

No. CEA-EC-11-16(18)/17/2026-FCA Division / 294

भारत सरकार /Government of India

विद्युत मंत्रालय /Ministry of Power

केन्द्रीय विद्युत प्राधिकरण /Central Electricity Authority

वित्तीय एवं वाणिज्यिक मूल्यांकन प्रभाग/Financial & Commercial Appraisal Division

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Sewa Bhawan, New Delhi

Date: 11.05.2026

To

1. Secretary, Department of Atomic Energy, Mumbai
2. Secretary, Ministry of Power, New Delhi
3. Principal Secretary (Energy) of all States/UTs
4. CMD, NTPC, New Delhi
5. CMD, NPCIL, Mumbai
6. Speakers/Participants in the Workshop

विषय:केन्द्रीय विद्युत प्राधिकरण द्वारा 17.04.2026 को नई दिल्ली में विद्युत मंत्रालय और एनटीपीसी के सहयोग से "शांति अधिनियम, 2025: सार्वजनिक-निजी भागीदारी के माध्यम से भारत के 100 गीगावॉट परमाणु ऊर्जा रोडमैप को सक्षम करना" पर आयोजित कार्यशाला पर रिपोर्ट/Subject: Report on Workshop organised by Central Electricity Authority in association with Ministry of Power and NTPC on 17.04.2026 in New Delhi on "the SHANTI Act, 2025: Enabling India's 100 GW Nuclear Power Roadmap through Public-Private Partnership"

Madam/Sir

A workshop was organised by the Central Electricity Authority (CEA) in association with Ministry of Power and NTPC on 17.04.2026 at Scope Convention Centre, New Delhi. The workshop brought together senior officials from CEA, DAE, NTPC, NPCIL, financial institutions, industry stakeholders and experts to deliberate upon operationalization of the SHANTI Act, 2025 and its role in achieving India's target of 100 GW nuclear power capacity.

2. Based on the deliberations in the Workshop, a report has been prepared and is enclosed for your kind information.

अनुलग्नक: यथोपरि।

Yours faithfully,

  
(Goutam Ghosh)

Chief Engineer, CEA

**Copy to:**

1. PPS to Chairperson/all Members of CEA
2. Director (IT), CEA- with a request to upload the same in CEA website

# WORKSHOP REPORT

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## Workshop on the SHANTI Act, 2025:

*Enabling India's 100 GW Nuclear Power Roadmap through Public–Private Partnership*

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**Date: 17th April 2026**

Venue: Scope Convention Centre, CGO Complex, New Delhi

Organised by: **Central Electricity Authority (CEA)** in association with  
**Ministry of Power and NTPC Limited**

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# I. FORMAL INTRODUCTION

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## 1.1 Background and Context

India stands at a defining juncture in its energy transition. The enactment of the Sustainable Harnessing and Advancement of Nuclear Technology for India (SHANTI) Act, 2025 — which received Presidential assent in December 2025 — represents a transformative shift in the country's nuclear governance architecture, opening the sector to structured private participation for the first time since 1962. The workshop was organised at important juncture, with the criticality of the Kalpakkam Prototype Fast Breeder Reactor (PFBR) on 6th April 2026, the commencement of commercial operations of 700 MW PHWR units at Kakrapar and Rawatbhata, and the CEA's Long-Term National Resource Adequacy Plan (March 2026) projecting a steep increase in non-fossil fuel demand.

## 1.2 Objectives of the Workshop

The workshop was convened to deliberate on the practical operationalisation of the SHANTI Act and to generate actionable recommendations for policy-makers, regulators, developers, and industry. Six thematic domains were addressed:

- Decoding the SHANTI Act, 2025 — provisions on private participation, licensing, liability, and the regulatory framework.
- Site selection, land acquisition, and project de-risking strategies.
- Cost optimisation, tariff structures, and innovative financing mechanisms.
- Localisation of the nuclear supply chain and skill development aligned with Make in India.
- Technology access: design certification, international collaboration, and streamlining approvals.
- Risk management: nuclear insurance and the civil liability framework.

## 1.3 Participants

The workshop was attended by senior officials from the Ministry of Power, Department of Atomic Energy (DAE), Central Electricity Authority (CEA), Nuclear Power Corporation of India Ltd. (NPCIL), NTPC Ltd. (formerly National Thermal Power Corporation Ltd.), Power Finance Corporation (PFC), Atomic Energy Regulatory Board (AERB), Nuclear Fuel Complex (NFC), Homi Bhabha National Institute (HBNI), state power generation companies, private sector organisations (including Westinghouse, Tata Power, Bajaj Energy, Hindustan Construction Company, L&T, Jindal Group), financial institutions (including BRICS New Development Bank), and the insurance sector (GIC Re). The broad representation ensured a multi-stakeholder perspective across all sessions.

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## II. INAUGURAL SESSION

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### 2.1 Welcome address:

Shri Praveen Gupta, Member (Economic & Commercial) of the CEA, opened the session by characterizing the 100 GW nuclear roadmap as an endeavour that requires an unprecedented level of multi-stakeholder collaboration. He emphasized that the success of the SHANTI Act depends on creating a seamless bridge between government policy, industrial execution, and academic research. His address focused heavily on the commercial viability of the sector, urging that nuclear power must be positioned as a cost-competitive alternative to fossil fuels. To achieve this, he advocated for the standardization of designs and processes to reduce overall project costs and ensure stable long-term tariffs.

Furthermore, Mr. Gupta highlighted the critical need for supply chain localization and the rapid development of a skilled workforce. He noted that without a robust network of domestic vendors and a steady pipeline of trained professionals, the ambitious 2047 targets would remain out of reach. He concluded by stressing the importance of regulatory harmony, specifically the need to align the provisions of the SHANTI Act with the existing Electricity Act to provide a clear, predictable environment for private developers and grid operators alike.

### 2.2 Context Setting:

Mr. Gurdeep Singh, Chairman and Managing Director of NTPC Limited, delivered a keynote address, that served as a candid assessment of the industry's readiness and a call for urgent execution. While acknowledging the **SHANTI Act, 2025** as a "pioneering effort" that effectively addresses long-standing concerns regarding civil liability and private participation, he noted with concern that the anticipated "excitement" from the private sector has yet to fully materialize. He urged stakeholders to move beyond legislative intent and focus on the immediate formulation of rules and guidelines, arguing that clarity in implementation is the only way to convert policy into actual investment.

A significant portion of his address was dedicated to NTPC's own commitment to the national roadmap, confirming that the utility aims to build **30 GW** of the 100 GW target by 2047. He emphasized that for a large-scale power producer like NTPC, the focus must remain on large-capacity reactor sets rather than Small Modular Reactors (SMRs), which he suggested might be better suited for captive industrial use despite their high standby costs. He also cautioned against technological over-dependence on any single supplier or country, asserting that India should prioritize control over technology and resources, even if domestic options are **5-10% costlier** at initial stage, to avoid the supply chain vulnerabilities currently seen globally.

Mr. Singh concluded by identifying critical operational bottlenecks, particularly the "state-level hesitation" that persists despite central government support for nuclear expansion. He noted that while NTPC is actively engaging with 14 states, acceptance levels remain inconsistent, necessitating greater public outreach and site visits to demonstrate that "nuclear is safe." He underscored that ensuring long-term fuel security for plants designed to operate for over 60 years is a non-negotiable prerequisite. By advocating for the repurposing of retiring thermal plant sites

which already possess land, water, and grid connectivity, he provided a practical strategy to de-risk projects and accelerate India's journey toward a "Viksit Bharat" by 2047.

### 2.3 Key note Address:

Mr. Ghanshyam Prasad, Chairperson of the Central Electricity Authority (CEA), delivered a keynote address that served as the operational and technical blueprint for India's nuclear expansion. His speech shifted the focus from high-level policy to the practical challenges of execution, emphasizing that scaling capacity from 8.8 GW to 100 GW by 2047 requires a "ten-fold" acceleration in pace. He characterized nuclear energy as a vital source of 24/7 baseload power, essential for maintaining grid stability and meeting international climate commitments while supporting India's rapidly growing electricity demand.

A major portion of his address was dedicated to the "operationalization" of the SHANTI Act, 2025. While hailing the Act as a legislative cornerstone, Mr. Prasad stressed that the current priority is the early formulation of detailed rules, procedures, and guidelines to make the framework functional on the ground. He advocated for the standardization of processes and the streamlining of regulatory approvals to compress project timelines noting that the current 13-year development cycle must be reduced to approximately 8–9 years to meet the 2047 target.

Mr. Prasad also highlighted the need for market liberalization and resource security. He predicted a shift from a single-player dominance to a competitive landscape featuring 10 to 12 companies, which would exponentially increase the capacity for construction. Furthermore, he identified critical "enablers" for this growth, including the diversification of nuclear fuel sources through long-term procurement, proactive site selection by state governments, and the repurposing of retiring thermal power plants. He concluded by pointing to emerging technologies like Small Modular Reactors (SMRs) as a key future pathway, provided that India can effectively manage the associated design and supply chain challenges

### 2.4 Inaugural Address:

Ms. Seema Jain, Member (Finance), Department of Atomic Energy, delivered a landmark inaugural address, which effectively signalled the dawn of a more commercialized era for India's nuclear sector. Her speech focused on the monumental task of scaling India's nuclear capacity to 100 GW by 2047, a goal she estimated would require a staggering investment of approximately ₹20 lakh crore. She pointed out that traditional government funding would no longer be sufficient to meet these requirements, necessitating a shift toward innovative financial instruments and a deeper engagement with the banking sector to unlock the necessary capital.

A central theme of her address was the strategic liberalization of the industry through the SHANTI Act, 2025. In a major policy update, she announced that the Atomic Energy Commission has officially cleared a proposal for Foreign Direct Investment (FDI) in the nuclear sector, which is currently undergoing inter-ministerial consultation. This move is intended to leverage the Act's "graded liability framework" to reassure global investors and private entities. By moving toward a Public-Private Partnership (PPP) model, she emphasized that the government aims to share both the risks and the rewards of nuclear development with private industry players.

Beyond financing, Ms. Jain highlighted the critical importance of technological indigenization, specifically targeting Light Water Reactor (LWR) technology. While India has achieved mastery in PHWR and FBR designs, she urged the industry to focus on end-to-end localization, ranging from reactor components to fuel processing. This transition is intended not only to ensure national energy security but also to position India as a reliable, self-reliant manufacturing hub within the global nuclear supply chain. Ultimately, her address served as a call to action for policy makers and industry leaders to treat nuclear energy as a commercially viable, bankable sector essential for India's long-term "Net Zero" ambitions.

## III. SESSION I: DECODING THE SHANTI ACT, 2025

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### 3.1 Evolution of the Legal Framework

The SHANTI Act, 2025 repeals both the Atomic Energy Act, 1962 and the Civil Liability for Nuclear Damage (CLND) Act, 2010 upon notification. The evolution leading to the SHANTI Act was traced across successive legislative interventions: the Atomic Energy Act 1962, amended in 1986 (control over strategic minerals), 1987 (authorising government companies to build, own, and operate nuclear power plants), and 2015 (permitting Joint Ventures between two government companies); and the CLND Act 2010, which introduced a no-fault, operator-channelled liability regime but with a flat ₹1,500 Crore liability cap irrespective of reactor size. The SHANTI Act addresses the structural limitations of this earlier framework across all three dimensions of participation, regulation, and liability.

### 3.2 Objectives and Preamble

The SHANTI Act is built around five declared objectives: enabling structured private sector participation in nuclear power production; fostering research, development, and innovation; establishing a robust statutory regulatory regime through the Atomic Energy Regulatory Board (AERB); providing a pragmatic and graded liability regime; and conforming to India's international treaty commitments. Critically, the preamble identified during the session as carrying the spirit of the Act's subordinate rules, recognises nuclear power as a 'viable, clean, low-carbon, baseload power generation source,' links nuclear energy to India's Sustainable Development Goals, and references the national commitment to Net Zero emissions by 2070.

### 3.3 Permitted Entities and Licensed Activities

The Act expands permitted participation beyond the historic government monopoly to include: any Department of the Government of India or institution established by it; any Company under the Companies Act, 2013; any Joint Venture among the foregoing; and any other person notified by the Central Government. Key licensed activities encompass the full project lifecycle, building, owning, operating, and decommissioning nuclear power plants; nuclear fuel fabrication including uranium enrichment up to a threshold; import, export, and use of prescribed equipment and substances; transport and storage of spent nuclear fuel; and import and export of nuclear technology and software.

Activities reserved exclusively for the Central Government — defined as strategic — include: uranium enrichment above the threshold and isotopic separation; management of spent fuel including reprocessing, recycling, and high-level radioactive waste management; and heavy water production and upgradation by isotopic separation. R&D and innovation in nuclear energy for peaceful purposes including by private institutions and academic institutes require no licence under the Act. The Act also, for the first time, permits patents for innovations relating to peaceful uses of atomic energy.

### 3.4 The Graded Liability Regime

The most consequential departure from the CLND Act is the adoption of a graded liability schedule calibrated to reactor thermal power, replacing the flat ₹1,500 Crore structure:

Reactor Capacity (Thermal MW)	Operator Liability (₹ Crore)
Greater than 3,600 MW	3,000
Greater than 1,500 MW up to 3,600 MW	1,500
Greater than 750 MW up to 1,500 MW	750
Greater than 150 MW up to 750 MW	300
Up to 150 MW; fuel cycle facilities; transportation	100

The maximum national liability remains capped at 300 million Special Drawing Rights (SDRs) — approximately ₹4,000 Crore as of the date of the workshop. Beyond the operator's cap, the Central Government bears liability up to this ceiling; for damages exceeding 300 million SDRs, additional compensation may be sought under the Convention on Supplementary Compensation for Nuclear Damage (CSC), to which India is a signatory. Supplier liability has been removed under the SHANTI Act, there is no equivalent to Section 17B of the CLND Act, justified on the basis of advanced passive safety design features, stringent quality control frameworks, and the provision for manufacturing site inspection. Only contractual liability for the supplier is retained. Also, Clause 46 of the CLND act which removed the possibility of exempting the operator from any proceeding which might, apart from this Act, be instituted against such operator has been removed.

Four principles underpin the liability regime: fair, adequate, and prompt compensation; strict no-fault liability on the operator; accessible and time-bound claims mechanisms; and binding, enforceable awards. A Nuclear Liability Fund is maintained through a per-unit electricity levy (currently 5 paisa per kWh under NPCIL's practice). The SHANTI Act removes the ₹2,000 Crore cap on this Fund that existed under the CLND Act, allowing it to grow continuously with nuclear generation.

### 3.5 Regulatory and Redressal Architecture

The AERB receives its statutory constitution through the SHANTI Act, conferring enhanced legal powers on the regulator. An Atomic Energy Redressal Council is established as a non-judicial forum to hear grievances relating to licensing, regulatory decisions, tariff disputes, and nuclear damage compensation. Appeals from Council determinations lie with the Appellate Tribunal (to include technical members from the atomic energy field), with further recourse to the Supreme Court.

### 3.6 Nuclear Tariff Framework

Nuclear tariff under the SHANTI Act continues to be determined by the Central Government on a cost-plus, single-part basis, with norms incorporating the cost of fuel, spent fuel management, decommissioning, heavy water, and other factors. The Act mandates a National Nuclear Energy Policy consistent with the National Electricity Policy under the Electricity Act, 2003.

### 3.7 Fuel Security — Nuclear Fuel Complex

The session also addressed fuel supply security, a critical enabler of the 100 GW roadmap. Nuclear fuel manufacturing is entirely indigenous, with the only external dependency being uranium ore concentrate for IAEA-safeguarded reactors. Current licensed production capacity at Hyderabad stands at 1,900 metric tonnes (MT); with the addition of a new facility at Kota (Phase I: 500 MT; Phase II: 1,000 MT), total PHWR fuel capacity will reach 2,900 MT by 2032. For the full PHWR programme targeting approximately 50 GW by 2047, further expansion — including at co-located new reactor sites planned to exceed 6,000 MT. The concept of a strategic fuel reserve equivalent to one-third of plant lifetime (approximately 20 years' supply) was identified as essential for investor confidence and risk mitigation.

### 3.8 Questions and Answers

The first line of questioning addressed whether SMRs and MMRs require a licence under the SHANTI Act, and whether import of a foreign-certified reactor design could be licensed in India on the basis of foreign regulatory approval alone. It was confirmed that irrespective of reactor size or power output, a licence from the Government of India is mandatory both for import and for operation. Proof of regulatory approval in the country of origin must be submitted as part of the licence application, but such proof does not substitute for Indian regulatory review— the Indian regulator's assessment is final and independent. The session chair invoked the Boeing 737 Max case, a design licensed by the US FAA that resulted in 630 deaths — as a cautionary example of the risks of deference to foreign regulators, reinforcing that safety must be established to Indian regulatory satisfaction without exception.

The second question concerned the ability to execute MoUs or NDAs with foreign technology suppliers before the SHANTI Act formally comes into force. It was clarified that DAE can issue a one-time authorisation permitting an entity to execute an MoU or NDA with a foreign party. However, the actual import of technology can only take place after the Act is notified and the relevant licence and safety authorisation have been obtained.

The third question, raised by a participant from NLC, asked whether the Nuclear Fuel Complex has a plan to support 100 GW target beyond the PHWR programme. It was confirmed that NFC is presently licensed only for PHWR fuel fabrication and that plans for Light Water Reactor fuel indigenisation through Joint Ventures, for example with Rosatom for additional VVER units are currently at an early conceptual stage, with detailed plans yet to be developed.

### 3.9 Summary

Session-I established the legislative foundation of the day's deliberations. The SHANTI Act was presented as a comprehensive reform of India's nuclear legal framework — repealing the Atomic Energy Act, 1962 and the CLND Act, 2010 and as the instrument enabling private sector participation, statutory regulation through AERB, a graded liability regime, and alignment with India's international treaty obligations. Fuel security was identified as a critical parallel enabler, with NFC's capacity expansion roadmap confirmed as sufficient for the current plan of PHWR programme of NPCIL, and accordingly expansion is to be planned by NFC for balance PHWR

capacity to be developed by other utilities by 2047; while plans for LWR fuel indigenisation remain at an early conceptual stage.

## IV. SESSION II: SITE SELECTION, LAND ACQUISITION, AND PROJECT DE-RISKING

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### 4.1 NPCIL's Siting Methodology

The siting process follows a structured, two-stage sequence. At the national level, the Government of India identifies broad regions based on power demand and favourable conditions. State governments then submit candidate sites to the Standing Site Selection Committee (SSSC), DAE, which applies mandatory rejection criteria and discretionary parameters before forwarding shortlisted sites for in-principle approval.

Mandatory rejection criteria include: location within Seismic Zone V under IS 1893:2016; presence of an active or capable seismic fault within a 5-km radius from reactor centres; and site conditions where fault activity could cause surface faulting affecting NPP safety. Additional parameters span land and water availability, proximity to power demand centres, airport and military screening distances, eco-sensitive areas, population distribution, and construction material availability.

### 4.2 Exclusion Zone Revision and Land Requirements

The exclusion zone (EZ) within which no public habitation is permitted is currently prescribed at a 1 km radius. A revision has been agreed in principle between AERB and DAE: the proposed EZ radius is planned to be reduced to 700 metres for 700 MW PHWRs and 500 metres for 220 MWe PHWRs, subject to site-specific Radiological Impact Analysis. This revision will deliver significant land savings: from 336 hectares to 179 hectares for a 4x700 MW cluster, and from 331 to 94 hectares for 220 MW configurations. Water requirements for a twin-unit 700 MWe inland site are substantial around 80 million cubic metres annually which structurally directs siting towards water-rich areas that, by their nature, tend to have high population density.

### 4.3 Land Acquisition Challenges and State Government Engagement

Land acquisition remains one of the most operationally difficult aspects of project development. Several sites have experienced delays in occupying acquired land due to unresolved resettlement disputes, directly increasing project costs through carrying charges and delayed investigations. Public perception is identified as a particular challenge in states without existing nuclear facilities contrasting with the positive outlook observed in communities already living near operating plants.

Recommended strategies for effective state engagement include: higher allocation of power from NPPs to the host state; a direct development incentive fund linked to every unit of electricity sold from the project; equity participation by the state in the NPP; and a formal coordination mechanism between the utility, state and local governments, and the Central Government for issue resolution throughout the plant lifecycle. Digitisation of land records was identified as a prerequisite for accelerating siting studies and should be communicated to state authorities as a priority action.

### 4.4 Fleet Mode and Multi-Unit Siting

A consistent recommendation across presentations was the adoption of fleet mode siting clusters of 6, 8, or 10 units at a single location to share common infrastructure as the primary lever for cost reduction and schedule compression. The twin-unit model is the minimum, sharing multiple

infrastructure elements; beyond that, per-unit costs drop substantially. Fleet mode also compresses the regulatory approval cycle by establishing precedents that can be referenced for subsequent units.

#### 4.5 Brownfield Repurposing of Thermal Power Sites — CEA Sub-Committee Findings

CEA constituted a Sub-Committee comprising officers from CEA, NPCIL, and AERB in January 2025 to evaluate the suitability of retiring thermal plant sites for nuclear power. The methodology applied a 17-point checklist (Phase I, from 28 sites) covering location, seismotectonic, land and water availability, meteorology, and surrounding population, narrowing to 10 sites for visits, then 6 after water analysis, and finally 3 sites for detailed study. Specific findings: Site 1 is suitable for 2×220 MW using land in the ash dyke area with adequate water, pending utility confirmation; Site 2 is suitable for 2×700 MW using material storage area land with water available subject to state government linkage, but approximately 15–20 families require relocation from within the EZ; Site 3 is suitable for 2×700 MW contingent on the EZ revision from 1 km to 700 m (currently under regulatory revision), with water available pending state confirmation.

Phase II extends the evaluation to 11 further sites comprising thermal units aged 30–40 years, using a 20-point checklist. Site visits are being planned following data collection from utilities. The pathway to conversion follows the established NPCIL siting procedure, beginning with seismic and geotechnical studies by the utility and submission to the SSSC.

#### 4.6 Questions and Answers

A participant from Telangana GENCO enquired about the per-MW land requirement breakdown and the feasibility of the Kothagudem site — a 720 MW thermal plant that has been decommissioned, leaving bare land available. It was confirmed that detailed land breakdowns and water balance diagrams are available for both 220 MW and 700 MW PHWR configurations, and that these can be shared. It was noted that the Kothagudem site had been evaluated during Phase I but was not found suitable; the reasons for rejection are available and can be provided to the state utility for review.

A representative from the BRICS New Development Bank enquired about the implementation readiness of the brownfield sites and the availability of financing for feasibility studies. It was clarified that Phase I work is at the shortlisting stage and that detailed geotechnical and seismic studies the next mandatory step are yet to be commissioned by the respective utilities. It was noted that multilateral banks, including the NDB, can provide grant and technical assistance funding even for pre-feasibility studies, and that the modality can be explored once a dashboard of site-wise status and specific study requirements is published. The EOI (Expression of Interest) and RFP route was confirmed as the intended commercial pathway for engaging industry and financiers.

From the floor, the session chair underlined that digitisation of land records by state governments is a prerequisite for efficient land acquisition study commencement, and committed to ensuring this message is formally communicated to state authorities as a follow-up to the workshop.

#### 4.7 Summary

This session addressed the practical challenges of bringing new nuclear capacity to ground. The NPCIL siting methodology and the CEA brownfield thermal repurposing study both pointed toward the same conclusions: land and water availability near population centres is the binding constraint;

the proposed EZ revision from 1 km to 700/500 metres will significantly ease land requirements; and state government partnership through equity participation, power allocation, and area development funds is essential for both land access and public acceptance. Fleet mode and multi-unit siting were consistently identified as the primary structural levers for cost and schedule reduction.

## V. SESSION III: COST REDUCTION, TARIFF STRUCTURES, AND FINANCING LEVERS

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### 5.1 Nuclear Tariff Governance

Nuclear tariff is fixed by DAE in consultation with CEA on a cost-plus, single-part basis, determined for five-year control periods by an Ad Hoc Committee. Under the SHANTI Act, disputes are channelled to the Atomic Energy Redressal Council, with further challenge before APTEL. This tariff is categorically distinct from Electricity Act tariff norms: it follows neither Section 62 (cost-plus regulated) nor Section 63 (competitive bidding) of the Electricity Act, and private operators under SHANTI will be governed by the same cost-of-service model.

### 5.2 Tariff Components and Current Levels

The nuclear tariff structure comprises Return on Equity (15.5% plus taxes), Interest on Debt (actual weighted average), Depreciation (2.33% per annum over 30 years), O&M expenses, Interest on Working Capital, Annual Fuel Recovery Charges (part of initial fuel loading cost recovered over 15 years), regular fuel reloading cost, Heavy Water Lease Charges (for PHWRs), Decommissioning Fees, and Foreign Exchange Variation. The tariff notified for the 2022–27 control period for existing NPPs ranges from ₹2.72 to ₹3.87 per unit. Indicative tariffs for new units based on different present day capital cost assumptions are: PHWR at ₹21 Crore/MW — approximately ₹7.77 per unit; PWR at ₹30 Crore/MW — approximately ₹7.88 per unit. If the nuclear power plants are commissioned in future years, then there will be increase in tariff by approximately ₹0.10 per unit per year due to increase in normative O&M cost.

### 5.3 Key Levers for Tariff Reduction

The session identified and quantified several actionable levers:

- Basic Customs Duty (BCD) exemption on all nuclear project imports — already notified by the Central Government until September 2035 provides an immediate and significant cost reduction.
- Back-loaded tariff structures, with lower Return on Equity in early years and higher in later years at the same NPV, improve front-end financial viability and are already incorporated in recent DAE norms.
- Fleet mode procurement and long-term supply contracts reduce equipment costs by enabling volume-based pricing.
- GST reduction on the nuclear island from 18% to 5% could reduce overall tariff by approximately 20 paise/unit, while complete GST elimination could achieve approximately 30 paise/unit reduction in tariff for PHWR (cost ₹21 Crore/MW)
- 1% reduction in Return on Equity could reduce tariff of PHWR (cost ₹21 Crore/MW) by approximately 15 paise/unit and tariff of PWR (cost ₹30 Crore/MW) by approximately 18 paise/unit
- 1% reduction in the applicable interest rate could reduce tariff of PHWR (cost ₹21 Crore/MW) by approximately 15 paise/unit and tariff of PWR (cost ₹30 Crore/MW) by approximately 2 paise/unit

- Increase in Plant Load Factor (PLF) of PHWR (cost ₹21 Crore/MW) from 72.5% to 80% could reduce tariff by 55 paise/unit.

## 5.4 Financing Mechanisms

Nuclear projects present a distinctive financing challenge: high capital outlay (₹30 Crore/MW and above), extended gestation periods of 7–10 years, and RBI's revised project finance norms requiring 51% or more of debt repayment from project cash flows, bankable PPAs, and a 10% cap on cost overrun funding with asset downgrade triggers. These structural constraints necessitate bespoke financing architecture.

Long-tenure debt of 30 years is identified as essential for tariff competitiveness. The financing landscape has advanced materially: ₹26,000 Crore has already been sanctioned to NPCIL at above 30-year tenure, the first such long-tenure nuclear loan in India establishing a benchmark transaction for the sector. The recommended multi-layer financing approach combines government infrastructure bonds, Development Finance Institution lending at concessional rates, back-loaded repayment structures aligned with tariff profiles, potential sovereign credit support, and debt-equity ratios potentially reaching 85:15 for strong balance sheet borrowers. The interest from multilateral financiers including the BRICS New Development Bank in supporting pre-feasibility and detailed project studies was noted as a further avenue for early-stage de-risking.

## 5.5 Questions and Answers

A participant from Bajaj Energy sought confirmation that the indicative tariff calculations assumed a 30-year loan tenure a product not presently available in the Indian market as a standard offering. It was confirmed that the calculations do assume a 30-year tenure, and it was clarified that while such tenures are not directly available through standard bank products, refinancing makes 30 years achievable in practice. PFC's recent balance sheet loan to NPCIL at above 30-year tenure was cited as evidence that the product is achievable, and it was noted that as the sector matures and lenders become familiar with nuclear project risk, 30-year project finance loans will follow as has been the experience with hydro and transmission.

A participant from the Jindal Group sought clarity on whether the nuclear tariff framework for private operators would fall under Section 62 or Section 63 of the Electricity Act 2003. It was unambiguously confirmed that nuclear tariff under the SHANTI Act is neither Section 62 nor Section 63, it is a distinct cost-of-service model governed by DAE, and the Electricity Act norms do not apply. Competitive bidding is not envisaged in the near term. It was noted that the current framework is appropriate for the sector-opening phase, and that competitive mechanisms may be introduced over time as the market matures, but this is not a near-term prospect.

## 5.6 Summary

This session made the economic case for nuclear power's competitiveness and identified the specific policy and financing reforms needed to achieve it. Indicative tariffs for new PHWRs and PWRs were presented alongside quantified sensitivity analyses for GST reduction, PLF improvement, interest rate reduction, and loan tenure extension. The landmark 30-year loan already sanctioned to NPCIL by PFC was noted as the pathfinder transaction establishing the financing template for the sector. The session confirmed that nuclear tariff governance sits outside the

Electricity Act framework and for the time being will follow a cost-of-service model under DAE. Competitive bidding may be introduced once the sector matures.

## VI. SESSION IV: LOCALISATION OF SUPPLY CHAIN AND SKILL DEVELOPMENT

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### 6.1 Localisation — The Imperative and the Benchmark

Localisation of the nuclear supply chain is established as a necessary condition for achieving target capital costs without it, cost reduction targets for imported technologies are unachievable. PHWRs, with near-100% indigenous supply after 50 years of programme development, serve as both the benchmark and the reference case. For imported PWR and SMR technologies, a phased manufacturing programme is the recommended approach: beginning with low and medium complexity components and progressively qualifying Indian vendors for safety-grade and Class 1 nuclear equipment as the programme scales.

### 6.2 Foreign Technology Localisation — AP1000 Case Study

The AP1000 design's material efficiency was presented as a significant localisation enabler: 50% fewer safety-grade valves, 35% fewer pumps, 80% less safety-grade piping, 45% less seismic building volume, and 70% less cabling compared to conventional PWR designs. Its fully modular construction structural, mechanical, electrical, and I&C modules, facilitates distributed manufacturing across Indian facilities. The tiered supplier model comprises a global tier for long-lead items (with Indian vendors able to qualify as global suppliers), an Indian supplier tier for items with shorter gestation periods, and a local tier for proximity sourcing near each project site.

Indian industry's existing nuclear and high-consequence manufacturing capability developed through the PHWR programme and associated defence and chemical process industries was assessed as a strong foundation for localisation of imported reactor technologies. The supplier qualification sequence follows a structured process: scope definition, screening analysis, supply capability assessment, technical and quality evaluation (gap analysis), quality audit (ASL and QSL for Class 1 equipment), and ongoing supplier oversight.

### 6.3 Long-Term Supply Visibility as an Enabling Condition

A recurring emphasis across the session was the need for long-term demand visibility as a prerequisite for supplier investment in capacity. Manufacturers require forward-looking demand signals 15 to 20-year procurement forecasts to justify investment in qualifying for nuclear-grade supply chains. Without this, private vendors will not build the specialised capacity needed for the 100 GW programme. Fleet mode execution, standardised design, and formal long-term supply agreements between project owners and qualified vendors were identified as the mechanisms to deliver this signal.

### 6.4 Skill Development

The nuclear sector's skill requirements are uniquely multi- and inter-disciplinary, spanning reactor physics, chemistry, life sciences, engineering, mathematics, medicine, and health care and at every level from reactor design through fuel management, operation, maintenance, radiation safety, and decommissioning. A critical distinction was drawn between graduate-level engineering skills

adequately served by existing academic infrastructure, diploma and ITI-level technical skills (welders, electricians, fitters, Radiation Safety Officers), which are equally essential for an expanding programme but presently underserved in skill development planning.

Homi Bhava National Institute (HBNI) was identified as the nodal institution for structured nuclear sector skill development, with a distributed university architecture across 14 DAE institutions (4 R&D Centres and 10 Grant-in-Aid institutions), 1,281 faculty, 3,985 students, and 10,182 degrees, diplomas, and certificates awarded since 2007 across 48 programmes under 9 Boards of Studies. HBNI currently produces 250–300 PhD graduates per year available for industry recruitment. Its offering value-added courses in reactor physics, radiation safety, ASME Boiler and Pressure Vessel Code, reactor thermal-hydraulics, piping integrity, severe accident phenomenology, welder qualification, and nuclear law can be customised to specific industry requirements upon engagement.

## 6.5 Questions and Answers

A participant from NTPC pressed on the vendor development timeline, noting the sequential nature of the process starting from design vetting, material qualification, QA processes and supply and asking how far advanced engagement with Indian regulators and manufacturers actually is. It was responded that the AP1000's modular, ASME-standard design, and the existing nuclear component manufacturing capability in India, positions the localisation curve as shorter than commonly assumed. Indian vendors engaged in nuclear, defence, and chemical process equipment manufacturing are already working to the same standards, and require orientation rather than wholesale capability development. It was noted that Westinghouse's engineering centre in India, with approximately 400 employees recruited from non-nuclear backgrounds and trained entirely on the job, is itself a demonstration that the workforce transition is achievable.

A participant from Hindustan Construction Company observed that end-to-end EPC models risk marginalising specialist civil contractors with deep nuclear construction experience noting that approximately 60% of India's nuclear infrastructure has been executed by experienced civil contractors operating under split models. It was recommended that pre-qualification criteria for nuclear projects should specifically recognise nuclear civil works experience, and that the choice between single EPC, multi-package, and split civil/nuclear island models rests with the project owner. Both models have precedents within NPCIL's portfolio, and project developers are encouraged to structure pre-qualification accordingly.

## 6.6 Summary

This session examined the two foundational enablers of a cost-competitive domestic nuclear programme. On localisation, the PHWR programme's near-100% indigenisation was presented as the benchmark, and the AP1000's modular, ASME-standard architecture was assessed as well-suited to leveraging India's existing nuclear and high-consequence manufacturing base. On skills, the session underlined the equal importance of ITI and diploma-level technical workforce development alongside graduate engineering training, and identified HBNI as the nodal institution for structured skill development across the full spectrum of nuclear sector requirements.

## VII. SESSION V: MAKING TECHNOLOGY AVAILABLE

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### 7.1 Design and Engineering Support for PHWRs

PHWRs represent the primary focus of the 100 GW roadmap — targeting approximately 50 GW by 2047 and are currently the only reactor type with 100% indigenous supply and over 50 years of operational experience in India. At present 6.46 GW of PHWR constitute approximately 73% of India's current nuclear capacity. Scaling the PHWR programme to 50 GW requires a coordinated multi-stakeholder ecosystem. To bridge the design and engineering capability gap at scale, a Design and Engineering Support Agency functioning under the Department of Atomic Energy is proposed, providing centralised design and engineering support, regulatory facilitation, and quality assurance to multiple operators deploying standardised PHWR designs.

### 7.2 Challenges in Adopting Foreign Reactor Technologies

The current regulatory pathway for First-of-a-Kind (FOAK) foreign reactor designs in India presents structural disincentives for both operators and technology suppliers. Design certification, an assessment of design suitability as distinct from site-specific review, having significant cost and takes approximately 18–20 months, and is loaded entirely onto the first project operator implementing that design in India. Operators are additionally required to finalise technology selection as early as the siting stage, limiting flexibility. Each year of delay attributable to design review adds approximately 2–3% to total project cost through IDC. The cumulative effect is to make the FOAK project economically unviable without structural reform of the approval architecture.

### 7.3 Technology Decoupling — The Proposed Framework

The workshop deliberated on a proposed reform framework resting on three elements

1. **Technology decoupling:** design certification by AERB should be made utility-agnostic and site-agnostic, conducted independently of any specific operator or site, with costs distributed across the fleet of future projects deploying that technology. Under the current model, technology selection is required from the siting stage and design review is site-dependent; the proposed model substitutes technology-agnostic siting with envelope criteria and conducts design certification independently.
2. **Technology-agnostic siting consent:** siting approval should use envelope criteria encompassing the requirements of multiple potential reactor types, removing the obligation to commit to a specific technology before regulatory processes begin.
3. **Streamlined international collaboration approvals:** the current process for NDAs, MoUs, and JVs requiring sequential coordination across DAE, MEA, DPIIT, and MoP and taking 6–9 months should be reduced to under 3 months through pre-vetted templates, a single-window portal on the model of PARIVESH, and mandatory time-bound responses from all departments.

### 7.4 Questions and Answers

A participant from Maharashtra State Power Generation Company asked whether CEA has published standard specifications, plant layout guidelines, land and water requirement standards, and safety guidelines for nuclear projects, comparable to the guidelines CEA historically published

for thermal power projects. It was acknowledged that no such guidelines currently exist for nuclear, as the sector has only now been opened. Their development was identified as a logical and necessary near-term deliverable, and the suggestion was recorded as a formal recommendation for follow-up by CEA.

A participant drew a comparison with the US NRC's Part 52 Design Certification Document (DCD) process under which a reactor design is licensed centrally independent of any specific site or utility, and operators subsequently reference the certified design in their Combined Licence Application contrasting it with the Part 50 concurrent licensing approach. The session chair confirmed that the concept of delinking siting from design review has been accepted in multi-tier reviews at AERB, and that a regulation formalising this arrangement is in its final stage. It was further clarified that for designs previously reviewed by AERB through pre-licensing consultation, such as the AP1000, only design changes from the reviewed version would be subject to fresh assessment, not a complete re-review. The principle established was clear: the rules and regulations being framed must honour not only the enabling sections of the SHANTI Act but the promotional spirit of its preamble, and all four regulatory players — DAE, AERB, CEA, and MoEFCC must operate according to the principles of coordinate, cooperate, collaborate, connect, convey, and convince.

## 7.5 Summary

This session addressed the structural barriers to deploying foreign reactor technologies in India. The FOAK design certification having significant cost loaded entirely on the first operator was identified as the central barrier. Three reforms were proposed: utility-agnostic and site-agnostic design certification by a central government agency; technology-agnostic siting consent using enveloping criteria; and reduction of NDA/MoU/JV approval timelines from 6–9 months to under 3 months. The session chair confirmed that AERB's delinking of siting from design review is already accepted in principle and is in the final stage of regulation.

## VIII. SESSION VI: SMR AND MMR DEVELOPMENT STATUS

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### 8.1 Strategic Role of SMRs in the 100 GW Roadmap

Small Modular Reactors (SMRs) and Micro Modular Reactors (MMRs) are addressed as a distinct and complementary segment of the 100 GW roadmap not competitors to large PHWRs and PWRs, but enablers of deployment in contexts where large reactor siting is constrained. Target segments include captive industrial power for energy-intensive industries, data centres, remote areas including the Northeast, maritime applications, and the replacement of retiring coal plant clusters in space-constrained brownfield locations. The employment uplift from replacing coal facilities with nuclear is estimated at 20–30%, while the carbon intensity reduction is substantially larger.

### 8.2 Indian SMR Development

India's indigenous SMR landscape centres on the Bharat Small Reactor (BSR) and the Bharat Small Modular Reactor (BSMR-200), developed under DAE. The Prototype Fast Breeder Reactor at Kalpakkam at 500 MWe represents the first operational fast reactor in India's three-stage programme, with two Compact Fast Breeder Reactors (CFBRs) planned as the second stage. The specific design requirements articulated for India-suitable SMRs include: road or rail transportability; a ground-breaking to grid timeline not exceeding 36 months; minimal site preparation; dry cooling options for water-scarce locations; compatibility with thorium-based fuel cycles; and siting flexibility to enable deployment closer to load centres.

### 8.3 Global SMR Progress and India-Relevant Offerings

International SMR development has accelerated. The SMR-300 design a 300 MWe light water reactor is characterised by a 25-acre footprint, air cooling capability, standardised construction enabling multiple simultaneous deployment, and a decommissioning profile substantially simpler than large reactors. Westinghouse's eVinci micro-reactor (1.5–5 MWe) targets remote applications with no on-site fuelling requirements and an unmanned operation capability. The AP300 (330 MWe) applies the modular architecture and passive safety philosophy of the AP1000 at a smaller scale.

### 8.4 Financing and Regulatory Challenges for SMRs

Two systemic challenges specific to SMRs were identified. First, a financing mismatch: nuclear assets have a useful life of 60–100 years, but available financing instruments typically offer tenures of 10–15 years. Bridging this gap requires innovative instruments such as 50-year PPAs and long-duration bonds. Second, the SHANTI Act's liability framework with its ₹100 Crore operator liability for reactors up to 150 MWe thermal was specifically identified as a proportionate and enabling provision for SMR deployment. The resolution of outstanding export control restrictions affecting technology transfer from certain vendor countries was noted as a necessary complement to the domestic legislative changes.

### 8.5 Questions and Answers

It was agreed upon by both presenters and the floor that large-scale reactors and SMRs are complementary, not competing technologies, and that India's programme must pursue both tracks in parallel. SMRs address deployment contexts like captive demand, remote regions, brownfield

coal transition that large reactors cannot efficiently serve, while large PHWRs and PWRs deliver the base of the 100 GW target. The session chair's closing observation that India's energy needs by 2047 and beyond will require capacity well in excess of 100 GW, and that the transition from coal will itself create demand for hundreds of gigawatts of reliable baseload replacement, was noted as the strategic context within which both technology categories must be developed urgently.

## 8.6 Summary

This session situated SMRs and MMRs as a complementary not competitive segment of the 100 GW roadmap, addressing deployment contexts where large reactor siting is infeasible: captive industrial demand, data centres, remote regions, and brownfield coal transition. India's indigenous SMR development (BSR, BSMR-200) and the PFBR's recent criticality as the launch of the second stage of the three-stage programme were presented alongside international offerings. The financing mismatch between nuclear asset lifespans of up to 100 years and available capital tenures of 10–15 years was identified as a systemic challenge requiring structural innovation in financing instruments.

## IX. SESSION VII: RISK MANAGEMENT — INSURANCE AND LIABILITY

### 9.1 Operator Liability under the SHANTI Act

The liability provisions of the SHANTI Act were examined in detail. An operator is liable for nuclear damage caused by a nuclear incident in its installation or involving nuclear material during transport to or from the installation, subject to a set of conditions governing the transfer of liability between operators. Where multiple operators are jointly liable, liability is joint and several but does not exceed the total cap specified in the Second Schedule. An operator is not liable where nuclear damage results from: a grave natural disaster of exceptional character; an act of armed conflict, hostility, civil war, insurrection, or terrorism; or from the contributory negligence of the claimant.

The concept of 'deemed operator' applies in transit and transportation scenarios: where material in transit causes damage at a temporary storage installation, the person responsible for transit is deemed the operator; where damage occurs during transportation, the consignor is deemed the operator unless a written agreement provides otherwise.

### 9.2 Insurance Framework — Indian Nuclear Insurance Pool (INIP)

The Act requires every operator, before commencing operations, to obtain an insurance policy, financial security, or a combination of both, covering its prescribed liability. This requirement does not apply to nuclear installations owned by the Central Government. The prescribed financial security alternative is a Bank Guarantee for the applicable liability amount.

The Indian Nuclear Insurance Pool (INIP), created by GIC Re with support from DAE and the Ministry of Finance, is the operational instrument for meeting this obligation. The Pool currently has a total capacity of ₹1,500 Crore, provided by 11 insurance companies with the following composition:

Insurance Company	% Share   Apportionment (₹ Crore)
<b>New India Assurance Ltd.</b>	40%   ₹600 Crore
<b>United India Insurance Ltd.</b>	20%   ₹300 Crore
<b>Oriental Insurance Co. Ltd.</b>	10%   ₹150 Crore
<b>ICICI Lombard General Insurance</b>	10%   ₹150 Crore
<b>National Insurance Co. Ltd.</b>	10%   ₹150 Crore
<b>IFFCO Tokio General Insurance</b>	2%   ₹30 Crore
<b>Reliance Insurance</b>	2%   ₹30 Crore

<b>TATA Insurance</b>	<b>AIG General</b>	2%   ₹30 Crore
<b>SBI Insurance</b>	<b>General</b>	1.50%   ₹22.5 Crore
<b>Cholamandalam General Insurance</b>	<b>MS</b>	1.50%   ₹22.5 Crore
<b>Universal General Insurance</b>	<b>Sompo</b>	1%   ₹15 Crore

The INIP operates a floating insurance policy covering all reactors under a single pool arrangement. The current premium structure is ₹30 Crore for the first reactor and ₹3.5 Crore per subsequent reactor. NPCIL's current premium, covering 24 reactors, totals ₹110.5 Crore plus applicable taxes. In the event of a nuclear incident requiring full Pool deployment, the Pool would require replenishment before renewing cover for other reactors; in this interim period, a Bank Guarantee would be required to maintain operational continuity for unaffected units.

As India's nuclear sector grows, GIC Re aims to strengthen INIP by expanding its overall capacity through multiple initiatives, including encouraging existing pool members to enhance their participation via frequent engagements, onboarding more domestic insurers by approaching the GI Council, and broadening coverage offerings where operator needs and appropriate pricing align such as introducing business interruption insurance and extending property damage cover to hot zone areas while simultaneously seeking viable international reinsurance support through structured reinsurance arrangements to ensure sustainable risk-sharing. The INIP will extend identical coverage arrangements to private operators, with premium rates calibrated to the specific risk profile and requirements of each operator.

### 9.3 Questions and Answers

A participant from Tata Power asked whether the Indian Nuclear Insurance Pool would be extended to private companies entering the nuclear sector under the SHANTI Act. It was confirmed unambiguously that the INIP will extend to private operators on the same basis as it currently serves NPCIL. Potential operators were invited to approach GIC Re directly to communicate their anticipated insurance requirements so that coverage products can be structured accordingly in advance of operational commencement. It was further clarified that premium rates will not be uniform they will be determined by each operator's specific requirements and risk profile rather than a standardised rate.

The session chair also noted, in closing, that the development of additional insurance products including business interruption cover and property damage cover for hot zones is actively under consideration by pool members, and that international reinsurance support may be sought as the pool's capacity requirements grow with India's expanding nuclear programme.

### 9.4 Summary

This session examined the practical risk management architecture available to operators under the SHANTI Act. The graded liability schedule was assessed as a material improvement over the flat CLND Act structure, providing proportionate treatment for SMRs and large reactors alike. The INIP now confirmed as extending to private operators was presented as the operational insurance

instrument, with its current ₹1,500 Crore pool capacity, floating policy structure, and active plans for expansion to include business interruption and hot zone property cover. The removal of the Nuclear Liability Fund cap under SHANTI was recognised as sound long-term risk architecture.

## X. KEY FINDINGS

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The following is the key findings and recommendations that emerged from the workshop as a whole.

### 10.1 Key Findings/recommendations

#### 10.1.1 Legal and Regulatory Framework

1. The SHANTI Act, 2025 is the foundational enabling instrument for India's 100 GW nuclear roadmap. The removal of supplier liability, the graded liability schedule, and the opening of the sector to private participation collectively resolve the two structural constraints i.e. legal and contractual framework that had historically deterred private investment.
2. Expeditious finalisation of rules and regulations under the Act is the most time-critical near-term deliverable. The rules must honour both the enabling sections and the promotional spirit of the Act's preamble, which carries equal weight with the regulatory and control provisions.
3. A pre-licensing vendor design review mechanism decoupled from any specific site or operator should be formally instituted by AERB to reduce FOAK cost and regulatory uncertainty for first movers. A regulation governing this process is at an advanced stage.
4. Formal inter-agency coordination mechanisms must be established among DAE, AERB, CEA, MoP, and MoEFCC to prevent sequential approval delays. A single-window facilitation mechanism for nuclear project clearances is essential.

#### 10.1.2 Fuel Security

1. Nuclear fuel manufacturing for all power reactors in India is entirely indigenous, with the sole external dependency being uranium ore concentrate for IAEA-safeguarded reactors. NFC's expansion roadmap — from 1,900 MT at Hyderabad to 2,900 MT by 2032 through phased additions at Kota — is sufficient for committed reactors; however, the full 50 GW PHWR programme by 2047 will require capacity exceeding 6,000 MT, necessitating further expansion at existing and co-located new sites.
2. A strategic fuel reserve equivalent to approximately one-third of plant lifetime — approximately 20 years of supply held in raw material or intermediate stage — must be established as a binding programme requirement for all new reactor contracts dependent on imported uranium. Without a credible lifetime supply assurance, the large capital investments of operators remain structurally exposed to geopolitical and contractual fuel supply risk.
3. Indigenisation of Light Water Reactor fuel through Joint Ventures remains at an early conceptual stage. Given that LWR-type technologies are expected to contribute approximately 39 GW of the 100 GW target, closing this gap in domestic fuel supply planning requires urgent and structured attention.

#### 10.1.3 Site Development and Technology Certification

1. Technology-agnostic siting consent using envelope criteria encompassing the requirements of multiple potential reactor types should replace the current practice of requiring technology finalisation before regulatory processes begin. This single change would compress overall project timelines by 12–18 months per project.

2. Design certification for foreign reactor technologies must be made utility-agnostic and site-agnostic, with costs distributed across the fleet through a Central Government-managed mechanism. The FOAK cost loading of significant cost on a single operator is a structural barrier that must be removed.
3. The approval process for NDAs, MoUs, and JVs for technology collaboration must be reduced from the current 6–9 months to under 3 months through pre-vetted templates, a PARIVESH-type portal, and time-bound departmental responses.

#### 10.1.4 Cost, Tariff, and Financing

1. Long-tenure debt of 30 years or more is essential for tariff competitiveness and achievable through refinancing and DFI commitment. PFC's ₹26,000 Crore sanction at above 30-year tenure establishes the precedent.
2. Reduction of GST on the nuclear island equipment from 18% to 0% could potentially reduce the tariff by approximately 4%, while increasing the PLF for PHWR reactors in staggered manner to 80% could also reduce the tariff by approximately 7-8%.
3. Time bound procurement of key supply material and bulk ordering can reduce the procurement cost.
4. Fleet mode execution, standardised design, and long-term supply contracts are necessary to deliver capital cost targets. Per-unit costs are not achievable on single-project procurement.

#### 10.1.5 Supply Chain and Skills

1. A national Phased Manufacturing Programme for nuclear components — starting with low and medium complexity items and progressively qualifying Indian vendors for safety-grade equipment — must be launched urgently, underpinned by 15–20 year demand forecasts communicated to industry.
2. ITI-level and diploma-level skill development for welders, fitters, electricians, and Radiation Safety Officers is as critical as graduate engineering skill development and must be incorporated into the national nuclear skill development plan. HBNI is positioned as the nodal institution and invites formal industry engagement on specific programme requirements.

#### 10.1.6 Risk Management, Insurance, and Liability

1. The graded liability schedule under the SHANTI Act ranging from ₹100 Crore for reactors up to 150 MWe thermal to ₹3,000 Crore for reactors above 3,600 MWe thermal represents a material and proportionate improvement over the flat ₹1,500 Crore structure of the CLND Act. The removal of supplier liability under the Act resolves a parallel structural barrier, directing reform solely at the chilling effect on equipment and technology suppliers without reducing compensation available to victims of nuclear incidents.
2. The Indian Nuclear Insurance Pool (INIP), with a current capacity of ₹1,500 Crore provided by eleven insurance companies, is confirmed as extending to private operators on the same structural basis as it currently serves NPCIL, with premium rates calibrated to each operator's specific risk profile. Prospective operators are urged to engage proactively with GIC Re ahead of operational commencement to enable coverage products to be structured in advance.

3. The INIP's current pool capacity will require enhancement as the fleet expands under private participation. Introduction of business interruption cover, property damage cover for hot zones, and augmentation through international reinsurance are under active consideration; the removal of the ₹2,000 Crore cap on the Nuclear Liability Fund under the SHANTI Act allowing it to grow continuously through the per-unit electricity levy provides sound long-term risk architecture for the Government's tier of liability above the operator cap.

## ANNEXURE: List of Presenters and Session Chairs

Session	Chair / Presenter(s)
<b>Inaugural</b>	Shri Praveen Gupta, Member (E&C), CEA (Welcome Address)   Shri Gurdeep Singh, CMD, NTPC (Context Setting)   Shri Ghanshyam Prasad, Chairperson, CEA (Keynote)   Ms. Seema Jain, Member (Finance), DAE (Keynote)
<b>Session I — Chair</b>	Dr. R.B. Grover, Member, Atomic Energy Commission and Emeritus Professor, HBNI
<b>Session I — Presenters</b>	Dr. Garima Sharma, Head SSSD, NCPW, DAE   Dr. Kamal Kapoor, Chairman and CEO, Nuclear Fuel Complex
<b>Session II — Chair</b>	Ms. Seema Jain, Member (Finance), DAE
<b>Session II — Presenters</b>	Shri Prateek Agarwal, Outstanding Scientist and ED (Corporate Planning), NPCIL   Shri T. Venkateswarlu, Chief Engineer (TE&TD), CEA
<b>Session III — Chair</b>	Shri Ajay Talegaonkar, Member, APTEL
<b>Session III — Presenters</b>	Shri Gautam Ghosh, Chief Engineer, CEA   Shri B.S. Arunachalam, Executive Director (Projects), PFC
<b>Session IV — Chair</b>	Dr. R.B. Grover, Member, Atomic Energy Commission and Emeritus Professor, HBNI
<b>Session IV — Presenters</b>	Dr. Alok Mishra, Director, Westinghouse India   Dr. Naveen Kumar, Associate Dean, HBNI   Shri R. Raghavan, Vice President, Tata Consulting Engineers Ltd.
<b>Session V — Chair</b>	Shri Dinesh Kumar Shukla, former Chairman, AERB
<b>Session V — Presenter</b>	Shri A.P. Samal, CGM-Nuclear, NTPC / CEO, NPUNL
<b>Session VI — Chair</b>	Shri Arun Kumar Nayak, former Head, NCPW, DAE
<b>Session VI — Presenters</b>	Shri Arun Kumar Nayak   Shri Anand Jain, CEO, Holtec Asia (Virtual)
<b>Session VII — Chair</b>	Shri Praveen Gupta, Member (E&C), CEA
<b>Session VII — Presenters</b>	Shri N.R. Chaudhary, NPCIL   Mrs. Pradnya Prabhu, GIC Re