

**GOVERNMENT OF INDIA
ATOMIC ENERGY
LOK SABHA**

UNSTARRED QUESTION NO:1669

ANSWERED ON:03.12.2014

GENERATION OF ATOMIC ENERGY THROUGH THORIUM

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Will the Minister of ATOMIC ENERGY be pleased to state:

- (a) whether Thorium can be used as a fuel for generation of atomic energy in the country and if so, the details thereof;
- (b) the estimated quantity of Thorium available in the country at present, State-wise;
- (c) whether the Government has formulated any scheme for generating nuclear power through Thorium and if so, the details thereof;
- (d) the power generation capacity of Thorium in comparison to natural uranium; and
- (e) the capacity of power projects which can be established in the country by using Thorium?

Answer

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

(a) Yes, Sir. On account of physics characteristics of Thorium, it is not possible to build a nuclear reactor using Thorium alone. It has to be converted into Uranium-233 in a reactor before it can be used as fuel. India has one of the largest reserves of thorium in the world and when used as a part of a three stage programme thorium can be used as fuel for sustainable generation of atomic energy in the country.

(b) The Atomic Minerals Directorate for Exploration & Research (AMD), a constituent unit of Department of Atomic Energy (DAE), has so far established 11.93 million tonnes of monazite (Thorium bearing mineral) in the country, which contains about 1.07 million tonnes of thorium. The state-wise resources of in situ monazite established by AMD as on October 2014 are as follows:

State	Monazite (Million tonnes)
Odisha	2.41
Andhra Pradesh	3.72
Tamil Nadu	2.46
Kerala	1.90
West Bengal	1.22
Jharkhand	0.22
Total	11.93

(c) On account of physics characteristics of Thorium, it is not possible to build a nuclear reactor using Thorium alone. It has to be converted into 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. 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 (PHWRs), 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 Uranium-233 that will be bred in Fast Breeder Reactors, when adequate nuclear installed capacity in the country has been built. Accordingly, the utilisation of Thorium as a practically inexhaustible energy source has been contemplated during the third stage of the Indian nuclear programme, which can be reached after a few decades.

(d) Thorium consists of 100% fertile isotope Thorium-232 and energy can only be produced by converting it into Uranium-233 in a nuclear reactor. However, natural uranium contains small amounts of about 0.71% of fissile isotope Uranium-235 in addition to the 99.3% of fertile Uranium-238. Due to the presence of the fissile Uranium-235 in natural uranium, energy can be generated from natural uranium directly. However, for utilising natural uranium completely, the fertile Uranium-238 also has to be converted to Plutonium-239 in a nuclear reactor. The energy produced from a nuclear fission of the fissile isotopes Uranium-233, Uranium-235 and Plutonium-239 is same. The power generation capacity from both natural thorium and natural uranium per unit mass is therefore same after they are converted to their respective fissile materials.

(e) The energy potential of the thorium reserve in the country is more than 155,500 GWe-years through the three stage nuclear programme devised to efficiently utilise the large reserve of thorium.