GOVERNMENT OF INDIA
PRIME MINISTER
LOK SABHA

UNSTARRED QUESTION NO:1533
ANSWERED ON:14.08.2013
NUCLEAR ENERGY
Sinha Shri Yashwant

Will the Minister of PRIME MINISTER be pleased to state:

(a) the progress made in the Indo-US nuclear deal;

(b) the number of new nuclear reactors ready to be installed in the country;

(c) the progress achieved by the thorium nuclear reactor in the country; and

(d) the expected cost of power per megawatt from the imported reactors and the indigenous thorium based reactors?

Answer

THE MINISTER OF STATE FOR PERSONNEL, PUBLIC GRIEVANCES & PENSIONS AND PRIME MINISTER'S OFFICE (SHRI V. NARAYANASAMY) :

(a) Pursuant to article 6
(iii) of the Agreement for cooperation concerning Peaceful Uses of Atomic Energy (of 2008) between the Government of the United States of America and the Government of India an Agreement on Arrangements and Procedures concerning reprocessing or other alteration in form or content of nuclear material, etc., was signed on 30th July 2010. The Administrative Arrangement under Article 17 of the Agreement is under discussion. Nuclear Power Corporation of India Limited (NPCIL) is engaged in techno-commercial discussions with M/s Westinghouse Electric Company and M/s General Electric- Hitachi in respect of the nuclear power projects at Mithivirdi and Kovvada respectively.

(b) The Unit-1 of Kudankulam Nuclear Power Project (KKNPP) has attained the first criticality (start of controlled self-sustaining fission chain reaction for the first time) on July 13, 2013. Work on Unit-2 of KKNPP is closely following that of Unit-1. Construction of five more nuclear power reactors viz. Rajasthan Atomic Power Station (RAPS) Units 7 & 8 at Rawatbhata in Rajasthan, Kakrapar Atomic Power Station (KAPS Units) 3 & 4 at Kakrapar in Gujarat and Prototype Fast Breeder Reactor (PFBR) at Kalpakkam in Tamil Nadu is in progress. Government has accorded financial sanction in March 2013 for setting up of Kudankulam Nuclear Power Project Units 3 & 4 (2X1000 MW) in technical cooperation with Russian Federation.

(c) Thorium plays a pivotal role in the Indian Nuclear power programme. Right from the inception of Indian nuclear power programme, work has been carried out on various aspects of thorium utilisation such as mining and extraction of thorium, fuel fabrication, irradiation in reactors, reprocessing and refabrication etc. In addition, studies have been carried out regarding use of thorium in different types of reactors.

Details of Research Programme:

(i) Thorium fuel fabrication through powder pellet route has been well established. Few tons of fuel have been made for CIRUS and Dhruva, Pressurised Heavy Water Reactor (PHWR) and for blanket assemblies for Fast Breeder Test Reactor (FBTR). Few pins have been fabricated using mixed oxides of (Th-Pu) for irradiation in research reactors.
(ii) Thoria bundles are used in the initial cores of PHWR. The irradiation experience of thoria fuel in the research reactors CIRUS and Dhruva, PHWR and test irradiations are satisfactory.
(iii) The thoria pins of CIRUS have been reprocessed to obtain U233. The recovered U233 has been fabricated as fuel for KAMINI reactor at Kalpakkam. The Post Irradiation Examination of one of the thoria bundle irradiated in PHWR has also been carried out for validation of theoretical analyses.
(iv) Studies have been carried out regarding use of thorium in different types of reactors with respect to fuel management, reactor control and fuel utilisation.
(v) A Critical Facility for Advanced Heavy Water Reactor has been commissioned in 2008 and is used for carrying out experiments to further validate the physics design features of Advanced Heavy Water Reactor.
(vi) A small research reactor KAMINI with 30 kWth capacity which utilises nuclear fuel based on Uranium-233 derived from irradiation of thorium, has been in operation at Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam.
Generation of power from Thorium:
(i) While it is true that Thorium can be used to produce nuclear energy, it should be noted that Thorium cannot be used directly. Thorium does not contain any fissile isotope, hence it cannot be used in a reactor alone. It can be used with added fissile material that can be either enriched Uranium, Plutonium or Uranium-233 (obtained after irradiation of Thorium).

(ii) Thorium absorbs the neutrons, which can more efficiently produce more Plutonium in a Plutonium-Uranium fuelled Fast Breeder Reactor for a faster growth. Therefore, using Thorium in the first, or an early part of second stage of nuclear power programme will adversely affect the rate of growth of nuclear power generation capacity in the initial periods.

(iii) Due to these reasons, large scale deployment of Thorium is to be postponed till the later part of the second stage. Thorium is to be introduced for large scale deployment at an optimal point during operation of Fast Breeder Reactors in the second stage. The third stage of Indian nuclear power programme contemplates making use of Uranium-233 to fuel Uranium-233 − Thorium based reactors, which can provide energy independence to the country for several centuries.

(iv) For timely development and demonstration of thorium deployment technologies on a large scale, alongwith extensive use of passive safety systems, Bhabha Atomic Research Centre (BARC) has designed a 300 MW Advanced Heavy Water Reactor (AHWR) to serve as a technology demonstrator. Activities towards construction of AHWR are proposed to start in the XII Plan period.

(d) The Kudankulam Nuclear Power Project (KKNPP) Units 3 & 4, having capacity of 1000 MW each to be constructed at the existing Kudankulam site in Tamil Nadu, in technical cooperation with Russian Federation, is expected to have a completion cost of `39,849 crore (at an exchange rate of `55 per dollar) yielding a completion cost/per MWe installed of about `20 crore/MW. The cost of reactors proposed to be set up in cooperation with USA and France will emerge after conclusion of techno-commercial negotiations, now in progress. As indicated in the answer to part Â© above, the deployment of thorium based commercial nuclear power plants is envisaged in the third stage of Indian nuclear power programme.