



Nuclear Power Plants in India

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Why in News

Recently, the government provided details related to various nuclear power plants in the country.

- Presently, **India has 22 operating nuclear power reactors**, with an installed capacity of 6780 MegaWatt electric (MWe). Among these eighteen reactors are **Pressurised Heavy Water Reactors (PHWRs)** and four are **Light Water Reactors (LWRs)**.
The **nuclear energy programme** in India was launched around the time of independence under the leadership of Homi J Bhabha.
- **Prototype Fast Breeder Reactor (PFBR)** is being implemented by the **Bharatiya Nabhikiya Vidyut Nigam Limited (BHAVINI)**, a wholly owned Enterprise of the Government of India under the administrative control of the Department of Atomic Energy (DAE).

Pressurized Heavy Water Reactor

- PHWR is a nuclear power reactor, commonly using **unenriched natural uranium** as its fuel. It uses **heavy water (Deuterium oxide D₂O)** as its coolant and moderator.
- The **heavy water coolant is kept under pressure**, allowing it to be heated to higher temperatures without boiling, much as in a typical pressurized water reactor.
- While heavy water is significantly more expensive than ordinary light water, it yields **greatly enhanced neutron economy**, allowing the reactor to operate without fuel enrichment facilities.

Light Water Reactor

- The light water reactor is a type of **thermal- neutron reactor** that **utilizes normal water** as opposed to heavy water.
- It is fuelled by **Low Enriched Uranium**.
- It uses water as both a coolant method and a neutron moderator.

- It **produces heat by controlled nuclear fission.**

Prototype Fast Breeder Reactor

- A breeder reactor is a nuclear reactor that **generates more fissile material than it consumes.** These are designed to **extend the nuclear fuel supply** for electric power generation.
- Breeder reactors achieve this because their neutron economy is high enough to create more fissile fuel than they use, by irradiation of a fertile material, such as **Uranium-238** or **Thorium-232** that is loaded into the reactor along with fissile fuel.
- **PFBR is a 500 MWe fast breeder nuclear reactor** presently being constructed at the **Madras Atomic Power Station in Kalpakkam (Tamil Nadu).**
- It is fuelled by **Mixed Oxide (MOX) Fuel.**

Mixed Oxide (MOX) Fuel

- MOX fuel is **manufactured from plutonium recovered from used reactor fuel, mixed with depleted uranium.**
- Mixed oxide (MOX) fuel provides almost 5% of the new nuclear fuel used today.
- MOX fuel also provides a means of burning weapons-grade plutonium (from military sources) to produce electricity.

Depleted Uranium

- In order to produce fuel for certain types of nuclear reactors and nuclear weapons, uranium has to be "enriched" in the U-235 isotope, which is responsible for nuclear fission.
- During the enrichment process the fraction of U-235 is increased from its natural level (0.72% by mass) to between 2% and 94% by mass.
- The **by-product uranium mixture (after the enriched uranium is removed)** has reduced concentrations of U-235 and U-234. This by-product of the enrichment process is known as depleted uranium (DU).

Source: PIB