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PFBR First Criticality: India Enters Stage 2 of Its Nuclear Programme

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PFBR First Criticality: India Enters Stage 2 of Its Nuclear Programme

📄 **PIB Special Features** Chapter 1 · 2 min read ·

Source: PIB Background, April 7, 2026

The indigenously designed and built **Prototype Fast Breeder Reactor (PFBR)** at Kalpakkam, Tamil Nadu attained **first criticality on April 6, 2026**. With it, India formally enters **Stage 2** of the three-stage nuclear power programme conceived by Dr. Homi Jehangir Bhabha, and becomes only the **second country after Russia** to operate a commercial-scale fast breeder reactor.

THE THREE-STAGE LOGIC

STAGE	REACTOR TYPE	FUEL STRATEGY
1	Pressurised Heavy Water Reactors	Natural uranium; produces plutonium
2	Fast Breeder Reactors (PFBR)	Uranium-Plutonium MOX; breeds more fuel than it burns (U-238 blanket breeds Pu-239)
3	Thorium reactors	Th-232 breeds U-233, unlocking India's vast thorium reserves

The PFBR is the bridge: its blanket assemblies will later carry Thorium-232, generating the Uranium-233 that Stage 3 needs.

WHO BUILDS, WHO DESIGNS

- **BHAVINI** (Bharatiya Nabhikiya Vidyut Nigam Limited) built and operates the 500 MWe unit at the Kalpakkam nuclear complex
- **IGCAR** (Indira Gandhi Centre for Atomic Research) developed the technology, under the Department of Atomic Energy
- Construction was sanctioned in 2003; criticality marks the move from construction to operations

THE CAPACITY ROADMAP

- Current installed nuclear capacity: **8.78 GW**; generation 56,681 million units in 2024-25 (3.1 percent of electricity)

- Projected: **22.38 GW by 2031-32**
- **Nuclear Energy Mission** (Budget 2025-26): **100 GW by 2047**, with Rs 20,000 crore for Small Modular Reactors; at least **5 indigenous SMRs by 2033** (BARC designs: BSMR-200, SMR-55, and a high-temperature gas-cooled reactor for hydrogen)
- **SHANTI Act, 2025** enables limited private participation; India has civil nuclear cooperation agreements with 18 countries

MAINS ANGLE

Why it matters: fast breeders multiply the energy extracted from India's limited uranium and make the thorium economy reachable; nuclear is the firm, low-carbon base the 2070 net-zero pathway needs. **Risks to weigh:** FBR economics remain unproven globally (most countries abandoned them), sodium-cooled systems carry unique safety engineering demands, and the 100 GW target requires a build rate India has never sustained.

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PFBR:

500 MWe; first criticality April 6, 2026; Kalpakkam, Tamil Nadu

Built by BHAVINI; technology by IGCAR; fuel: Uranium-Plutonium MOX

India: second country after Russia with a commercial fast breeder

PROGRAMME AND TARGETS:

Three-stage programme: PHWR, FBR, thorium reactors (Bhabha)

Installed nuclear: 8.78 GW (3.1 percent of electricity); 22.38 GW by 2031-32; 100 GW by 2047

Nuclear Energy Mission: Rs 20,000 crore for SMRs; 5 indigenous SMRs by 2033

SHANTI Act 2025: limited private participation; 18 civil nuclear cooperation agreements

Sources: [PIB](#), [Department of Atomic Energy](#)



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