

WRITTEN ANSWERS TO UNSTARRED QUESTIONS

GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
RAJYASABHA
UNSTARRED QUESTION NO- 2721
ANSWERED ON 19/12/2024

INDIA'S INDIGENOUS THORIUM-BASED REACTOR PROGRAM

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Will the PRIME MINISTER be pleased to state :-

- (a) the current progress of country's indigenous thorium-based reactor programme for sustainable nuclear energy development;
- (b) whether Government has identified new locations for nuclear power plants, particularly in regions with lower energy access;
- (c) the details of policies being formulated to enhance the safety of nuclear material transportation across the country;
- (d) ongoing international collaborations in advanced nuclear research apart from the International Thermonuclear Experimental Reactor (ITER) project; and
- (e) the initiatives being undertaken to raise public awareness and acceptance of nuclear energy as a green and sustainable energy source?

ANSWER

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS
AND PRIME MINISTER'S OFFICE (DR. JITENDRA SINGH)

- (a) India's vast thorium reserves are to be utilized for long term energy security in a sustainable manner. Thorium (^{232}Th) is a fertile material, which is required to be converted into a fissile material (^{233}U) through irradiation in a nuclear reactor along with the nuclear fuel. Spent fuel thus produced, is required to be reprocessed to recover ^{233}U , thereafter fuel in the desired properties is produced using this ^{233}U . In this regard, necessary R&D is being carried out. Department of Atomic Energy (DAE) is engaged in various Thorium related R&D activities. Some important highlights of these achievements and activities are the following:

- i) Thorium Oxide (Thoria) pellets contained in bundles have been used in the initial cores of our operating Pressurised Heavy Water Reactors (PHWRs) and valuable experience has been generated in operation and re-use of this irradiated thoria. Thoria based fuels have also been irradiated in the research reactors of Bhabha Atomic Research Centre (BARC), a Constituent Unit of DAE. After such irradiation, these fuel elements have been examined in the laboratories at BARC, yielding excellent results.
 - ii) The irradiated Thoria pins of research reactors have been reprocessed to obtain Uranium-233. The recovered Uranium-233 has been fabricated as fuel for the 30 kW (thermal) KAMINI reactor, which is in operation at Indira Gandhi Centre for Atomic Research (IGCAR), a Constituent Unit of DAE at Kalpakkam. This is the only reactor in the world operating with Uranium-233 fuel.
 - iii) The technologies for fabrication of Thoria based fuel pellets, carrying Uranium-233, have been established.
 - iv) Studies have also been carried out to use Thorium in different types of reactors with regard to fuel management, reactor control and fuel utilisation.
- (b) In addition to the sites where presently reactors are in operation / under implementation, the Government has accorded 'in principle' approval for five new sites for setting up nuclear power plants in future.
- (c) Nuclear material are transported across the country in compliance with the safety requirements specified in AERB safety code on 'Safe Transport of Radioactive Material'. This safety code is based on the regulations published by the International Atomic Energy Agency (IAEA) and establishes requirements that shall be satisfied to ensure safety and to protect persons, property and the environment from the effects of radiation in the transport of radioactive material. The code elaborates on the requirements of protection which need to be achieved for containment of the radioactive contents, control of external radiation levels, prevention of criticality, where applicable, and prevention of damage caused by heat, where applicable.
- (d) India is a member state to International Atomic Energy Agency and has entered into intergovernmental agreements for civil nuclear co-operation with 18 countries through which scientific collaboration, nuclear safety and security co-operation, trade,

human resource development and training are conducted with international fraternity in the field of peaceful use of nuclear energy – both power and non-power application. In context of international collaboration in advanced nuclear reactor research, DAE is studying the progress of SMR development in other countries. At present, no collaboration/co-operation focused on SMR or other advanced reactor concepts has been entered into with any of the foreign countries.

India participates in various knowledge sharing events organised by IAEA as member state. Global Centre for Nuclear Energy Partnership (GCNEP), a constituent unit of DAE has signed MoUs with 16 international partners including USA, Russia, IAEA, France, etc.

Major Multilateral international collaborations in advanced nuclear research are mentioned below:

- CERN (European Organization for Nuclear Research, France and Switzerland)
- FAIR (Facility for Antiproton and Ion Research, Germany)
- JHR (Jules Horowitz Reactor, France), etc
- UK-India Civil Nuclear Collaboration
- ORNL-USA, under Indo-US Civil Nuclear Energy Working Group
- Collaborative Project between CEA (France) and IGCAR (DAE, India)

Indian Institutions Fermilab collaboration (IIFC) in the field of Physics and advanced technologies for high intensity proton accelerators is ongoing bilateral collaboration with Fermi National Accelerator Laboratory (FNAL), USA.

- (e) Many initiatives are being taken at multiple levels to spread awareness about the peaceful uses of nuclear energy, merits of nuclear power and address the apprehensions of the people in a simple, understandable and credible manner for acceptance of nuclear energy as a green and sustainable energy source:

- Journalists' workshops, Outreach exhibitions, high visibility ground events, are held by DAE at various locations of the country regularly.
- Paramanu Jyoti program, reaching out to thousands of schools in the country
- DAE Social media channels of Facebook, Instagram, X and You tube are also used to reach out to millions of people.

- Campaign through broadcast media, print media is also taken up from time to time.
- A well planned public awareness program has been operational for disseminating the knowledge and advancements in the three stages of Indian nuclear energy with exhibition charts and demonstration models.
- To create scientific temperament among students & young generation, lectures are provided at Colleges, Schools & other educational institutions.
- Industrial visits are arranged for college students every week to experience the laboratories / facilities of the Department.
- Engineering and science students are allowed to carry out their implant training and project work.
- Students from various Schools in the country are encouraged to visit the Department every week as part of the platinum jubilee celebrations of DAE. Visit to labs, competitions, interaction with senior scientists will kindle the interest in scientific research and give them a chance to experience the clean, green technologies used for nuclear power generation and clarify their queries on the safety and aspects of nuclear power. They in turn become our ambassadors.
- To encourage the post graduate students to pursue S&T as their career, a Summer Training Programme in Physics & Chemistry (STIPAC) is organized every year at IGCAR.
- Teachers from various schools and colleges have been encouraged to visit DAE and interact with the scientists and engineers to create awareness of the innovations and developments in various domains of nuclear science and engineering. This has a great positive impact on the students to whom they teach on the benefits of nuclear power and its uses to the society.
- Public awareness and interactive sessions are organised regularly to showcase the activities of the Department and encourage more participation from public, particularly disseminating the benefits of nuclear power generation and answering their queries. Apart from energy sector, the awareness on the spin-offs from the nuclear science and technology which has several societal applications is explained. The public is also informed how DAE has pioneered the application of radiation based technologies in health care, agriculture, food preservation, industrial sector, sludge hygenisation to name a few.

- Annual Anu-yatra programmes have been organised covering many nodal educational institutions in the country, to showcase the indigenous progress in Science and Technology. This yatra is primarily to initiate scientific curiosity amongst the students in rural areas and also to spread awareness on the necessity of nuclear energy and the spin-off technologies developed by DAE and its various activities. Exhibitions, competitions, interactive talks are held at each institution covering a wide audience of college, school students, teachers and general public. The objective of the program is three-fold:
 - to highlight the progress in nuclear science and technology in India, including nuclear power and societal applications of ionizing radiation; benefits of clean green nuclear energy.
 - to create interest among the youth on science subjects and to explore the educational and career opportunities at DAE; and
 - dispelling myths on nuclear energy.
- Distribution of single sheets in simple local language addressing each of the issues concerning the local people.
- Showcasing short films.
- Radio jingles.
- Addressing community leaders and people's representatives.
- Lectures / Presentations in schools and colleges.
- Setting up of 'Halls of Nuclear Power', permanent exhibition centres.
- Nuclear Power Plant models installed at museums / science centres in various parts of the country.
- Innovative approaches like exhibition on wheels, street plays, etc. have also been taken up to reach out to the rural masses in this
- A new project is envisaged for next five years taking up such scientific communication and public engagement activities to take up all the above events.

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