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Mumbai to Host
India Nuclear Energy Forum
23–25 September 2027

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Editorial

Strengthening India's Nuclear Supply Chain

India's nuclear expansion presents a defining industrial opportunity: can domestic industry deliver the materials, components and specialised engineering the programme demands? Beyond reactor construction lies a complex network of manufacturers, suppliers, quality specialists and engineering companies whose readiness will influence project execution. This month, we explored the business and industrial foundations of India's nuclear supply chain, focusing on manufacturing capacity, critical materials, supplier qualification, quality assurance and traceability. For established manufacturers and aspiring MSME suppliers alike, the challenge is to meet nuclear-grade requirements and convert existing industrial capabilities into reliable, scalable supply.

A significant step towards bringing this ecosystem together is the India Nuclear Energy Forum (INEF-2027), scheduled for 23–25 September 2027 in Mumbai. Announced by Dr S. Shamasundar, Honorary Director of India Nuclear Forum and Managing Director of ProSIM R&D Pvt. Ltd., the event aims to advance dialogue on building a robust Indian nuclear industry. INEF-2027 will bring together industry stakeholders, manufacturers, technology providers, EPC contractors, suppliers and policymakers to explore partnerships, address supply chain challenges and identify opportunities arising from India's nuclear expansion. The forum will also encourage collaboration to strengthen domestic capabilities and accelerate industry participation.

In our next issue, we turn the spotlight on Nuclear Fuel Supply. We will explore India's fuel cycle capabilities, uranium resources, fuel fabrication, zirconium production and the industrial challenges of securing reliable fuel supplies for an expanding nuclear fleet.

Umesh Kumar Shimladka
Managing Editor

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Strengthening India's Nuclear Supply Chain

India's nuclear expansion depends on more than reactor construction. Long-lead components, limited manufacturing capacity and specialised suppliers could affect project delivery. Explore how stronger domestic manufacturing, early capacity planning and resilient supplier networks can help India meet its nuclear power ambitions.



Nuclear.IN Desk

India's nuclear expansion will depend not only on reactor technology and project approvals but also on the industrial capacity to deliver critical equipment on time. As the country moves towards its target of 100 GWe of nuclear power capacity by 2047, the supply chain will face a significant test. Manufacturers must meet rising demand while maintaining nuclear-grade quality, traceability and reliability.

The challenge is not simply to manufacture more equipment. It is to ensure that qualified suppliers, specialised materials, testing facilities and skilled workers are available when projects need them.

India's nuclear programme has a strong domestic manufacturing base. However, scaling up production across multiple projects will require coordinated capacity planning, wider supplier participation and better management of long-lead components.

The question is whether the supply chain can expand at the pace required by the nuclear programme.

1. Long-Lead Components: The Critical Path to Construction

Nuclear power plants require equipment that can take months or years to engineer, manufacture, inspect and qualify. These include reactor pressure-boundary components, steam generators, primary coolant pumps, large forgings, specialised valves and control systems.

Such equipment cannot always be sourced from the open market. Manufacturers must meet detailed technical specifications and nuclear quality requirements. Some components also require specialised production facilities, dedicated tooling and extensive testing.

Consequently, a delay in one critical component can affect several project activities. Civil construction may progress, but installation and commissioning can remain dependent on equipment that has not arrived.

The risk increases when multiple reactor units enter construction simultaneously. Even if the total manufacturing capacity appears adequate, suppliers may struggle to meet overlapping delivery schedules.

India has already taken steps to address this challenge. In February 2026, the government reported that standardisation of indigenous 700 MWe pressurised heavy water reactors (PHWRs) had enabled bulk procurement of long-manufacturing-cycle equipment, with staggered deliveries helping reduce time and cost.

This approach offers an important lesson: long-lead procurement must begin early and be aligned with the project schedule. Reactor design, supplier selection, manufacturing capacity and delivery planning need to progress together.

2. Specialised Materials and Technologies: Where Dependencies Matter

Nuclear manufacturing depends on materials with specific mechanical, chemical and performance properties. These include nuclear-grade steels, nickel-based alloys, specialised forgings, tubes, welding consumables and other qualified materials.

Their availability is only one part of the challenge. Manufacturers must also demonstrate that the materials meet the required specifications and can be traced through production and inspection.

The same applies to specialised technologies. Certain instrumentation and control systems, electronic components, advanced manufacturing processes and testing capabilities may involve a limited number of qualified suppliers.

Dependence on a single source can create a bottleneck if that supplier faces production problems, export restrictions, logistics disruptions or competing orders from other nuclear projects.

Indigenisation can reduce these risks, but it requires more than replacing an imported component with a locally manufactured one. Indian companies need access to technical knowledge, suitable production facilities, testing infrastructure and the expertise to meet nuclear requirements.

The objective should be to develop domestic capability across the full manufacturing process, including material production, fabrication, inspection and qualification.

At the same time, imports may remain necessary for selected technologies and materials. A resilient supply chain should therefore combine domestic production with carefully managed international sourcing.

3. Supplier Concentration and Delivery Risks

A supply chain can appear strong while remaining vulnerable to the failure of a few critical suppliers.

For example, several component manufacturers may depend on the same source for specialised forgings, raw materials or electronic systems. A disruption at that source could affect multiple projects at once.

Transport and logistics create additional risks. Large and heavy nuclear components require suitable handling facilities, route planning and specialised transport arrangements. Delays in approvals, port operations or inland movement can affect delivery schedules even when manufacturing is complete.

Supplier concentration also limits the flexibility of project owners. If only one qualified manufacturer can supply a component, a production delay may leave few immediate alternatives.

India needs to widen its qualified supplier base wherever technically and economically feasible. This includes developing second-source manufacturers for critical components and identifying common dependencies across different projects.

The government has outlined several measures to strengthen the domestic supply chain for the ten approved 700 MWe PHWR units. These include bulk orders, vendor-base expansion, indigenous equipment development, support for MSMEs and opportunities for qualified local suppliers.

However, adding vendors must not become a numbers-driven exercise. New suppliers need appropriate technical capabilities, quality

systems and manufacturing controls. Supplier diversification must strengthen reliability without weakening nuclear-grade standards.

4. Capacity Planning for Fleet-Mode Construction

India's potential capacity is far more than acknowledged. Heavy engineering capacity that has come up to serve infrastructure projects as well as precision manufacturing eco system can be effectively leveraged through well planned orientation towards nuclear requirements and making it attractive for that supply chain to shift towards investing on Nuclear capability. Some of the initiatives that could make it happen are:

Standardised reactor designs improve manufacturing engineering and planning thus more predictable output and efficiency. Repeat reactor design across several sites means plan production runs that pay for invested tools and dedicated facilities that improve delivery predictability.

Fleet-mode construction can give manufacturers greater visibility of future orders. Greater visibility provides investment theses.Investment in machinery, skilled personnel, testing facilities and production capacity will create highly scalable capacity.

Coopting the Suppliers: India's nuclear expansion plans include ten indigenous 700 MWe PHWRs approved under the fleet-mode programme. The government has also highlighted the role of domestic manufacturing in supporting the wider 100 GW target. Yet, repeat orders alone will not guarantee timely delivery. Project owners must provide suppliers with realistic schedules and vision of future demand. If several projects require the same equipment at the same time, manufacturers need to understand the combined requirement rather than plan for each contract in isolation.

A coordinated capacity plan should map critical components against project milestones. It should identify manufacturing bottlenecks, supplier utilisation, material availability and testing capacity.

Such plans bring out best practices from several industries such as concurrent engineering, simultaneous engineering, Agile methodologies etc of managing project and programs by identifying commonalities and constraints to produce, and create specilaised lines where applicable.

Nothing improves efficiency like levelling; nothing helps levelling like uniform demand. However, in life uniform demand is a pipedream. Least that can be done is to ensure predictable demand for suppliers. Uncertain order pipelines discourages investment, while sudden increases in demand can stretch existing facilities beyond their practical limits.

The solution is to connect reactor construction plans with long-term industrial planning.

5. Building Robus Capacity and Supply Chain Resilience

Strengthening India's nuclear supply chain requires action across several areas.Robust capacity need not create everything within the country as long as it can ensure continuity and best things are produced in best places at best cost. However, it is critical to retain technology within the country to address any geopolitical issue – what is true for technology need not be true for every system where there are multiple independent sources outside of the country.

1.Expand critical manufacturing capacity. Investments should focus on components with long production cycles, limited supplier availability or of high strategic importance. This includes suitable forging capacity, specialised fabrication, precision machining and advanced testing facilities.

2.Develop more qualified suppliers. Large manufacturers, reactor operators and engineering organisations can work with MSMEs to improve technical capability, documentation, welding, inspection and quality assurance. Supplier development should begin well before a project reaches its procurement peak. Ideally involve supplier from initial design stage and not after tender.

3.Secure material availability. Early identification of material requirements and strategic sourcing

can reduce the risk of shortages. Where feasible, domestic producers should be supported in developing nuclear-grade materials and consistent production processes. Supplier shouldn't develop only based on patriotism – for supplier to be patriotic, owner has to be more patriotic in supporting them.

4.Improve supply chain visibility. Digital systems can track orders, production milestones, inspection status and dispatch schedules. Early warnings can help project teams respond before a delay affects installation or commissioning.

5. Strengthen workforce and testing infrastructure. Expanding manufacturing output requires skilled engineers, welders, inspectors, quality professionals and technicians. Testing and qualification facilities must also keep pace with industrial demand.

6. Ensure suppliers are able to self-inspect before supply. Inspection shouldn't end-up becoming either a bottleneck or an activity that feels like harassment.

Finally, resilience requires contingency planning. Project owners should identify single-source dependencies, assess alternative suppliers and prepare responses to material, manufacturing and these measures should be implemented without compromising nuclear safety, regulatory requirements or product quality.



Capacity Must Grow with Nuclear Ambition

India's nuclear expansion presents a major opportunity for domestic manufacturers, engineering companies and specialised suppliers. However, the scale of the programme will test the industry's ability to deliver complex equipment within demanding schedules.

The central challenge is to align manufacturing capacity with project demand. Long-lead components must be ordered early. Specialised materials must be secured. Qualified suppliers must have the resources to expand production. And project owners must coordinate procurement across multiple reactor units.

India's nuclear supply chain will become more resilient when domestic manufacturing, supplier development, standardisation and capacity planning work as parts of a single system.

The target is not merely to manufacture more equipment in India. It is to build a supply chain that can deliver nuclear-grade components reliably, repeatedly and at the pace required by the country's long-term energy ambitions.



India’s Nuclear Expansion Needs a Resilient Supply Chain

Long lead times, a limited pool of qualified manufacturers, strict material requirements, regulatory clearances and geopolitical risk will shape how quickly India can build new nuclear capacity.





Dr. B. Venkatraman
Former Director, IGCAR

India’s nuclear power expansion will depend on more than reactor designs, project approvals and construction schedules. It will also depend on whether the right materials, equipment and qualified components are available when projects need them.

This makes the nuclear supply chain a strategic priority. A delay in a single critical component can push back installation and every activity that follows. A shortage of qualified suppliers can narrow procurement options. And a long manufacturing cycle can move delivery well beyond the date the project team expected.

The Scale of the Task

India’s installed nuclear capacity stands at 8,780 MW. The Government aims to raise this to 22,380 MW by 2031–32 and to 100 GW by 2047. The nearer target depends on completing ten indigenous 700 MWe Pressurised Heavy Water Reactors (PHWRs), approved in 2017 for construction in fleet mode, alongside further VVER units at Kudankulam.

Building at this pace places heavy, simultaneous demands on a small group of fabricators, including Larsen & Toubro (L&T), BHEL and Godrej & Boyce. Their throughput must grow with the programme, or component backlogs will follow.

Long Lead Times, Limited Capacity

Nuclear power plants require specialised equipment, including reactor pressure vessels, steam generators, heat exchangers, large forgings, nuclear-grade valves and pumps, and instrumentation and control systems. These demand advanced manufacturing capabilities, strict quality controls and extensive inspection, and production capacity cannot always expand as quickly as project demand.

Large forgings show why. The biggest reactor pressure vessel forgings start as steel ingots of 500–600 tonnes, worked on presses of 14,000 tonnes or more, a capability few companies worldwide possess. In 2007, Japan Steel Works could make about four vessel sets a year at its Muroran plant; tripling that to twelve took an investment of about ¥80 billion and was completed only in 2011. In India, L&T’s heavy-forgings facility at Hazira, Gujarat, set up in 2010 as a joint venture with NPCIL and

designed for 600-tonne ingots, became wholly owned by L&T in 2025. Such capacity takes years to build and qualify; it cannot be switched on when orders arrive.

Fleet mode reflects this reality. NPCIL has placed bulk orders well ahead of need: BHEL's 2021 order for 12 steam generators, for example, serves units targeted for completion by 2031.

The International Atomic Energy Agency (IAEA), in its Nuclear Supply Chain Toolkit, highlights longer lead times, which the COVID-19 pandemic extended further, along with supplier compliance with nuclear requirements and the management of sub-suppliers. These challenges make procurement planning a project-level concern, not just a purchasing function.

Materials Cannot Simply Be Substituted

The reactor pressure vessel (RPV) houses the reactor core and contains the coolant at pressures over 150 times atmospheric and temperatures around 300 °C. It is a key barrier against the release of radioactivity, and because it cannot practically be replaced, its condition largely decides how long a plant can operate.

Most modern pressurised water reactor vessels are forged from SA-508 Grade 3 Class 1, a manganese-nickel-molybdenum low-alloy steel with a minimum yield strength of 345 MPa. The VVER-1000 units at Kudankulam use the Russian chromium-nickel-molybdenum-vanadium steel 15Kh2NMFA.

A stronger steel exists within the same specification: SA-508 Grade 4N, with a minimum yield strength of 585 MPa. Yet it is not used for operating reactor vessels, because strength is not the governing property. The wall facing the core must retain adequate fracture toughness after 40–60 years of neutron irradiation, which hardens the steel and raises the temperature at which it changes from ductile to brittle behaviour.

The RPV illustrates a wider rule: availability alone is not enough. Materials must meet the applicable specifications and come with the required quality records and traceability. Buyers cannot simply replace an unavailable item with a readily available alternative, because any change may require technical review, verification and approval, and safety-significant changes may need regulatory acceptance. Each step adds time.

Geopolitics and Imported Supply

Where fuel, materials or components come from abroad, supply is exposed to events far outside a project's control. India knows this from experience. Following the US Nuclear Non-Proliferation Act of 1978, the United States ended nuclear cooperation with India in 1980, including the supply of fuel and spare parts for the Tarapur reactors it had built. Decades of restricted access to international nuclear trade, until the Nuclear Suppliers Group exemption of 2008, also pushed India to build domestic capability in heavy water, fuel and zirconium alloys, capability that today underpins the PHWR programme.

Imported reactors carry similar exposure today. A 2017 audit attributed the more than seven-year delay in the commercial operation of Kudankulam Units 1 and 2 partly to delayed supply of equipment and working documents by the overseas partner. In 2022, the Government told Parliament that the conflict in Ukraine was likely to affect the schedule of later units, citing logistics and ocean freight problems for components from Russia and Ukraine. Sanctions, export controls, shipping disruptions and payment channels can all lengthen lead times, and for a qualified, design-specific component there may be no ready alternative source.

For imported designs, resilience therefore means ordering long-lead imports early, holding strategic spares, qualifying alternative sources where the design permits and progressively localising components, so that a disruption abroad does not halt construction at home.

Qualification and Regulatory Clearance

Not every industrial manufacturer can supply nuclear-grade components. Vendors must understand the applicable codes, qualit

assurance systems, documentation requirements and inspection processes, and must demonstrate consistent control over their manufacturing processes.

Industrial capability is only the first step. Vendor pre-qualification, stage-wise inspection, quality assurance audits and the requirements of the Atomic Energy Regulatory Board (AERB) that every project must satisfy determine the actual pace of delivery. These demands limit the number of qualified suppliers for certain products, and dependence on a small vendor base becomes a real risk when several projects need the same equipment at the same time.

MSMEs and the Cost of Qualification

India's nuclear growth creates opportunities for domestic manufacturers, including micro, small and medium enterprises (MSMEs). The opportunity lies in identifying suitable product categories, investing in quality systems and developing capabilities that meet nuclear-sector expectations.

Qualification, however, is costly. It needs investment in testing and non-destructive examination equipment, quality systems and trained personnel, with long payback periods and irregular orders. To justify that investment, MSMEs need long-term order visibility, assured offtake and targeted vendor-development support. Expanding this pool of qualified suppliers is central to reducing dependence on a few vendors for critical items.

Planning, Standardisation and Resilience

Developers, engineering teams and suppliers must coordinate well in advance. That means identifying critical items, forecasting demand for major components, reserving supplier capacity, placing orders early and tracking manufacturing progress, while allowing time for qualification, testing and documentation.

Repeat reactor designs help. Standardisation lets manufacturers reuse proven processes, develop dedicated tooling and build experience across successive orders, improving productivity and delivery predictability, provided it remains consistent with approved designs and applicable safety requirements.

Resilience also depends on upstream inputs. India already produces many critical materials domestically; the Nuclear Fuel Complex, for example, manufactures zirconium alloy tubing for PHWRs. Some inputs, however, still come from abroad. Supplier diversification, stronger logistics planning, transparent production schedules and early identification of bottlenecks can reduce exposure to any single supplier or disruption.

From Manufacturing Capability to Delivery Readiness

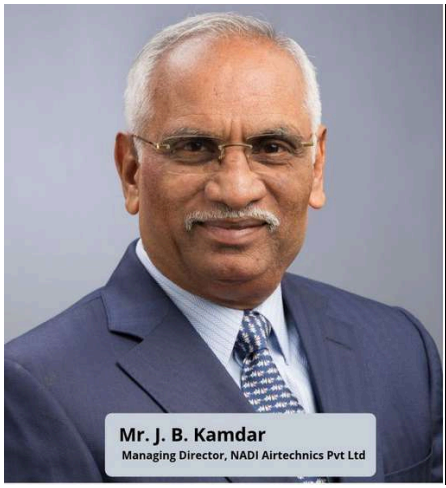
India's nuclear expansion will need more than additional factories. It will need a coordinated industrial ecosystem in which project developers, manufacturers, quality professionals, regulators and policymakers plan capacity together, backed by sustained investment, skilled personnel and testing facilities.

The central question is no longer simply whether Indian industry can manufacture a component. It is whether it can qualify, produce, inspect and deliver that component reliably, within the project's schedule and without compromising nuclear safety or quality.

Building this capability today will help India meet future project demand, avoid preventable delays and strengthen the resilience of its nuclear power programme.

Read the related features on the Nuclear .IN Magazine website for a deeper look at long-lead components, capacity planning, the differences between nuclear and conventional power-sector supply chains, and what Indian suppliers need to prepare for. **Click here for Insight Article in Nuclear.IN Magazine Website.**

Nuclear Supply Chain: NADI Airtechnics MD on Key Priorities | Interview





What will it take for Indian suppliers to meet the demands of a growing nuclear industry? In this Q&A, ***Mr. J. B. Kamdar, Managing Director, NADI Airtechnics Pvt Ltd****, a Systemair Company, shares his insights on supplier readiness, quality assurance, MSME participation and global opportunities.*

India's nuclear programme is entering a major expansion phase. What does this mean for specialised engineering suppliers such as NADI Airtechnics?

The expansion presents both an opportunity and a responsibility. Scaling India's nuclear capacity from under 9 GW towards 100 GW by 2047 will require repeatability, reliability construction and suppliers capable of delivering consistent quality at scale.

Having supplied fans to nuclear power plants at Tarapur, Kaiga, Kota, Narora, Kalpakkam, Kudankulam and Kakrapar, NADI understands the demanding requirements of this sector. For specialised engineering suppliers, the opportunity lies in early design involvement, indigenous engineering capabilities and long-term lifecycle support.

What are the key strengths of India's existing nuclear supply chain, and where are the most important gaps?

India has developed strong indigenous engineering, manufacturing and project execution capabilities, supported by experienced public-sector organisations, research institutions and established industrial suppliers. This foundation provides a valuable platform for the next phase of nuclear expansion.

The key gaps are in expanding the qualified vendor base based on technical capabilities, strengthening specialised testing infrastructure, developing skilled manpower and improving supply-chain capacity for large, simultaneous projects. Greater standardisation, predictable procurement schedules and closer collaboration between design agencies, utilities and manufacturers will help address these gaps while maintaining stringent safety and quality requirements.

What should companies do to become nuclear-ready, particularly in terms of qualification, quality assurance, certification and documentation?

In the nuclear industry, safety and quality are sacrosanct. Certifications such as ISO 9001, ISO 14001 and ISO 45001 provide a foundation, but nuclear-sector requirements go further. These may include customer audits to the manufacturers plants, witnessed performance tests, proven past record of supplies to the nuclear industry, controlled manufacturing processes and complete traceability from raw material procurement to dispatch, as specified in the contract.

Read the full interview on the Nuclear .IN Magazine website. To Read Click headline -

India's Nuclear Supply Chain: J. B. Kamdar on Quality, MSMEs and Growth

Did you follow physics Nobel prize of 2026?

The discovery has connection with what we dealt inin the last edition, i.e 'Source Term'. Neutrinos, fundamental atomic particle with no electric charge, no mass and virtually undetectable is released due to Nuclear reactions occurring naturally in the universe. Off course Neutrinos are not studied in 'source term' we explained ; they are not even detectable and method to detect them is what the Nobel prize is for.

The Neutrinos are so small that they can pass through atoms without ever colliding. To improve their chance of collision with something, Antarctic ice is used as a receptor with sensors embedded in it. As most of us know nuclear forces can't be explained by classical physics of Newtonian gravity nor Maxwellian electromagnetism.

Purpose of this space is not to explain anything in detail, but to give pointers to the curious. If you are interested in understanding how elements of the atoms stay together, you may want to read-up Quark interaction through exchange of gluons governed by Quantum Chromodynamics (QCD) and the attraction & repulsion interplay that keeps the atom together - you will come across other related terms such as mesons, gluons etc... when you study.

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If you have questions or suggestions on topics that need to be highlighted.
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Nuclear Localization in India: Progress and Gaps

India's nuclear localisation journey now faces a crucial test: translating proven manufacturing capabilities into a scalable, reliable supply chain. The experience of the 700 MWe PHWR programme offers important lessons for closing industrial gaps and preparing suppliers for future demand.





Mr. Kishor U. Agrawal
Former Associate Director,
Nuclear Power Corporation of India (NPCIL) 36 years Meritorious service and Joint secretary, Indian Nuclear Society (INS)

Govt of India's ambition's nuclear program of 100 GWe by 2047 will test more than its ability to build reactors. It will test the depth, capacity and reliability of its domestic supply chain. Can Indian manufacturers deliver critical nuclear components at scale, meet stringent quality requirements and keep pace with demanding project schedules? The answer will depend on how effectively the country closes its remaining manufacturing gaps.

India has made significant progress in developing indigenous capabilities through its pressurised heavy water reactor (PHWR) program which includes 220 MWe, 540 MWe & 700 MWe reactors. However, expanding nuclear capacity will require more than increasing production volumes. It will demand deeper component-level indigenisation, reliable access to specialised materials, advanced technology & testing infrastructure and a larger pool of qualified suppliers.

For industry, the distinction is critical. Manufacturing a component in India does not necessarily mean that its entire supply chain is indigenous. Imported materials, specialised processes and critical subcomponents can still create dependencies. Identifying and addressing these gaps will be essential as India scales up its nuclear program.

Yet, local manufacturing does not automatically mean complete indigenisation. A component may be manufactured in India while relying on imported materials, specialised processes or critical sub-components. Assessing such type of localization therefore requires a closer look at individual components and the capabilities needed to manufacture them domestically with similar quality & precision.

Closing the Component-Level Gaps

The next phase of nuclear growth will require sustained attention to specialised equipment, critical materials and manufacturing processes. Large pressure vessels, Steam generators, Reactor components, Pumps, Motors and Specialised piping systems can involve complex fabrication, inspection and qualification requirements.

India has considerable heavy-engineering expertise, but suppliers must also demonstrate

that their processes meet the technical and quality requirements of relevant nuclear standards. Investment in advanced manufacturing, testing facilities, inspection systems and skilled manpower will be essential to deepen the indigenisation.

Long-lead components present another challenge. Equipment such as End shields, Calandrias, Steam generators and Primary coolant pumps may require substantial planning and manufacturing lead time. Procurement decisions must therefore be taken early and aligned with construction schedules. Delays in critical equipment can affect the progress and completion of the entire project.

Quality and Capacity Must Grow Together

Expanding the nuclear supply chain is not simply a question of increasing production volumes. Suppliers must establish robust quality-assurance systems, material traceability, controlled manufacturing procedures and comprehensive documentation. Utilities and industry can support this process through clearer specifications, predictable procurement schedules, standardisation wherever technically appropriate, and early engagement with potential suppliers. They must also invest in qualified welders, inspectors, engineers and other skilled personnel.

At the same time, a broader mix of nuclear technologies, including PHWRs, Light-water reactors, Small modular reactors and Fast breeder reactors, will create new opportunities. Each technology, however, has its own requirements. Suppliers must develop and innovate the necessary new manufacturing technology and qualifications rather than assume that experience with one reactor type automatically translates to another.

The expansion programme therefore needs to strengthen:

- Nuclear-specific quality-management systems (QMS).
- Material certification and traceability.
- Welding procedures and personnel qualification.
- Non-destructive examination.
- Metrology, calibration and testing.
- Document control and manufacturing records.
- Financial and production capacity for long-duration contracts.



This is an area where structured vendor-development programmes could substantially increase domestic manufacturing capacity.

Turning Ambition into Industrial Capability

Government, Utilities and Industry must work together to strengthen domestic manufacturing through policy changes, finance, investment in specialised facilities and coordinated workforce development will be important. Nuclear-sector organisations can also contribute through vendor development, technical guidance and training.

The government could strengthen nuclear localisation through easier access to finance, a review of the 18% GST rate with a possible reduction to 5%, subject to policy approval, and better public awareness and support for land acquisition around nuclear project sites.

India's PHWR experience provides a strong starting point. The challenge now is to identify remaining localization gaps, strengthen critical capabilities and ensure that domestic suppliers meet the scale, quality and delivery requirements of an expanding nuclear power programme.

The success of meeting 100 GWe target will depend not only on how many reactors India can to build, but also on how reliably its industrial ecosystem including land acquisition, financing sector and grid support them.

Click to Read the full website feature here- **Make in India for Nuclear: Localization Reality**

Heavy Water, Uranium and Race to Secure India's Nuclear Future





Mr. Kailash Agarwal,
Former Director of NRG-BARC &
IAEA fuel-cycle specialist

As India expands its PHWR fleet, production, inventory and long-term supply arrangements will become increasingly important.

India has developed substantial domestic capability in heavy-water production, an important advantage for its PHWR programme. But as new reactors are commissioned, the supply-chain question is not simply about annual production. It is also about initial inventory and storage.

During normal reactor operation, heavy water is primarily required to make up for losses. A newly commissioned PHWR, however, requires a substantial initial inventory. This means production and accumulated stocks must be planned alongside the expansion of the reactor fleet. India's heavy-water plants also have applications beyond nuclear power. Oxygen-18, produced as a by-product, has applications in the medical sector.

Uranium presents a different strategic challenge. While India has domestic uranium resources, imported uranium will continue to be important for an expanding nuclear programme. International uranium trade is governed by specific arrangements, making long-term agreements with multiple supplier countries an important element of supply security.

The broader lesson is that nuclear supply-chain resilience cannot depend on a single strategy. India will need to combine domestic manufacturing, capacity expansion, technology development, international collaboration and long-term material-supply agreements.

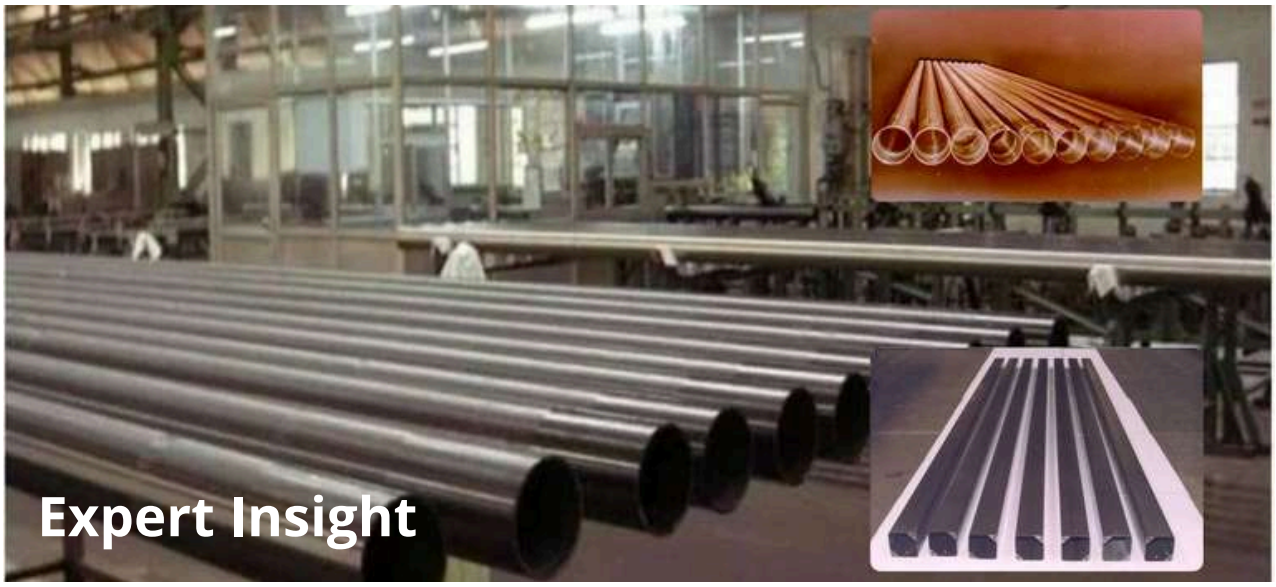
Transition towards PWRs and SMRs will add another layer of complexity, with new requirements for specialised technologies and major components. Experience of China offers a useful perspective. International technology and business partnerships initially supported the development of its domestic capabilities; over time, China built an industrial base capable of supplying nuclear technology and equipment.

For India, the long-term opportunity is similar: use the expansion towards 100 GWe not only to secure domestic supply, but to build an industry capable of serving global nuclear markets.

Click link to read full article- **Nuclear Supply Chain: Why Uranium, Heavy Water Matter**

From Zircon Sand to Nuclear Fuel: India's Domestic Zirconium Advantage

India operates a nuclear fleet dominated by PHWRs, alongside the Russian-designed pressurised water reactors (PWRs) at Kudankulam. Domestic industry supplies virtually all major material requirements for India's PHWR programme, including nuclear fuel and zirconium-based fuel and reactor components.





Dr Dinesh Srivastava
Former Chairman &
Chief Executive of NFC and
Distinguished Scientist

India's nuclear self-reliance extends deep into the materials and manufacturing chain behind its reactors. For the PHWR programme, the country has developed domestic capabilities covering nuclear fuel, zirconium-based materials, fuel components and several major reactor systems.

The zirconium value chain runs from zircon sand through zirconium sponge and alloys to tubes and components used in fuel assemblies. NFC has developed capabilities across this chain, alongside fuel-pellet and fuel-bundle manufacturing. The scale of the programme also demands stringent quality control and nuclear-grade inspection.

For the existing PHWR programme, zirconium is not expected to become a major constraint. Production can be expanded as reactor requirements increase. The larger challenge lies in specialised materials and technologies required for the next generation of reactors.

Certain specialised niobium-containing materials remain import-dependent because of stringent purity and quality requirements. PWRs and SMRs will also require further development of technologies for major components, including large reactor pressure vessels.

This creates a new supply-chain priority: capacity expansion must progress alongside technology development and qualification. Private-sector manufacturers supplying steam generators and other reactor systems will increasingly have to scale their capabilities as the nuclear programme expands.

India's PHWR experience demonstrates that long-term domestic capability building can transform critical supply chains. The next objective is to apply that experience to newer reactor technologies. For the 100 GWe ambition, the question is no longer simply whether India can manufacture nuclear materials. It is whether its industrial ecosystem can scale, qualify and innovate fast enough - and eventually supply the global nuclear market.

Click here to read full article - Zirconium: Can Nuclear Supply Chain Scale to 100 GWe?

Building India's Nuclear Supply Chain: An Industry Perspective | Interview

India's nuclear expansion is opening opportunities for MSMEs in nuclear-grade piping, valves, heat exchangers, electrical assemblies and engineering services. ***Mr. Madhukar Sharma, President & Director, ASME India Private Limited,*** *shares his perspective with Nuclear .IN Magazine on localization, supplier qualification and industry collaboration.*





Mr. Madhukar Sharma
President & Director, ASME India Private Limited

How do you see India's nuclear supply chain evolving?

India's nuclear supply chain is entering an important phase. As the act paves the entry of private sector owners / operators the market will expand and so will deeper participation from engineering industries across manufacturing, design, engineering, and systems integration value stream. A key part of this evolution will be creating more pathways for MSMEs to participate in the sector and connect with larger industry opportunities.

Where are the biggest opportunities for localization and indigenization?

There is considerable scope across nuclear-grade piping, valves, Seals & Gaskets , Electrical assemblies , heat exchangers, structural materials, process instrumentation, and modular assemblies. Engineering services, digital technologies, inspection, material traceability, and safety assessment also present opportunities. Many Indian MSMEs already bring specialized engineering and manufacturing capabilities that can contribute to these areas.

What are the key challenges facing India's nuclear suppliers?

The foremost challenge at the beginning of the road ahead will be qualified personnel workforce. Nuclear projects have specialized requirements around safety, quality, documentation, certification, and traceability. Access to technical knowledge, training, standards, testing infrastructure, and long-term visibility can make it easier for a wider supplier base to engage with the sector. availability

How can large companies and MSMEs/start-ups strengthen the domestic supply chain?

The way forward is through collaboration. Large companies can provide mentorship, vendor-development opportunities, and greater visibility into future requirements. MSMEs and start-ups bring specialized capabilities, agility, and innovation. Connecting these strengths through shared platforms, technical programmes and industry dialogue can broaden and deepen the domestic supply chain.

What is your outlook for Indian industry?

India has an opportunity to build a more inclusive and globally connected nuclear supply chain that can have ability to fulfill variety of NPP technologies – BSR , AP1000, VVER . For ASME India, workforce development and cultivating & strengthening MSME is an important part of our mission. We are focused on creating connections to technical knowledge, standards, research and skills and wider industry networks so that more Indian enterprises can participate in emerging sectors, including nuclear energy.

Material to Megawatt - Where 100 GWe Is Won: Industry Note

BRIDGE: Buffer | Ready | Integrate | Deliver | Govern | Expand





Mr.Venkata Ramana R
Director-Strategic Operations,
Babcock Power APAC Pvt Ltd

***E**very megawatt begins with materials: steel, specialised alloys, zirconium, concrete, cables, electronics and other essential inputs. Between the first material certificate and grid synchronisation, these inputs pass through multiple stages of procurement, manufacturing, quality assurance and delivery. Six critical handovers can determine whether India's nuclear supply chain delivers at the pace required to support the 100 GWe ambition.*

The BRIDGE framework identifies these handovers and the actions needed to strengthen them.

Handover	Key constraint	Required action	Expected outcome
Mill to shop: BUFFER	Long lead times for alloys and forgings; few sources	Owners and EPCs share long-range demand; qualify second sources early	Resilient supply, shorter cycles
Shop to nuclear grade: READY	Qualified MSME pool is small for a ten-fold expansion	Clear qualification path; vendor mentoring; quality built into every shop	Wider qualified vendor base
Design to shop floor: INTEGRATE	Technology owners protect know-how; new processes take time, quality risk	Localization remains the goal; regulatorqualified global equipment for critical items while capability matures, with service assurance, staged technology transfer	Mutual confidence; deeper localization
Factory to site: DELIVER	Oversized equipment, many sites, tight schedules	Treat logistics as engineering scope	Predictable delivery
Record to regulator: GUARANTEE	Traceability burden grows with fleet and supplier count	Digital traceability from material to installation	Auditable assurance
Module to fleet: EXPAND	New designs not yet standardized	Standardize early; repeat manufacturing	Learning-curve gains for SMRs

An immediate priority: a think tank, convened by a neutral platform such as INF, complementing mission structures, of nuclear professionals, engineers, designers, project managers, policy and decision makers, government stakeholders and supply-chain specialists, to develop recommendations on these six handovers. Done well, Indian industry becomes a global nuclear-grade exporter.

India’s Nuclear Growth Depends on Supply Chain Readiness

Material availability, qualified manufacturers and long procurement cycles will influence how quickly India can expand its nuclear power capacity.



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India’s nuclear expansion will depend on more than reactor designs, project approvals and construction schedules. It will also depend on whether the right materials, components and manufacturing capabilities are available when projects need them.

This makes supply chain readiness a strategic priority. A delay in a critical component can affect an entire project schedule. A limited pool of qualified suppliers can restrict procurement options. Meanwhile, long manufacturing lead times can push deliveries beyond planned dates.

Materials Must Be Available on Time

Nuclear projects require materials and components that meet specific technical and quality requirements. These include specialised steels, large forgings, valves, pumps, instrumentation and control systems, and other safety-related equipment.

However, availability alone is not enough. Materials must meet the applicable specifications and have the required quality records and traceability. Manufacturers must also demonstrate that their products and processes meet the relevant requirements.

Therefore, buyers cannot always replace an unavailable item with a readily available alternative. Any proposed change may require technical assessment, verification and approval. Early planning is essential to avoid preventable delays.

Qualified Manufacturers Are Critical

India’s nuclear expansion will create opportunities for domestic manufacturers, including micro, small and medium enterprises (MSMEs). However, production capacity alone does not qualify a company to supply the nuclear sector.

Manufacturers must understand the applicable technical codes, quality assurance requirements, documentation and inspection processes. They must also demonstrate consistent control over their manufacturing operations.

Developing these capabilities takes time and investment. Expanding the pool of qualified suppliers can help reduce dependence on a limited number of manufacturers and improve the industry's ability to meet rising demand.

For MSMEs, the first step is to identify suitable product categories, understand the relevant qualification requirements and invest in the capabilities needed to meet nuclear-sector expectations.

Long Procurement Cycles Require Early Planning

Nuclear procurement often begins well before equipment is needed at the construction site. Complex components may require detailed engineering, specialised raw materials, dedicated manufacturing capacity, inspections and acceptance testing.

However, early ordering alone cannot guarantee timely delivery. Advanced engineering is equally important. Equipment specifications must be developed and stabilised early enough for suppliers to plan materials, tooling and manufacturing activities. If engineering decisions are delayed, procurement and production can also be affected.

Project developers, engineering teams and suppliers must therefore coordinate from the early stages. They need to identify long-lead items, assess manufacturing capacity and align delivery schedules with project milestones. Sufficient time must also be allowed for supplier qualification, testing and documentation.

For manufacturers, this requires a long-term view of investment. Decisions on machinery, skilled personnel and production capacity depend on realistic demand visibility, technical requirements and the time needed to develop nuclear-sector capabilities.

Building Capacity Beyond the Reactor

India's nuclear ambitions require a supply chain that can deliver the right materials and components from qualified sources, at the right time and to the required standards.

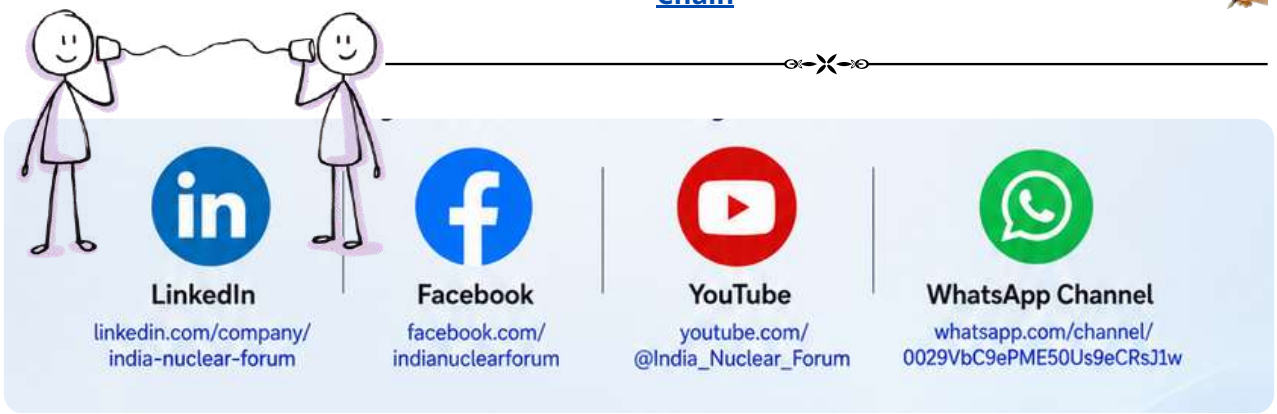


Achieving this will require closer coordination among project developers, engineering organisations, manufacturers, quality professionals and policymakers. Standardised designs and well-planned procurement can support more predictable manufacturing, while supplier development can help widen the domestic industrial base.

The central question is no longer simply whether Indian industry can manufacture a component. It is whether manufacturers can qualify, produce, inspect and deliver it reliably within the project schedule without compromising nuclear safety or quality.

Building supply chain readiness today will help Indian industry prepare for future nuclear projects and support the country's long-term capacity ambitions.
Read the full feature on the Nuclear .IN Magazine website for a closer look at the differences between nuclear and conventional power-sector supply chains, and what Indian suppliers need to prepare for.

Click the headline to Read - **Nuclear-Grade Materials: Securing India's Nuclear Supply Chain**



Beyond the Reactor: Mapping the Complete Nuclear Plant Supply Chain

A nuclear power plant depends on a vast network of suppliers, from reactor equipment manufacturers to electrical, instrumentation and control (I&C) specialists. Understanding how these suppliers connect across the nuclear island, turbine island and balance of plant is essential to identifying business opportunities in India's expanding nuclear sector.



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A nuclear power plant is more than a reactor and a turbine. It consists of hundreds of systems working together. A complex network of various players work in coordination to make this happen. They include equipment manufacturers, component suppliers, system integrators and project contractors. Each plays a defined role in delivering a plant that meets strict technical, quality and safety requirements.

For suppliers entering the nuclear sector, understanding this network is the first step towards identifying business opportunities.

Three Plant Zones, One Connected Supply Chain

The nuclear plant supply chain spans three broad areas: the nuclear island, the turbine island and the balance of plant.

1) Nuclear island contains the reactor and its associated systems. Depending on the reactor design, procurement may include reactor pressure boundary components, specialised valves, piping, pumps, heat exchangers and safety-related equipment. These items may require stringent material traceability, documented manufacturing processes, inspection and formal quality assurance.

2) Turbine island converts steam energy into electricity. Its supply chain includes turbines, generators, condensers and associated mechanical and electrical equipment. Although some equipment may follow conventional power-sector practices, nuclear project specifications and interface requirements still apply.

3) Balance of plant (BOP) covers supporting systems and infrastructure. These may include water treatment, cooling systems, electrical distribution, ventilation, fire protection and other plant services. The scope varies by design and project.

Together, these three areas create a broad procurement market. However, suppliers must understand the technical requirements of each package before pursuing an opportunity.

Mechanical, Electrical and I&C: Core Equipment Network

Mechanical equipment forms a major part of nuclear procurement. Pumps, valves, piping,

pressure vessels and structural components must meet the specifications applicable to their intended service.

Electrical systems are equally important. Transformers, switchgear, cables, motors and power distribution equipment support plant operation. Their required qualification depends on their function, location and safety classification.

Instrumentation and control (I&C) systems monitor plant conditions and support operational and protective functions. Sensors, transmitters, control panels, software and digital systems may face specific qualification, reliability and cybersecurity requirements.

Not every component has the same safety significance. Safety-related equipment performs or supports functions credited for nuclear safety and is subject to applicable requirements. Non-safety-related equipment supports other plant functions but must still meet its specified performance, quality and reliability requirements.

This distinction matters. A supplier's existing industrial capability may be a starting point, but it does not automatically establish qualification for nuclear applications.

How the Supplier Tiers Work

The supply chain typically operates through several tiers.

Tier 1: Major equipment suppliers, system integrators or package contractors that deliver directly to the plant owner or main contractor.
Tier 2: Manufacturers and specialist suppliers providing components, assemblies or services to Tier-1 organisations.
Sub-tier suppliers: Businesses supplying raw materials, forgings, castings, fasteners, cables, machining, testing and other specialised inputs.

The exact structure varies by project and procurement package. A company may occupy different tiers across different contracts. For smaller manufacturers, the route into nuclear projects may begin with a qualified Tier-1



or Tier-2 supplier rather than a direct contract with the plant owner. Yet entry requires more than competitive pricing. Buyers also assess technical capability, manufacturing controls, quality documentation, traceability and the ability to meet delivery commitments.

Managing Interfaces Is Critical

Even a capable supplier can create project delays if its equipment does not integrate properly with other systems. Dimensions, loads, electrical connections, control signals, materials and delivery schedules must align with the overall design.

Therefore, equipment manufacturers, system integrators and project contractors must coordinate specifications, drawings, inspections and design changes. Clear responsibility at each interface reduces rework and helps prevent procurement delays.

For India's nuclear supply chain, the opportunity extends far beyond reactor equipment. It includes specialised components, electrical systems, I&C, plant services and supporting manufacturing capabilities. Suppliers that understand the complete network can identify where their capabilities fit, which approvals they need and how to build credible relationships with nuclear project buyers.

Read the full website feature for a deeper look at nuclear plant procurement, supplier tiers, qualification requirements and opportunities for Indian manufacturers. **Click here**

Nuclear Procurement: Traceability from Material to Installation

India operates a nuclear fleet dominated by PHWRs, alongside the Russian-designed pressurised water reactors (PWRs) at Kudankulam. Domestic industry supplies virtually all major material requirements for India's PHWR programme, including nuclear fuel and zirconium-based fuel and reactor components.



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Take product stewardship initiative and multiply it by about 1000 times, you get nuclear traceability requirement. Material and supply chain integrity is at the core of nuclear supply chain where there are no gaps in information through the journey of the material. Every technical specification, material extraction, processing, component manufacturing through to its end of life as well as post life needs to be documented, verified and controlled.

In nuclear power projects, a component not only must meet its design requirements but also track its history through its journey. Its origin, manufacturing history, inspection results and installation records must also be established. This makes procurement and quality assurance critical to nuclear supply chain integrity.

Unlike conventional industrial procurement, nuclear procurement often requires extensive documentation, qualified suppliers and rigorous quality controls. These requirements help ensure that components meet their specified safety, performance and reliability standards throughout their service life.

It Starts with the Specification

Process begins with clear technical specifications and procurement documents. These define material grades, design requirements, applicable codes, manufacturing processes, inspection criteria and acceptance conditions.

Dealing with a supplier who isn't used to nuclear supply, is an additional burden on the buyer – it is very difficult to train on processes that feel excessive to normal requirements. Buyer however will have to make requirements exhaustive and complete, to increase the catchment area of the supply chain.

Therefore, buyers must ensure that suppliers understand technical & quality requirements before manufacturing begins, and specify all documentation testing & inspection records needed for inspection. While the overall process is not dissimilar to any other industry, because of nature of nuclear industry, discretion to pass an exception does not lie close to the point of inspection. Therefore, it is lot easier for the supplier to comply with every single item even if its variation is minimal whether it is material specification, manufacturing tolerances or inspection resports.

Traceability: From Raw Material to Component

Material traceability, similar to product stewardship initiative, links a component to its original material and manufacturing history. Material test certificates, heat numbers, batch records, inspection reports and test results provide evidence that the supplied item meets the specified requirements.
This information gets appended as component moves through manufacturing, inspection, storage and installation. Where required, identification marks and records must be maintained even when material is cut, machined or fabricated into smaller parts.

For critical components, traceability helps investigators establish the origin of materials and assess the impact of any identified defect. Missing or inconsistent records can delay acceptance and create costly rework.

Supplier Surveillance and Non-Conformance Control

Supplier selection is only the first step. Nuclear buyers help suppliers by conducting quality audits, reviewing manufacturing plans, witnessing inspections and monitoring critical production activities, depending on the component and applicable requirements. These controls help identify problems before components reach the plant site.

When a product fails to meet a specified requirement, it must be recorded and controlled as a non-conformance. The supplier and purchaser must assess the issue and determine the appropriate corrective action. Depending on the circumstances and applicable rules, the item may require repair, rework, rejection or formally authorised acceptance under an approved disposition process.

Preventing Counterfeit and Suspect Items

Counterfeit, fraudulent and suspect items (CFSI) present another supply chain risk. Such items may have false certificates, altered identification marks or misleading claims about their origin and performance. Procurement teams can reduce this risk by purchasing through



approved channels, verifying suppliers and manufacturers, checking certificates against original records, and applying risk-based inspection and testing. Unusually low prices, incomplete documentation and unexplained changes in supply routes should trigger further scrutiny.

Quality Continues After Manufacturing

Quality assurance does not end when a component passes its final inspection. Improper storage, handling, preservation or transportation can damage equipment and compromise its condition. Suppliers and project teams must follow specified preservation requirements, protect sensitive surfaces and components, and maintain appropriate storage conditions. At delivery, receipt inspection checks the item's identity, condition, documentation and compliance with purchase requirements before acceptance.

Nuclear procurement is a continuous chain of verification, not a one-time purchase or inspection. From material certificates to installation records, each stage must preserve the evidence needed to demonstrate conformity. As India expands its nuclear programme, strong procurement controls and traceability systems will be essential for building a reliable domestic supplier base.

Read the full website feature for a closer look at supplier qualification, quality audits, CFSI prevention and lifecycle documentation. Click here to read in detail - **Nuclear Procurement and Quality Assurance: Traceability matters**

Nuclear Manufacturing: From Capability to Supplier Approval

Supplier registration opens the process. Technical evaluation and required assessments establish suitability. Formal approval defines the scope for which the supplier is accepted.



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India's nuclear expansion will create opportunities for domestic manufacturers. However, manufacturing a component successfully does not automatically qualify a company to supply the nuclear sector.

Nuclear buyers require evidence that suppliers can meet defined technical, quality and documentation requirements. Manufacturers must demonstrate that their facilities, personnel and processes are suitable for the specific product or service.

Pathway from manufacturing capability to nuclear supplier approval involves several distinct stages. Exact process depends on the buyer, component, applicable codes and procurement requirements.

Nuclear Supplier Approval Pathway

Step 1: Identify the Product and Buyer: Select the component or service the company intends to supply. Identify prospective buyers and understand their procurement requirements. Check the applicable technical specifications, quality requirements and standards before proceeding.

Step 2: Complete Supplier Registration: Submit the required company information, manufacturing capabilities, facility details, certifications and relevant experience. Registration establishes the company's credentials for consideration. It does not automatically qualify the company to supply nuclear components.

Step 3: Undergo Technical Evaluation: The buyer assesses whether the manufacturer has the required equipment, engineering capability, skilled personnel and production capacity. Previous experience, technical records and manufacturing processes may also be reviewed.

Step 4: Demonstrate Quality and Process Qualification: Establish the quality assurance arrangements required for the product. Qualify special processes, such as welding, where specified. Demonstrate that inspection, testing, material control and traceability meet the applicable requirements.

Step 5: Complete Audits and Required Assessments: The buyer may conduct a supplier quality audit, inspect the

manufacturing facility or require additional technical demonstrations. Any identified gaps must be addressed through corrective actions. Product-specific qualification or testing may also be required.

Step 6: Receive Approval for the Defined Scope
After satisfactory evaluation, the buyer may approve the supplier for a specified product, process, facility or scope of work. The company may then be eligible to participate in relevant procurements, subject to the buyer's procedures and contract requirements. Approval does not guarantee a purchase order or qualify the company for every nuclear component.

What Manufacturers Must Get Right

Quality assurance: Maintain controlled procedures and effective quality management systems.

Technical compliance: Meet the applicable design, material, manufacturing and inspection requirements.

Traceability and documentation: Maintain material certificates, manufacturing records, inspection reports and test results as required.

Audit readiness: Keep records current and address non-conformances systematically.

From Evaluation to Approval

For Indian manufacturers, entering the nuclear supply chain requires more than production capacity. It requires demonstrable technical competence, controlled manufacturing processes and documented evidence of compliance.

The key is to identify the intended product, understand the buyer's requirements and close capability gaps before seeking approval.
Supplier registration opens the process. Technical evaluation and required assessments establish suitability. Formal approval defines the scope for which the supplier is accepted.

Read the full website feature in Nuclear .IN Magazine: Click the below headline to Read **Nuclear Manufacturing and Supplier Qualification: From Capability to Approval.**



Mumbai to Host India Nuclear Energy Forum from 23–25 September 2027

India Nuclear Energy Forum 2027 (INEF-2027) will bring together nuclear industry stakeholders to discuss policy, technology, supply-chain partnerships and investment opportunities as India works towards its target of 100 GWe of nuclear power capacity by 2047. The event will be held at IIT Bombay, Mumbai, from 23 to 25 September 2027.



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India's nuclear energy sector is approaching a new phase of growth. As the country works towards its ambition of achieving 100 GWe of nuclear power capacity by 2047, the need for stronger industry participation, advanced technologies, domestic manufacturing and investment is becoming increasingly important.

Against this backdrop, the India Nuclear Energy Forum (INEF 2027) will bring together stakeholders from India and abroad in Mumbai from 23 to 25 September 2027. The flagship event of India Nuclear Forum (INF) will be organised under the theme "Towards Creating a Robust India Nuclear Energy Ecosystem."

The forum aims to connect policymakers, nuclear operators, technology developers, manufacturers, engineering companies, MSMEs, start-ups, researchers, investors and international industry representatives. Its objective is to encourage meaningful dialogue, develop business partnerships and strengthen the capabilities needed to support India's long-term nuclear energy ambitions.

An Industry at a Turning Point

India's nuclear sector is entering an important period of transition. The SHANTI Act and the evolving framework of rules and regulations are central to discussions about the future of nuclear power, including industry participation, investment, technology development and regulatory requirements.

Department of Atomic Energy has also invited stakeholder feedback on the draft SHANTI Rules and Regulations. This consultation process highlights the importance of industry perspectives in shaping the framework for the sector's development.

For manufacturers, engineering companies and technology providers, these developments could create new opportunities. However, converting opportunities into projects will require more than policy changes. It will also depend on qualified suppliers, reliable manufacturing capacity, technology partnerships, skilled professionals and effective project execution.

INEF 2027 is being developed to address these interconnected priorities. It will provide a platform for discussing policy, exchanging technical knowledge, exploring commercial opportunities and building international cooperation across the nuclear value chain.

Four Pillars of Engagement

The proposed forum will bring together four complementary programme elements: a technical conference, an exhibition, a business forum and a policy advocacy forum.

Technical Conference: The conference will feature keynote lectures, symposia, panel discussions and technical paper presentations by Indian and international experts. Topics will include reactor technologies, nuclear fuel, advanced applications, safety, plant operations, digitalisation and emerging research.

Exhibition: The exhibition will enable companies and institutions to showcase products, technologies, engineering capabilities and services relevant to nuclear power and its associated industries. It will also provide visibility to domestic suppliers and emerging technology developers.
Business Forum: Business-to-business meetings will encourage collaboration between Indian and international companies. Discussions will explore supplier development, localisation, joint ventures, technology transfer, manufacturing partnerships and supply-chain opportunities.

Policy Advocacy Forum: This platform will bring together industry representatives, experts and other stakeholders to discuss policy priorities, regulatory frameworks, licensing requirements and measures that could support responsible investment and wider industry participation.

Together, these four elements aim to connect technical knowledge with commercial opportunities and policy dialogue.

Five Tracks to Address Industry Priorities

The proposed INEF-2027 programme will be organised around five tracks covering major areas of nuclear energy development.

1. Policy, Regulation and Finance

Discussions will address policy frameworks, licensing procedures, regulatory requirements, project economics, financing, insurance and project bankability. The objective will be to examine the conditions needed to support sustainable nuclear power development.

2. Reactor Technologies, Applications and Nuclear Fuel

This track will cover large reactors, small and micro modular reactors (SMRs/MMRs), the nuclear fuel cycle, thorium, nuclear fusion, nuclear heat applications and green hydrogen. It will provide a platform to discuss technology development, research priorities and emerging applications.

3. Industry, Supply Chain and Operations

Domestic manufacturing and supplier development will be important areas of engagement. Topics will include nuclear-grade materials, component manufacturing, supplier qualification, quality assurance, plant operations and maintenance, nuclear safety, artificial intelligence and digital technologies.

4. Innovation and People

Research and development, deep-tech start-ups, technology innovation, workforce development and capacity building will form the focus of this track. Strengthening India's technical capabilities and developing a skilled workforce will be essential to supporting future projects.

5. Business Forum and International Collaboration

This track will focus on prospective nuclear operators, localisation, international country sessions, joint ventures, technology transfer and industry partnerships. It will also provide opportunities for Indian companies to explore collaboration with international technology providers and suppliers.

Connecting the Nuclear Supply Chain

For India's nuclear industry, achieving the 100 GWe ambition will require a strong and reliable supply chain. Reactor projects depend on a wide network of organisations supplying specialised materials, components, equipment, engineering services and digital solutions.

Consequently, domestic manufacturing and supplier development are expected to remain important industry priorities. MSMEs, in particular, could explore opportunities in precision engineering, fabrication, electrical systems, instrumentation, testing, maintenance and other supporting services, subject to applicable technical, quality and regulatory requirements.

However, entering the nuclear supply chain requires more than manufacturing capability. Suppliers must understand nuclear quality assurance, traceability, documentation, qualification requirements and the safety expectations associated with their products and services.

INEF 2027 aims to provide a meeting ground for these stakeholders. Manufacturers and service providers will be able to explore industry requirements, identify potential partners and discuss the challenges involved in developing nuclear-grade capabilities.

For international companies, the forum could also offer an opportunity to engage with Indian organisations and examine potential partnerships, localisation strategies and technology collaborations.

Building Partnerships for the Next Phase of Growth

The nuclear energy ecosystem extends beyond reactor construction. It includes fuel-cycle organisations, research institutions, component manufacturers, EPC companies, plant operators, testing agencies, technology developers, service providers and educational institutions.

Each plays a role in supporting safe, reliable and timely project delivery. Therefore, stronger coordination between these stakeholders will be essential as India plans to expand its nuclear capacity.

INEF 2027 aims to encourage this coordination by bringing technical, commercial and policy discussions together under one platform.

For start-ups and technology developers, the event will provide a proposed platform to present innovations and identify potential collaborators. For researchers and academics, technical sessions and paper presentations will create opportunities to exchange knowledge. For companies, the exhibition and business forum will support engagement with prospective customers, partners and suppliers.

The forum will also encourage international participation, creating opportunities to exchange experiences and explore areas of cooperation across the nuclear industry.

First Notification: Industry Feedback Invited

India Nuclear Forum is issuing this first notification in draft form to invite suggestions and feedback from industry stakeholders, experts, institutions and prospective participants.

The proposed themes and programme structure are intended to evolve through consultation. Feedback from the nuclear industry will help identify priority subjects, emerging technologies, supply-chain challenges and opportunities for collaboration.

Industry representatives, prospective delegates, authors, exhibitors, sponsors and institutional partners are invited to express their interest and contribute their perspectives. For full details of the event check **India nuclear Energy Forum Website**

For more detailed news at magazine website. Click the headline - **India Nuclear Energy Forum – INEF 2027 to Bring Nuclear Industry Stakeholders Together in Mumbai**

INF Takes Industry Dialogue on Nuclear MSMEs to IIT Madras





(1) Dr S Shamasundar MD ProSIM. (2) Panelists and organisers: (from left to right) Dr Kallol Roy, former CMD of BHAVINI and visiting Professor at IIT Madras; Ambassador Tirumurthy, Chair, Deccan Center for international Relations; Dr B Venkat Raman, Former Director of IGCAR, Ms Monisha Kumar, COO, MARG consultants; Dr S Shamasundar MD ProSIM R&D Pvt Ltd and Hon Director India Nuclear Forum; Smt Rajani Sankaran, former CMD, BHAVINI, and Accountant General, Tamilnadu.

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India Nuclear Forum (INF) is strengthening industry engagement to support the development of India's nuclear supply chain. Its participation in the international conference "Building India's Nuclear Ecosystem: Policy, Technology & Industry" at IIT Madras on 8 October 2026 was part of this effort.

Dr S. Shamasundar, Honorary Director of INF and Managing Director of ProSIM R&D Pvt Ltd, highlighted the role of micro, small and medium enterprises (MSMEs) in strengthening domestic value chains and building industrial capabilities.

The session, "Strengthening Domestic Value Chains and Capacity Building," addressed an important requirement for India's nuclear expansion: developing a wider network of capable suppliers that can meet the sector's demanding quality and qualification standards.

Connecting Industry and Building Capabilities

For INF, industry engagement is an important part of its role as a connecting platform for the nuclear industry. Bringing together manufacturers, engineering companies, technology providers, research organisations and other stakeholders can help improve understanding of industry requirements and identify opportunities for collaboration.

MSMEs have the potential to contribute across manufacturing, engineering, specialised services and component supply. However, entering the nuclear supply chain requires more than production capacity. Companies must also develop appropriate quality systems, traceability, documentation and technical capabilities.

Dr Shamasundar also highlighted ProSIM's role in connecting research and development organisations, nuclear plant operators, EPC companies, system integrators, vendors and regulators. Better coordination among these stakeholders can help bridge the gap between technology development and industrial implementation.

Supporting India's Nuclear Growth

The discussion comes at a time when India is seeking to expand its nuclear power capacity and strengthen domestic manufacturing. Achieving these goals will require a more resilient supply chain, a broader base of qualified suppliers and closer industry collaboration.

Through its engagement with industry forums and knowledge-sharing platforms, INF seeks to encourage dialogue on these challenges and support the development of a stronger nuclear industrial ecosystem.

Read the full report: **Dr Shamasundar Highlights the Role of MSMEs in India's Nuclear Supply Chain**

INF Connects BNMIT Students with India's Nuclear Industry





1) Mr N. Rama Mohan, Fellow of the Indian National Academy of Engineering (INAE) and former Executive Director (Engineering–LWR) and Executive Director (Reactor Safety and Analysis) at Nuclear Power Corporation of India Limited (NPCIL), addresses students at B. N. M. Institute of Technology (BNMIT), Bengaluru, during a session on power generation and nuclear science .(2) Group photograph following the session at BNMIT. Pictured in the centre are Dr Yasha Jyothi M. Shirur, Head of the Department of Electronics and Communication Engineering (ECE) and Faculty Advisor–CASS; Mr N. Rama Mohan; and Umesh Kumar S, Editor of Nuclear .IN Magazine along with fellow students.

Nuclear.IN Desk

India Nuclear Forum (INF) is extending its industry engagement to students and future engineers. An awareness session at B. N. M. Institute of Technology (BNMIT), Bengaluru, on 30 September 2026 highlighted the growing role of engineering professionals in India's expanding nuclear energy sector.

The session, "An Overview of Power Generation and Nuclear Science," was organised by the Department of Electronics and Communication Engineering (ECE), BNMIT, in association with the IEEE Circuits and Systems Society (CASS). Mr N. Rama Mohan, Fellow of the Indian National Academy of Engineering (INAE) and former Executive Director of Nuclear Power Corporation of India Limited (NPCIL), also a member of the Editorial Advisory Board of Nuclear .IN Magazine introduced students to power generation, nuclear science and India's nuclear energy programme.

Building Awareness Among Future Engineers

A key objective of the session was to help students understand the range of career opportunities emerging in the nuclear sector. Mr Rama Mohan explained that India's nuclear expansion will require professionals from diverse engineering disciplines, not just nuclear engineering.

For electronics and communication engineering students, potential opportunities include instrumentation and control, automation, sensors, communication systems, monitoring and diagnostics, embedded systems and digital technologies.

The session also introduced students to key organisations in India's energy and nuclear ecosystem, including the Department of Atomic Energy (DAE), Bhabha Atomic Research Centre (BARC) and NPCIL.

INF's Role in Knowledge Sharing

The programme provided an opportunity to introduce students to India Nuclear Forum and its activities. INF works to connect stakeholders across the nuclear sector through industry engagement, knowledge sharing and networking. Nuclear .IN Magazine, published by INF, also serves as a platform for information on nuclear technology, policy, industry developments, supply chains and emerging opportunities. Such outreach can help bridge the gap between academic learning and industry awareness. It can also encourage students to explore career paths linked to India's nuclear programme.

Preparing Talent for Nuclear Growth

As India works towards its long-term nuclear power ambitions, developing a skilled workforce will be as important as expanding generating capacity. Engineering graduates will be needed across design, manufacturing, construction, commissioning, operations, maintenance and research. Through student outreach and knowledge-sharing initiatives, INF seeks to build greater awareness of the nuclear sector and its evolving requirements among the next generation of professionals.

Read the full report: **Why Electronics Engineers Matter to India's Nuclear Future**

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Voice of Indian Nuclear Energy Community

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Nuclear Fuel Supply: The Next Frontier for India’s Nuclear Industry



Nuclear.IN Desk

India’s nuclear energy ambitions are entering a new phase. As the country moves towards its target of 100 GWe of nuclear power capacity by 2047, attention must extend beyond reactor construction, equipment manufacturing and project execution. A reliable, secure and scalable nuclear fuel supply chain will be equally important to achieving this goal. This will be the focus of the next issue of Nuclear .IN Magazine.

Nuclear fuel is not simply a commodity purchased for a power plant. It is the outcome of a complex industrial chain that connects uranium resources, mining, processing, conversion, enrichment where required, fuel fabrication, quality assurance, transportation and reactor operations. Each stage demands specialised technology, stringent quality controls and long-term planning.

India has developed substantial capabilities in nuclear fuel production for its pressurised heavy water reactor (PHWR) fleet. The Nuclear Fuel Complex (NFC) plays a central role in supplying fuel and associated materials for the country's indigenous reactor programme. India has also developed expertise in zirconium alloy production and fuel bundle manufacturing.

However, the next phase of nuclear expansion will bring new requirements. A larger reactor fleet will increase demand for uranium, fuel fabrication capacity and specialised materials. At the same time, the expansion of different reactor technologies, including light water reactors and small modular reactors, will create additional fuel-cycle requirements. Some designs may also depend on international suppliers, specialised enrichment services or different fuel specifications.

Therefore, fuel security must be addressed through a long-term strategy. Domestic resource development, fuel fabrication capacity, strategic inventories, supplier diversification and international cooperation will all have important roles. Equally, the industry must consider transportation, regulatory approvals, quality assurance and the ability to maintain uninterrupted fuel deliveries throughout a reactor's operating life.

The opportunities extend beyond established nuclear organisations. Engineering companies, material suppliers, specialised manufacturers, testing laboratories and technology developers can

contribute to a stronger fuel ecosystem. However, participation will require a clear understanding of technical specifications, qualification requirements, investment needs and procurement timelines.

The industry must also look ahead. Advanced reactors and emerging fuel technologies could change future demand patterns. Preparing for these developments will require coordination among policymakers, utilities, research institutions, fuel-cycle organisations and private-sector companies.

Your Views Matter

For this upcoming issue, Nuclear .IN Magazine invites industry leaders, nuclear fuel specialists, uranium and material suppliers, reactor operators, researchers, technology developers and other stakeholders to share their views.

We welcome practical insights on:

- Fuel security: Can domestic resources and international partnerships support India's expanding reactor fleet?
- Supply-chain capacity: What investments are needed in uranium processing, fuel fabrication and specialised materials?
- Industry participation: Where can private companies and MSMEs contribute to the nuclear fuel ecosystem?
- Technology readiness: How should India prepare for the fuel requirements of new reactor designs and SMRs?
- Long-term planning: What measures can ensure reliable fuel availability throughout the life of a nuclear power plant?

We particularly welcome informed viewpoints, industry experiences, technology perspectives and recommendations that can help strengthen India's nuclear fuel supply chain.

As India advances towards 100 GWe, the question is not only how quickly the country can build nuclear power plants, but also how reliably it can fuel them.

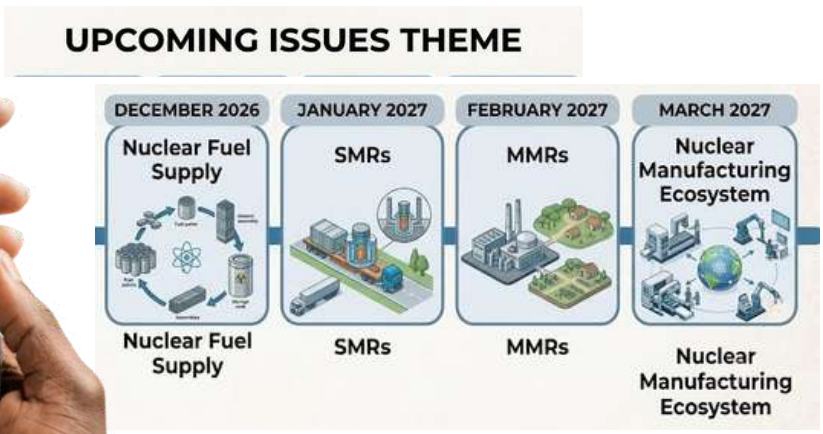
Share your perspective about any one topic related to Nuclear Fuel supply and contribute to the next issue of Nuclear .IN Magazine. Help shape the industry conversation on securing India's nuclear fuel future.

Submission: Up to 250 words | Deadline: 10 November 2026

Selected contributions will be published in Nuclear .IN magazine, on the Nuclear .IN website and across our social media platforms. Share your perspective. Help shape the conversation on India’s nuclear supply chain.
Send your views to: editor.magazine@indianuclearforum.in

For more info Contact **Mobile: +91 89049 02223.** *Privacy Note: Your contact details will be used only for communication and will not be shared or published without your consent.*





India's Nuclear Moment

Latest Developments Shaping India's Nuclear Future

October 2026

AEC Forecasts Massive₹7.5 Lakh Crore Private Investment



Atomic Energy Commission Chairman A.K. Mohanty projected a massive ₹7.5 lakh crore private capital infusion. This investment aims to deploy 30 GW of nuclear capacity by 2047. The strategic capital will accelerate the commercial deployment of India's indigenous Small Modular Reactors (SMRs). This initiative marks a historic transition from a state-monopolized procurement framework to a robust, multi-counterparty clean energy market.

59 Live Nuclear Projects Tracked Geographically



Industrial B2B tracking agencies mapped 59 active nuclear energy projects across six Indian states. Andhra Pradesh leads the domestic pipeline with 16 distinct developments. Meanwhile, Gujarat, Maharashtra, and Tamil Nadu follow closely with 10 projects each. This extensive geographic spread underscores the nationwide push to rapidly scale up clean baseload infrastructure over the coming decades.

Pre-Construction Approvals Surge



Out of the 59 tracked nuclear projects, 24 have officially entered advanced pre-construction regulatory evaluation phases. Simultaneously, 16 projects have successfully transitioned into active ground construction. These statistics signal a dramatic reduction in administrative bottlenecks, ensuring that the next wave of civil nuclear power plants meets strict implementation timelines across the country.

Energy Summit Debates BSR



The 20th India Energy Summit in New Delhi placed the Bharat Small Reactor (BSR) at the center of national policy. Industry veterans and supply-chain leaders urged immediate engineering standardisation. They focused on modifying existing 220 MWe Pressurised Heavy Water Reactor technologies. The primary goal is to provide reliable, captive baseload power to heavy industrial clusters.

Peaceful Nuclear Stance Reaffirmed



At the United Nations General Assembly, India formally highlighted its clean energy milestones and expanding SMR roadmap. The delegation emphasized safe, peaceful nuclear utilization to combat climate change. Additionally, India highlighted its role as a key technical partner, providing robust civil nuclear engineering assistance to emerging economies throughout the Global South.

India Funds Global Clean-Tech



During the 9th India-UN Development Partnership Fund event, multiple developing partner nations expressed formal gratitude. They recognized India's persistent efforts in sharing clean-tech expertise and development aid. The collaborative fund continues to support sustainable energy access globally, showcasing India's growing influence as a reliable supplier of peaceful, green technological solutions.

UCIL Celebrates Diamond Jubilee



The Uranium Corporation of India Limited celebrated 60 years of operation at the Jaduguda mining hub. The diamond jubilee event featured advanced technological demonstrations for domestic ore processing. Officials also reviewed the proposed site for the Saha Institute of Nuclear Physics' Dark Matter Laboratory, merging industrial fuel production with cutting-edge fundamental physics research. Read full Article by clicking here - **UCIL Updates in Nuclear .IN Magazine**

NTPC Proposes New Sites



Public sector giant NTPC Limited finalized comprehensive feasibility studies for three new nuclear power stations. Earmarked across Madhya Pradesh, Bihar, and Odisha, these sites form the foundation of NTPC's ambitious expansion program. The utility aims to construct 30 GW of capacity across 14 states, heavily diversifying its traditional fossil-fuel generation portfolio.

Heavy Engineering Conglomerates Align

Following the implementation of the SHANTI Act, heavy engineering majors like L&T and MTAR Technologies restructured their B2B operations. The companies launched comprehensive supply chain reviews to mass-produce indigenous reactor components. This commercial pivot directly serves private captive operators, who are now legally permitted to own and operate modular nuclear assets.





BARC Targets Private Consortiums



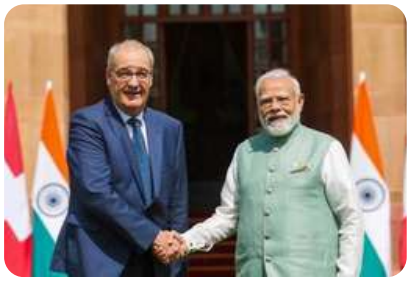
The Bhabha Atomic Research Centre accelerated high-level commercial negotiations with major private conglomerates, including Reliance Industries and Adani Power. The discussions focused on commercialising the indigenous 200 MWe Bharat Small Modular Reactor (BSMR-200) design. This proactive technology transfer initiative aims to leverage private engineering capacity to operationalise five specialized, captive industrial small modular reactors by 2033.

Global Trends, Indian Opportunities

October 2026 | 5 Global Developments

October 2026

1. India-Switzerland Strategic Breakthrough



During a high-level bilateral meeting in New Delhi on October 5, 2026, Prime Minister Narendra Modi and Swiss President Guy Parmelin formally signed multiple bilateral agreements. Alongside pacts on migration and infrastructure, both nations officially agreed to deepen strategic cooperation in civil nuclear energy. This framework opens up fresh B2B opportunities for Swiss infrastructure and high-precision engineering companies to participate in design, manufacturing, and technology capacity building for India's expanding civilian fleet.

2. Deepening South-South Nuclear Frameworks at the UN

On October 23, 2026, during the 81st session of the United Nations General Assembly (UNGA), India leveraged its chairmanship of the Regional Cooperative Agreement (RCA) for Research, Development and Training related to Nuclear Science and Technology. The delegation formally reiterated India's institutional commitment to South-South cooperation, using its platform to share peaceful nuclear science, regulatory knowledge, and clean-tech capabilities with developing nations across the Global South.

3. Poland Deepens Nuclear Strategic Ties



Indian Prime Minister Narendra Modi and Polish Prime Minister Donald Tusk held high-level delegation talks in New Delhi on October 22, 2026. The two leaders officially agreed to expand their comprehensive strategic partnership by deepening industrial collaboration in civil nuclear energy, space, and defence. The bilateral framework actively invites advanced Polish technology majors to engage in strategic clean-tech co-development and co-production projects within India.

4. Vietnam Expands Strategic Nuclear Ties



During the 19th India–Vietnam Joint Commission Meeting led by External Affairs Minister S. Jaishankar and Vietnamese Foreign Minister Le Hoai Trung, the two nations formalised a broadened strategic blueprint. Building on their Enhanced Comprehensive Strategic Partnership, the two sides officially agreed to expand bilateral cooperation into civil nuclear energy alongside collaborative frameworks for space exploration, military hardware joint production, and resilient supply chains.

5. INF, Decom Mission Sign MoU

India Nuclear Forum (INF) has signed an agreement with Decom Mission, a trade organisation focused on late-life energy assets and decommissioning. As India advances towards its 100 GW nuclear power target, the partnership will connect India's growing nuclear industry with international decommissioning expertise. Over the next 12 months, both organisations will organise joint seminars, shared events and trade missions to promote knowledge exchange and explore industry partnerships.

Engineering Problem?

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ProSIM has been a major contributor to Indian nuclear ecosystem for more than two decades. It has supported design, engineering, seismic analysis and qualification, R&D for PHWR, LWR, and PHWR reactors. ProSIM has worked with many DAE entities including NPCIL, IGCAR, BARC, NRB and also ITER IN and ITER I/O. ProSIM has worked with EPCs, engineering companies in France, Germany, India, Korea, UK, and USA.

Stay Connected with India's Nuclear Community

India Nuclear Forum (INF) *is an industry-led collaborative platform dedicated to advancing India's nuclear energy ecosystem. INF brings together policymakers, government agencies, industry leaders, technology providers, researchers, academics, and young professionals to support the growth of safe, sustainable, and innovative nuclear energy solutions for India's future.*



Connect with policymakers, industry leaders, researchers, technology providers, and professionals shaping India's nuclear future.

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