GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
LOK SABHA
UNSTARRED QUESTION NO–1766
ANSWERED ON 10/12/2025

FINANCIAL AND OPERATIONAL STRUCTURES FOR SMR DEPLOYMENT

1766. SHRI BRIJMOHAN AGRAWAL

Will the PRIME MINISTER be pleased to state:-

(a) the details of specific financial and operational structures such as PPP models including BOOT or PPA guarantees being formulated to attract private investment for Small Modular Reactor (SMR) deployment;
(b) the details of preferred SMR technologies like Light Water or High-Temperature Gas along with localization targets and incentives for domestic manufacturing to build India's value chain;
(c) the details of revised Atomic Energy Regulatory Board (AERB) protocols for SMR safety security and siting near industrial zones including the measures to address public concerns;
(d) the details of strategies to ensure competitive Localised Cost of Energy for SMRs versus renewables with tariff mechanisms for data centres;
(e) the details of long-term plans for SMR waste management including transport guidelines along with the skill programmes projecting workforce needs for next five years;
(f) the details of leading PSUs actively working with the Ministry and their respective achievements so far in this technology; and
(g) the details of NTPC Nuclear cell's plans with Chhattisgarh & Madhya Pradesh for nuclear project development?

ANSWER

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

(a) & (b) Preferred SMR technology is light water reactor based pressured water technology. Based on PWR technology Bhabha Atomic Research Centre (BARC), a constituent Unit of Department of Atomic Energy (DAE) has initiated design and development of 200 MWe Bharat Small Modular Reactor (BSMR-200 MWe) and 55 MWe Small Modular Reactor (SMR-55 MWe), with a purpose of;

a. Repurposing of retiring fossil fuel-based power plants,
b. Captive plants for energy intensive industries such as steel, cement and process industries.
c. Off-grid applications for remote locations.

BARC is also developing up to 5 MWth high temperature gas cooled reactor for hydrogen generation. Gas cooled reactor technology is selected as the hydrogen production requires high temperature. However, research and development is required for design and development of high temperature materials and reactor.

Most of the critical equipment and components are made in the country for well proven Pressurized Heavy Water Reactor (PHWR) design. The industries engaged in manufacturing of PHWR are likely to participate in manufacturing of critical equipment and components for SMRs. Localisation of manufacturing and supply chain for these SMRs are envisaged in line with the "Make in India" initiative. Manufacturing of critical equipment and components, such as special steel and heavy forgings for reactor pressure vessel, primary coolant pumps, heat exchangers, control rod drive mechanisms, instruments along with their associated electronics and control systems etc., are within the capability of Indian industries with technical handholding by BARC. Further, participation of private sector/ Indian industry will be for construction of SMRs through engineering, procurement and construction (EPC) contracts. This create complete domestic ecosystem of manufacturing and supply chain.

The technological advancement and know-how developed by Indian industries in the process can be leveraged to get potential collaboration/ business opportunities in Indian and abroad as many countries are planning to develop and deploy SMRs. One of the major incentives for the heavy industries from the private sector can be the ownership (as permissible by the extant Atomic Energy Act) and guaranteed rights over the green electric power generation by SMRs. The decarbonisation of energy incentive industries could be helpful in avoiding the proposed carbon tax on export of goods.

(c) &(d) Different types / designs of Nuclear Power Plants (NPPs) in India are to be sited, designed, constructed, commissioned & operated complying with the regulatory requirements of AERB. AERB safety and regulatory requirements for licensing of NPPs are mostly technology neutral. In light of the evolving developments in the

fields of SMRs, AERB has conducted review of its existing regulatory requirements and concluded that the same regulatory framework can generally be applied for safety regulation of advanced reactors as such as SMRs, except for technology specific aspects for which review may be required when details of proposed sites and design of specific SMR is submitted to AERB. AERB also participates in various international forums to keep itself abreast about the developments in regulation of SMRs and suitably adopt them when required.

With respect to nuclear security, AERB regulates those engineering aspects of nuclear security which have a bearing on safety, within the main plant boundary of Nuclear Power Plant (NPP), as per requirements specified in the AERB documents titled "Nuclear Security Requirements for Nuclear Power Plants". The same approach can also be used for SMRs.

With respect to measures being taken to address public concerns, AERB has an established public outreach program to spread awareness and keep the public informed on radiation and nuclear safety related matters. AERB views public outreach as an essential element to build long-lasting trust and confidence with media and public at large. AERB conducts awareness programs in the vicinity of NPPs and radiation facilities, to engage with public and spread awareness about radiation safety regulation. AERB publishes its quarterly e-newsletters, annual report and all relevant information related to radiation and nuclear safety matters on its website. AERB also issues press releases on matters related to nuclear and radiation safety.

(e) DAE has a comprehensive and internally aligned framework to ensure safe and long-term management of radioactive waste generated from the existing reactors. Same framework can be used for small modular reactors. Nuclear waste arising from the nuclear power plants and fuel cycle facility will be safely managed/disposed under the provisions of "The Atomic Energy Act, 1962", subsequent amendments and the Atomic Energy (Safe Disposal of Radioactive Wastes) Rules, 1987.

As a waste management philosophy, no waste in any physical form is released/disposed to the environment unless same is cleared, exempted or excluded from regulations. Low and intermediate level waste generated from operation and maintenance of a nuclear power plants are managed at plant site itself. These wastes are treated, concentrated, compacted, immobilized in solid like cement and disposed in specially constructed structures such as reinforcement concrete trenches and tile

holes located at the site. The disposal facility is kept under constant surveillance to confirm effective containment of radioactivity present in the disposed waste.

Broad philosophy of nuclear waste management remains same to reduce the overall nuclear waste burden i.e., recovery of useful radioisotopes, if any, volume reduction followed by vitrification of waste in stable glass matrix and storage in engineered facilities kept under surveillance at par with internationally accepted practices. However, in case of SMRs the reprocessing technology is to be re-engineered based on the fuel configuration.

The transportation of radioactive material is as per guidelines stipulated by AERB and will be in line with existing reactors.

(f) Currently SMRs are in design stage. So far, only Engineers India Limited and Bharat Heavy Electricals Limited (BHEL) have been approached for detailed engineering of BSMR-200. Nuclear Power Corporation of India Limited (NPCIL) has been closely associated with BARC for formation of detailed report for BSMR-200.

(g) National Thermal Power Corporation (NTPC) Group [except Tehri Hydro Development Corporation Limited (THDC) and North Eastern Electric Power Corporation Limited (NEEPCO)], two MoUs have been signed by NTPC, one with the Government of Madhya Pradesh on 24.02.2025 and another with the Government of Chhattisgarh on 10.03.2025, to collaborate and explore opportunities to develop a project in each state, with the project capacity to be determined based on water availability, and approval from the Government of India.

*****