GOVERNMENT OF INDIA
DEPARTMENT OF ATOMIC ENERGY
LOK SABHA
UNSTARRED QUESTION NO.1939
TO BE ANSWERED ON 07.03.2018

UTILIZATION OF NUCLEAR MATERIALS

1939. SHRIRAMSINH RATHWA:

Will the PRIME MINISTER be pleased to state:

(a) the quantum of nuclear material utilized in power production and other sectors during each of the last three years, nuclear power plant-wise and sector-wise;

(b) the action plan and the target for the supply and usage of nuclear energy sources in the next three years;

(c) the names and quantum of sources of indigenous atomic energy including thorium; and

(d) the status of the technology developed in the country to utilize the aforesaid sources?

ANSWER

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

(a) The approximate requirements of atomic fuel/uranium for Pressurised Heavy Water Reactors (PHWRs) are as follows:

Unit Capacity (MW)	Annual requirement at 85% Capacity Factor (tons UO_2)
220	45
540	100
700	125

The approximate requirements of atomic fuel/uranium for Light Water Reactors (LWRs) currently in operation are as given below:

Unit Capacity(MW)	Annual Fuel Requirement (tons, low enriched uranium)
160	6 (at 85% CF)
1000	25 (at 90% CF)

(b) To augment indigenous resources of uranium and thorium, Atomic Minerals Directorate for Exploration and Research (AMD), a constituent unit of Department of Atomic Energy (DAE) has taken measures to augment domestic uranium and thorium resources by state-of-the-art, integrated, multi-disciplinary exploration utilising remote sensing, heliborne / ground geophysical survey, geological, radiometric and geochemical surveys and drilling with high-tech hydrostatic rigs and 'sonic' drill rigs in several productive, prospective and potential areas of the country. Laboratories have been upgraded with modern, high-tech instruments and equipment to provide rapid and accurate analytical support to field investigations.

Thorium resources are contained in the mineral monazite, which occurs in association with other Beach Sand Minerals (BSM) like ilmenite, leucoxene, rutile (titanium minerals), zircon (zirconium mineral), garnet and sillimanite (industrial minerals).

(c) The status of uranium and thorium (monazite) resources as on January, 2018 is given in Annexure 1 and Annexure 2.

(d) Research & Development on Thorium utilisation continues to be a high priority R&D area of the Department of Atomic Energy (DAE). 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. 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. 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 thorium fuel.

ii) The irradiated Thoria pins from 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. 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 been also 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 are well underway 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.

vi) A Critical Facility for Advanced Heavy Water Reactor was commissioned in 2008 at Trombay and is being used since then for carrying out experiments to further validate the physics design features of AHWR.

In addition, the Department has an active programme for utilisation of Thorium in High Temperature Reactors, Molten Salt Breeder Reactor and Accelerator Driven Sub-critical System. Various technologies, fuels, and materials are also being developed for these innovative reactors and advanced energy systems.

The Pressurised Heavy Water Reactor (PHWR) technology to utilise the domestic uranium reserves has been developed indigenously and it has attained maturity.

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Annexure 1: Status of Uranium Resources :

State	Uranium Reserves	
	U_3O_8 (tonne)	U (tonne)
Andhra Pradesh	1,44,541	1,22,570
Telangana	18,550	15,731
Jharkhand	67,712	57,420
Meghalaya	23,040	19,538
Rajasthan	9,421	7,989
Karnataka	4,682	3,970
Chattisgarh	3,986	3,380
Uttar Pradesh	785	666
Uttarakhand	100	85
Himachal Pradesh	784	665
Maharashtra	355	301
Total	**2,73,956**	**2,32,315**

Annexure 2 : Status of monazite resources

State	No. of deposits	Resource (million tonne)
Odisha	10	3.06
Andhra Pradesh	26	3.69
Tamil Nadu	51	2.46
Kerala	35	1.84
West Bengal	1	1.20
Jharkhand	1	0.21
Maharashtra	3	0.004
Gujarat	1	0.003
Total	**128**	**12.467**

Monazite in the beach placer sands contains about 9-10% thorium oxide (ThO_2). The monazite resource (12.47 million tonne) contains approximately 0.98 million tonne thorium metal (Th) or approximately 1.12 million tonne ThO_2.

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