



BSMR-200 (Bharat Small Modular Reactor): Opening of India's Nuclear Energy Sector

Under the Nuclear Energy Mission announced in the Union Budget 2025–26, the Government of India has allocated ₹20,000 crore toward the research, design, development, and deployment of Small Modular Reactors (SMRs).

The **objective** of the Bharat Small Modular Reactors (BSMRs) is to advance India's nuclear energy capabilities through compact, safe, and flexible technology, targeting, an installed nuclear capacity of 100 gigawatts (GW) by 2047 and net-zero carbon emissions by 2070. Developed by the Bhabha Atomic Research Centre (BARC) and the Nuclear Power Corporation of India Limited (NPCIL), the BSMR-200 (a 220 MWe pressurized heavy water reactor) is designed to serve as a sustainable, low-carbon energy source.

Bhabha Atomic Research Centre (BARC) has undertaken the design and development works on SMRs such as the **220 MWe Bharat Small Modular Reactor (BSMR-200)**, **55 MWe Small Modular Reactor (SMR-55)**, and **Up to 5 MWth High temperature gas cooled reactor (HTGCR)** meant for hydrogen generation.

The initiative is a part of the government's broader objective of commissioning at least five indigenously designed SMRs by 2033 and scaling nuclear capacity to 100 GW by 2047.

The **BSMR-200 has emerged as the lead project** under the programme and is being jointly developed by BARC and the Nuclear Power Corporation of India Limited (NPCIL). **Having received in-principle approval** from the Atomic Energy Commission, the project is currently awaiting final clearance from the Cabinet Committee.

This pilot project is estimated to cost ~₹30 crore per MW, translating to a net project outlay of ~₹5,960 crore, which will be funded under the Nuclear Energy Mission program.

Construction and operationalisation of the BSMR unit is estimated to take 60–72 months, post approval. The reactor will be located at the Tarapur Atomic Power Station in Maharashtra and is **intended to serve as a standardised template for future SMR projects**.

The SMR-55 and HTGCR have received in-principle approvals from AEC but are progressing through regulatory and technical milestones respectively and are expected to be presented to the Cabinet Committee in due time.

Under the Nuclear Energy Mission budget, ₹7,000 cr has been allocated for the development and construction of the 2 SMR-55 units and ₹320 cr for the HTGCR unit. In addition to this ₹1,252 cr will be incurred towards design, engineering, and development of the reactor complexes.

Nuclear Energy Mission Outlay (₹ crs.)

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| Development and Construction of BSMR-200 | ₹5,960crs |
| Development and Construction of 2 units of SMR-55 | ₹7,000crs |
| Design and construction of High Temperature Gas Cooled Reactor (HTGCR) | ₹320crs |
| Design, engineering & development works for new reactors & reactor complex | ₹1,252crs |

The SHANTI Act, 2025

The government is opening private and foreign participation in the nuclear sector with the tender for the 220 MWe BSMR-200 open for foreign companies' participation (through domestic partnerships). This progression is anchored in the enactment of the Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act, 2025.

The SHANTI Act permits up to 49% FDI in nuclear projects via JVs with domestic entities. It is done to facilitate technology transfer across reactor design, safety systems, and advanced materials, including SMRs.

The Act streamlines regulatory oversight by granting statutory authority to the Atomic Energy Regulatory Board (AERB) and aligns India's liability framework more closely with global norms by removing the Unlimited liability to foreign suppliers and replacing it with limited liability to defined contractual or intentional damage scenarios with graded caps linked to reactor size, reducing the burden for smaller reactors.

Nuclear projects are highly capital intense, including the BSMR-200, which is currently estimated at ₹30crs per MW. Private sector capability in nuclear operations remains nascent, with Nuclear Power Corporation of India Limited (NPCIL) being the only operator with established expertise. Insurance availability and pricing also remain high, with high initial premiums likely to impact project-level returns for early private participants. Thus, the introduction of foreign players is expected to reduce the operational and economical burden on private players.

Potential Beneficiaries**NTPC – Nuclear Project Developer Capability**

- NTPC is pivoting toward nuclear energy through its nuclear-dedicated subsidiary NTPC Parmanu Urja Nigam Ltd. (NPUNL). It has earmarked ₹~56,000crs (\$62bn) towards installation of 30 GW of Nuclear energy production by 2047, as a part of the government's 100 GW nuclear energy goal.
- Anushakti Vidhyut Nigam Ltd. (ASHVINI), a JV between NPUNL and NPCIL has been created to build large-scale reactors, which includes the 2,800 MW Mahi Banswara Rajasthan Atomic Power Project.
- Global partnerships with Rosatom (Russia) and EDF (France) allow NTPC to explore and collaborate on new nuclear technologies such as large, pressurized water reactors and Small Modular Reactors (SMRs).
- The company is investigating advanced, safer fuel technologies, such as thorium-based fuel (ANEEL™) in collaboration with Clean Core Thorium Energy to introduce cleaner energy resources to its otherwise thermal based portfolio.

BHEL – Nuclear Turbine & Power Island Expertise

- BHEL has executed critical works for Kudankulam Units 3 & 4, including erection of turbine generator island packages for 2×1000 MWe units, reflecting strong capabilities across large-scale nuclear equipment supply and execution.
- BHEL's long-standing collaboration with BARC and NPCIL across India's three-stage nuclear program provides it with deep design, engineering, and manufacturing integration capabilities, rather than just vendor-level participation.
- The company has contributed to Advanced Heavy Water Reactor (AHWR) development (Thorium-based), showcasing involvement in next-generation nuclear technologies beyond conventional PHWRs.
- As the only indigenous manufacturer of nuclear steam turbine generator sets, BHEL controls a critical part of the "power island", which remains essential even in SMR configurations.

Power Mech Projects – Nuclear EPC Execution

- Power Mech's entry into the nuclear segment is via the BHEL-led Kaiga project, marking the EPC's entry into the highly regulated, compliance-heavy nuclear-grade construction standard.
- The company continues to develop its expertise in civil, structural, and architectural works specific to nuclear facilities, including handling of safety-critical construction environments.
- Its prior experience in large-scale thermal and industrial EPC projects provides a strong base for scaling into modular construction frameworks required for SMRs.

Walchandnagar Industries (WIL) – Core Reactor Equipment Manufacturing

- WIL is one of the few private Indian companies with pre-qualification for Class I nuclear components from NPCIL, BARC, and BHAVINI, placing it in the highest safety-critical supplier category.
- WIL has extensive manufacturing expertise in core reactor components such as calandrias, end shields, moderator heat exchangers, and sodium piping for both PHWRs and fast breeder reactors (PFBR).
- WIL has been evaluated and approved by global nuclear majors such as EDF (AREVA), Westinghouse, GE, and Atomenergomash for localization of their nuclear equipment. Its expertise in exotic material handling, heavy forgings, and nuclear-grade fabrication aligns directly with the requirements of localized SMR manufacturing and potential export supply chains.

MTAR Technologies – Precision Nuclear Component Supplier

- MTAR is actively developing actuators and bearings for the Bharat Small Modular Reactor (BSMR) program. The company is expected to be a primary beneficiary of India's policy to develop five indigenous SMRs by 2033.
- MTAR has built deep technical engagement with NPCIL and BARC, not just as a supplier but as a collaborative development partner for critical nuclear subsystems.
- MTAR's portfolio includes Control & Safety Rod Drive Mechanisms (CSRDM/DSRDM) and other reactor-critical assemblies, placing it in the core safety architecture of nuclear plants.
- MTAR Technologies has secured significant orders totalling ₹504 crore from Megha Engineering & Infrastructures Ltd (MEIL) for Kaiga Units 5 and 6 in December 2025. The company is heavily involved in high-precision engineering for India's civil nuclear sector, specializing in reactor island components, fuel management, and refurbishment.

Larsen & Toubro (L&T) – Advanced Nuclear Manufacturing & Technology

- L&T has established a strategic partnership with Holtec International for the SMR-300 reactor, placing it directly within the global SMR commercialization ecosystem rather than just domestic supply.
- The company has received US Department of Energy authorization, enabling legal transfer of nuclear technology, which is a critical barrier for most international players. This position is L&T uniquely for cross-border SMR deployment.
- Its heavy engineering complexes (notably Hazira) can manufacture reactor pressure vessels, steam generators, and safety-critical nuclear components, aligning well with the modular fabrication requirements of SMRs.
- **Recent Nuclear Order Wins (2024-2026):**
 - **ITER Fusion Project, France (Oct 2024):** L&T secured an order to deploy advanced welding technology for assembling, welding, and inspecting the Vacuum Vessel for the global nuclear fusion project in Cadarache, France.
 - **Kudankulam Nuclear Power Project (KKNPP Units 5 & 6) (Sept 2025):** L&T's Heavy Civil Infrastructure (HCI) vertical won a "significant" order (valued between INR 1,000 and 2,500 crore) from NPCIL to perform the mechanical package installation, including the nuclear reactor, turbine systems, and seawater systems.
 - **Fast Breeder Reactor Components (Oct 2025):** The Heavy Engineering arm secured orders for critical equipment for both domestic and international nuclear projects, including specialized heat exchangers.
 - **Steam Generators for NPCIL Fleet (April 2026):** L&T's Heavy Engineering arm dispatched the seventh 700 MWe Steam Generator for India's nuclear fleet programme ahead of schedule.

View and Outlook

The BSMR-200 tender is a critical step in India's efforts to broaden nuclear energy development participation beyond the state. It effectively operationalises the regulatory and institutional framework created under the SHANTI Act, enabling private and foreign involvement in the sector's expansion. However, execution timelines, cost economics, and capabilities' development remain key watchouts for assessing this initiative's success.

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