

GOVERNMENT OF INDIA  
DEPARTMENT OF ATOMIC ENERGY  
**RAJYA SABHA**  
**UNSTARRED QUESTION NO. 646**  
TO BE ANSWERED ON 21.12.2017

**RESEARCH ON HEAVY WATER REACTOR TECHNOLOGY**

646. SHRI PARIMAL NATHWANI:

Will the PRIME MINISTER be pleased to state:

- (a) whether Government has started its research on the Advanced Heavy Water Reactor Technology;
- (b) if so, the details thereof; and
- (c) what are the benefits of using this technology?

**ANSWER**

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

(a)&(b) Research & Development on Thorium utilisation continues to be a high priority R&D area of the Department of Atomic Energy (DAE). On account of physical characteristics of Thorium, it is not possible to build a nuclear reactor using Thorium alone. It has to be converted to Uranium-233 in a reactor before it can be used as fuel. With this in view, a three-stage nuclear power programme, based on a closed nuclear fuel cycle has been chalked out to use thorium as a viable and sustainable option, right at the inception of India's nuclear power programme. The three stage nuclear power programme aims to multiply the domestically available fissile resource through the use of natural uranium in Pressurised Heavy Water Reactors, followed by use of plutonium obtained from the spent fuel of Pressurised Heavy Water Reactors in Fast Breeder Reactors. Large scale use of Thorium will subsequently follow making use of the Uranium-233 that will be bred in Fast Breeder Reactors, when adequate capacity has been built in the country. The third stage of Indian nuclear power programme which contemplates making use of Uranium-233 to fuel Thorium Uranium-233 based reactors can provide energy independence to the country for several centuries. All efforts towards technology development and demonstration have been undertaken, so that a mature technology is available in time.

India is considered a world leader in research and development of Thorium technologies and is well recognised in the international community. Today India leads the world in number of publications related to Thorium. Bhabha Atomic Research Centre (BARC), and other research organisations under with DAE, are engaged in various R&D activities to address the utilisation of Thorium in different types of reactors. Some important highlights of these 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 thorium fuel. Thoria based fuels have also been irradiated in the research reactors of BARC. 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) at Kalpakkam. This is the only reactor in the world operating with Uranium-233 fuel.
  - iii) 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.
  - v) Indigenous efforts towards development and demonstration of Thorium-based reactor technology have been undertaken with BARC-designed Advanced Heavy Water Reactor (AHWR, 300 MWe). This 300 MWe reactor using thorium based fuel will serve as a technology demonstrator not only for the thorium fuel cycle technologies, but also for several advanced passive safety features. AHWR will generate nearly 60% of its power from Thorium. AHWR will demonstrate all related technologies for commercial utilisation of Thorium.
  - vi) A Critical Facility for Advanced Heavy Water Reactor was commissioned in 2008 at BARC and is being used since then for carrying out experiments to further validate the physics design features of Advanced Heavy Water Reactor (AHWR).
- (c) This is aimed at utilisation of our Thorium reserves for power generation.

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