GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
LOK SABHA
UNSTARRED QUESTION NO - 4103
ANSWERED ON 12/08/2026

STRENGTHENING INDIA'S INDIGENOUS NUCLEAR ENERGY ECOSYSTEM

4103. SHRI JAGDAMBIKA PAL

Will the PRIME MINISTER be pleased to state:-

(a) whether the Government has undertaken a comprehensive review of India's long-term nuclear energy strategy including the development of indigenous nuclear technologies and advanced reactor systems and if so, the details thereof;

(b) whether the Government proposes to encourage greater participation of the private sector in nuclear manufacturing, engineering services, research and development and supply chains while ensuring robust regulatory oversight and nuclear safety and if so, the details thereof;

(c) whether the Government proposes to accelerate the development and deployment of thorium-based nuclear technologies to strengthen India's long-term energy security and reduce dependence on imported nuclear fuel and if so, the details thereof; and

(d) the details of policy measures taken or proposed to be taken to build a globally competitive, self-reliant and technologically advanced nuclear energy ecosystem in the country?

ANSWER

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

(a) Yes, India's long-term nuclear energy strategy is guided by the three-stage nuclear power programme aiming for utilisation of vast thorium reserves for energy security in a sustainable manner.

The strategy has been further strengthened through the Nuclear Energy Mission (NEM) announced in the Union Budget 2025–26 aimed for expansion of nuclear energy with the objective of achieving 100 GWe by 2047. A two-pronged strategy adopted to accelerate nuclear capacity addition; (i) Deployment of large reactors such

as 700 MWe indigenous Pressurised Heavy Water Reactors (PHWRs) and advanced reactor designs at green field sites for rapid expansion; and (ii) Development & deployment of Small Modular Reactors (SMRs) in brown field sites for repurposing retiring fossil fuel-based power plants, captive plants for energy intensive industries, and off-grid applications for remote locations.

The Mission also aims to develop and operationalise at least five indigenous Small Modular Reactors (SMRs) by 2033. In this regard, Bhabha Atomic Research Centre (BARC) a constituent Unit of Department of Atomic Energy (DAE) has undertaken the design and development of indigenous SMRs, namely 220 MWe Bharat Small Modular Reactor (BSMR-200), and 55 MWe Small Modular Reactor (SMR-55) for power generation, and a High Temperature Gas Cooled Reactor (HTGCR) having capacity up to 5 MWth, which can be coupled with suitable thermochemical cycle for hydrogen production.

Indira Gandhi Centre for Atomic Research (IGCAR) a constituent Unit of DAE, is piloting the second stage of India's Nuclear Power Programme and is mandated to conduct a broad based multidisciplinary programme of scientific research and advanced engineering development, directed towards establishment of technology of Sodium Cooled Fast Breeder Reactors (FBR) and associated closed fuel cycle facilities, a cornerstone of India's long-term nuclear strategy. This includes the development and applications of new and improved materials, techniques, equipment and systems for FBRs, pursuance of research in basic sciences, engineering and technology to achieve breakthroughs in Fast Reactor technology.

Towards this IGCAR has set up and operated a number of facilities and there has been continuous increase in the implementation of R&D infrastructure projects towards achieving the mission oriented targets.

The Government has also enacted the Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025 to enable a wider participation of both public and private sectors. Further, the Government has announced measures for enabling R&D in SMRs and new advanced technologies. The aforementioned measures envisage a significant contribution from indigenous PHWR technology based nuclear power plants.

(b) Yes, DAE is aiming to encourage greater participation of the private sector in nuclear manufacturing, engineering services, research and development and supply chains. In this regard, the SHANTI Act, 2025 has been enacted for participation of public and private entities in the field of nuclear energy, while ensuring the highest standards of safety, security, safeguards and regulatory oversight.

DAE is engaging Indian industries through knowledge sharing and handholding for new technology developments for the SMRs, thus developing nuclear vendors for self-reliance in the field of nuclear technology encouraging R&D ecosystem in private sector. Development of critical items such as low alloy steel forgings for reactor pressure vessels and reactivity control drive mechanisms has already been realised through domestic industry, while development of other critical equipment has been initiated with the domestic industry and start-up.

Thus, Indian industries play a key role in the manufacture of equipment for these reactors, strengthening indigenous capabilities and the domestic nuclear supply chain.

Greater participation of the private entities also in nuclear sector is envisaged after the entry in to force of the reforms under the SHANTI Act 2025, which also puts in place a robust regulatory oversight and nuclear safety by according statutory status to the Atomic Energy Regulatory Board.

DAE also promotes Make in India policy of the Government of India and development of new vendors.

(c) India is pursuing the Three-Stage Nuclear Power Programme, based on a closed fuel cycle, to achieve optimum utilisation of its limited uranium resources and exploit its abundant thorium reserves. Thorium unlike uranium, is a fertile material and needs to be converted to fissile uranium-233 in a nuclear reactor, before it can be used to generate energy by nuclear fission. In first stage, domestically available natural uranium is used as fuel in Pressurised Heavy Water Reactors (PHWRs), followed by reprocessing of the spent fuel of PHWRs to extract plutonium. In second stage U-238 is further bred into Pu-239 in Fast Breeder Reactors (FBRs) utilizing reprocessed Pu-239 as fuel. In third stage, only after adequate capacity of FBRs is installed, large scale utilisation of thorium will follow, making use of fissile uranium-233 bred from thorium in a breeder reactor initially utilizing Pu-239 as driver fuel. In this regard, the

Department has undertaken sustained research and development for thorium utilisation. Thorium Oxide (Thoria) pellets have been used in the initial cores of operating PHWRs, and Thoria-based fuels have been irradiated in BARC research reactors. The irradiated Thoria pins have been reprocessed to obtain uranium-233, which has been fabricated as fuel for KAMINI reactor installed at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam.

The Three-Stage Indian Nuclear Power Programme can provide long term energy security and reducing dependence on imported nuclear fuel.

(d) DAE has undertaken several measures to build a globally competitive, self-reliant and technologically advanced nuclear energy ecosystem in the country. These include:

1. SHANTI Act, 2025, which envisages participation of public and private entities in nuclear manufacturing, engineering services, research and development and supply chains.
2. Implementation of the Nuclear Energy Mission with development of at least five indigenous SMRs by 2033.
3. Design and development of indigenous technologies such as BSMR-200, SMR-55 and HTGCR.
4. Expansion of indigenous nuclear medicine infrastructure through the Isotope Production Reactor (IPR) to substantially augment domestic production and making India self-reliant in the field of medical isotopes.
5. Continued capacity building in reactor design, manufacturing, construction and the nuclear fuel cycle, thereby supporting long-term energy security and self-reliance.

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