Leveraging India's Thorium Reserves

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Why in News?

The Government has replied in Parliament about India's roadmap to expand nuclear power capacity to 100 GW by 2047, harnessing its abundant thorium reserves through the 3-Stage Nuclear Power Programme.

- **Thorium –** It is a naturally occurring, ***weakly radioactive, silvery-white metal*** found in rocks and soil (Th, atomic number 90).
- **Nuclear Potential –** Thorium is fertile, meaning it is ***not fissile*** on its own but can be converted into the fissile isotope uranium-233 through neutron bombardment in a reactor.
- **Abundance –** It is found in trace amounts in most rocks and soils. The primary commercial source is the ***mineral monazite***, found in India, Brazil, Australia, and the USA.
- **Thorium Reserves in India –**
  - An estimated 13.15 million tonnes of monazite are found in ***coastal beach and red sands*** (Kerala, Tamil Nadu, Odisha, Andhra Pradesh, Maharashtra, Gujarat).
  - ***Inland deposits*** are also found in Jharkhand, West Bengal, and Tamil Nadu.
  - Monazite sands contain 9–10% thorium oxide.
  - **Total reserves** – Approx 1.04 million tonnes thorium metal or Approx 1.18 million tonnes thorium oxide.

Key Highlights of Nuclear Expansion Roadmap

- India currently operates 25 nuclear power plants with a ***combined capacity of 8,880 MW.***
- **Current capacity target –** It is planned to be increased to about 22 GW by 2031-32 on progressive completion of projects under implementation.
- **Long-term vision –** 100 GW by 2047.
- **Thorium Utilisation –** India has limited uranium but abundant thorium; it must be converted into Uranium-233 before use.
- The ***3-Stage Programme*** ensures optimal use of uranium while preparing for large-scale thorium deployment.
- **Three-Stage Nuclear Programme -**
  - **Stage 1** - Pressurised Heavy Water Reactors (PHWRs) using natural uranium.
  - **Stage 2** - Fast Breeder Reactors (FBRs) using plutonium from PHWR spent fuel.
  - **Stage 3** - Thorium-based reactors using Uranium-233 bred from thorium, once

sufficient FBR capacity is achieved.

- **Current Projects – *BHAVINI*** is commissioning a 500 MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam, Tamil Nadu.
- Approval granted for 2 × 500 MWe twin FBR units (FBR 1&2) at Kalpakkam.
- **Community Engagement –** BHAVINI is conducting CSR and outreach activities to build local trust. The public and students are educated on nuclear safety features and the benefits of nuclear energy.

References

1. PIB | Leveraging India's Thorium Reserves
2. PIB | Thorium based Reactors