

YEAR-END SPECIAL



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*my Dear*  
**APOCALYPSE**

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# ON A PATH TO BECOME VISHWAGURU

AtmaNirbhar India in Atomic Energy a major milestone

*Atomic energy is critical for any nation. India has been continuously working on this critical energy for many decades. Giving insight into India's Department of Atomic Energy (DAE), one of India's senior and distinguished scientists, Dr Anil Kakodkar, former Chairman, Atomic Energy Commission, former Secretary, Department of Atomic Energy, presents India's atomic journey in becoming AtmaNirbhar. In an engaging interview with M. Rajendran, he explains the potential areas India can achieve self-sufficiency using atomic energy through material and process applications research.*

**The atomic energy programme of the nation has achieved many milestones. Which ones would you highlight as the most critical?**

Dr Homi J Bhabha started the Indian atomic energy program, and it is perceived with the widest possible horizon. We call it a mission mode program in atomic energy. The application of atomic energy is the program's main thrust and is made in the broadest possible way. Basic research is done with an open-ended objective and covers all aspects of science and technology.

**So, DAE does all this research?**

It is done by centres of DAE like Bhabha Atomic Research Centre (BARC), Indira Gandhi Centre for Atomic Research (IGCAR), Raja



Ramanna Centre for Advanced Technology (RRCAT). These are the large laboratories working in the Government. There are also autonomous institutions like the Tata Institute of Fundamental Research (TIFR), Tata Memorial Centre, Institute for Plasma Research, Chennai Mathematical Institute. They do fundamental research, but technologies like the first computer in the country were made in TIFR. BARC does thermal reactors research and application of radioisotopes, RRCAT researches on laser and accelerator technologies, IGCAR second stage of our nuclear program. While they also go deep into basic research. That is the strength of the Indian atomic energy program.

### **Is it correct to say that India is AtmaNirbhar using atomic energy for energy requirements?**

Yes, it was one of the objectives on the application side. Dr Bhabha conceived the three-stage nuclear program and began a comprehensive work. Tarapur Unit 1 and 2 was done under a turnkey agreement with the USA to assess how large nuclear power plants need to be set up, operated and maintained in Indian grids. Simultaneously he set up a group to define the reactor type, ideally suited for Indian requirements, particularly in achieving self-reliance or atmanirbhar. The group concluded, that in order to be AtmaNirbhar, the ideal technology would be a Pressurized Heavy Water Reactor (PHWR). It was visualized that it would be possible for India to develop this technology, manage and use it. It was done at a time when this technology was not mature. So, while we had a turnkey agreement with the USA, we set up collaborative arrangements with the Canadians.

India was participating in the technology, even while it was at the development stage of the reactor in Canada. That allowed India to start its self-reliant work step by step. So in 1974, when the Canadians left midway, we could carry on. No doubt, there was some delay, but India could achieve self-reliance in this technology. Unit-1 of Kaiga Generating Station (KGS-1) completed 962 days of continuous operation on December 31, 2018, setting

the world record of long continuous operation among PHWR.

Moreover, since we made this technology 100 per cent in India, it was done at half the cost. India today has a platform to build a large scale power production.

### **What has been the contribution of atomic technology in developing the health sector in India?**

Tata Memorial Centre is a cancer research hospital at Parel engaged in basic research. Later, the TMH research centre at Advanced Centre for Treatment, Research & Education in Cancer (ACTREC), Kharghar was set up and upgraded for treatment. One wing deals with basic cancer research, and another one deals with clinical research. It is a more focused activity; application and research go hand in hand.

### **Has there been any intervention in Agriculture?**

Today if you see the contribution of atomic energy in oilseeds and pulses, a large variety of them have been developed in BARC. This is done along with agricultural universities, and it has been a successful program. A common saying is that if you eat an idli or dosa anywhere in Maharashtra, there is a 99% chance of being made out of urad dal of BARC variety called TAU1. In terms of pulses like black gram, oilseeds, particularly groundnut, BARC has contributed to a large share of national production.

### **Sewage management using atomic energy. What promise does it hold?**

In collaboration with Amdavad Municipal Corporation (AMC), Ahmedabad, BARC has set up a Technology Demonstration Pilot Project, "Sewage Sludge Hygienisation Plant," at Shahwadi Ahmedabad. Another liquid sludge irradiator, Sludge Hygienisation Research Irradiator (SHRI), has been operating at Vadodara for radiation treatment of raw sludge containing 3-4% solids for the last 30 years. Some farmers have now formed a society and are managing a few of these plants, where they take the sludge, dry it and pack it as biofertilizer, taking the nutrition back to the soil. Now

Indore is following up on this model. By Hygienisation, you kill the pathogens and derive value for safe conditioning of soil.

### **What has been the contribution to material development?**

The comprehensive capability in BARC and other institutions allows India to develop products and processes. We do not depend on others and are atmanirbhar.

BARC has done research on carbon nanotubes on a large scale. It is a high-tech material with abilities to absorb a large amount of energy. So, it helped reduce the weight of bulletproof jackets. BARC developed Bhabha Kavach, an armour panel that gives personal protection against bullets of different threat levels. A special process developed in BARC is used to create panels offering Level III and Level III+ protection, and these are much lighter than currently available armours.

During Covid, EC-Vikram-An IoT Based Health Monitoring System was developed by Electronics Corporation of India Limited (ECIL), DAE. It helped monitor remotely a Covid patient and how much time they can spend in proximity with another non-covid person.

Luminescence based molecular imaging is another technique developed by BARC that helps in real-time visualization of biological processes and progression of tumour growth. It is a promising technology.

BARC has developed technology to transport vaccines in a van (called SHIVAY) cooled by liquid nitrogen to maintain a cold chain. This is in addition to the inbuilt refrigeration system in such vans.

### **Connecting research and industrial application remains a challenge.**

Not anymore. The examples I just gave prove it, and the Homi Bhabha National Institute promotes research where there is also an academic drive and rigour, and it has become a vibrant and dynamic research environment. It has a full ecosystem, people with diverse disciplines, and capabilities to complement each other's knowledge to resolve a problem facing the country and global community.