributions to several frontier areas in nuclear physics.. He has also played a leadership role in establishing the Accelerator based Mass Spectrometry programme at the Mumbai Pelletron accelerator facility. Dr. Kailas is a Fellow of the Indian Academy of Science and Indian National Science Academy. He won the Indian Nuclear Society award for Radiation Technology. He is a recipient of Sir C. V. Raman medal in Physical Sciences from the Indian Science Congress in 2012. Dr. Kailas has edited a special issue on 'Accelerator Driven System' on behalf of the Indian Nuclear Society and two others on 'Physics in the Indian Nuclear Power Programme' and 'Accelerators for Science and Technology' on behalf of the Indian Association for Nuclear Chemists and Allied Scientists.

Dr. Ratan Kumar Sinha graduated in Mechanical Engineering from Patna University in 1972, and after completing the one year course of BARC Training School, he joined Reactor Engineering Division of BARC in 1973. At present he is Secretary, Department of Atomic Energy and Chairman, Atomic Energy Commission. Dr. Sinha has been guiding the design and development of new advanced reactors at BARC to utilize thorium. He is also responsible for the design and development of the Indian high temperature reactor intended for hydrogen generation. Dr. Sinha is a nationally and internationally recognized expert in the area of nuclear reactor technology. He has represented India in several important forums of the International Atomic Energy Agency. Dr. Sinha has received several awards and honours. These include the Homi Bhabha Science and Technology Award, VASVIK Award, Indian Nuclear Society Award and the DAE Special Contributions Award and Indian National Academy of Engineering Prof. S.N. Mitra Memorial Award. He was elected a Fellow of the Indian National Academy of Engineering in 1998. Dr. Sinha was conferred the honorary Doctorate of Science (D.Sc.) degree by the University of Mysore.

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