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EDITORIAL ANALYSIS

Nuclear at a Crossroads — SHANTI Act, Private Entry, and India's 100 GW Ambition

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INTERVIEW ANGLE

"The SHANTI Act enables private sector entry into nuclear power for the first time, supporting India's 100 GW by 2047 target. But private entry into nuclear power is more complex than into solar or wind — liability, safety, fuel security, and site acquisition are existential challenges. Can India really achieve 100 GW?"

THE CORE ARGUMENT

The SHANTI Act (Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India) — which enables private Indian companies to build, own, and operate nuclear power plants — is the most significant reform of India's nuclear sector in 63 years. Combined with the 100 GW by 2047 target announced by the CEA, it signals a decisive break with the NPCIL monopoly model. The editorial argues, however, that nuclear is categorically different from other energy technologies: safety failures are catastrophic, liability is complex, fuel supply is geopolitically sensitive, and public acceptance is fragile. The policy ambition is correct in direction but requires an execution roadmap that addresses each of these dimensions — not just the legislative opening.

WHY NUCLEAR, WHY NOW?

India's Energy Trilemma

India faces a trilemma: achieve Net Zero by 2070 + deliver energy access for 1.4 billion people + maintain energy security (reduce import dependence). Nuclear is uniquely positioned because:

1. **Low lifecycle carbon**: 4-12 g CO_2/kWh (vs. 820 g for coal, 490 g for gas)
2. **Firm/dispatchable power**: unlike solar/wind, nuclear works 24/7 regardless of weather
3. **High energy density**: small land footprint relative to output

4. **Domestic fuel potential**: India's vast thorium reserves (Stage 3 of the three-stage programme)

Current Nuclear Contribution

India's 8.8 GW nuclear capacity generates ~3% of total electricity — far below the global average of ~10%. France (70%), South Korea (30%), USA (19%) show what a nuclear-committed pathway looks like.

WHAT SHANTI CHANGES

BEFORE SHANTI	AFTER SHANTI
NPCIL monopoly on nuclear power	Indian private companies can enter
CLNDA 2010: supplier liability deterred investment	New liability regime (supplier shield)
Atomic Energy Act 1962: state-centric governance	Modernised governance framework
No SMR pathway	Bharat Small Reactors (220 MW) explicitly enabled
No private sector RFP possible	RFPs for BSR already issued

THE EXECUTION CHALLENGES

1. Liability — The Ghost of CLNDA

The Civil Liability for Nuclear Damage Act, 2010 (CLNDA) contained **Section 17b** — which allowed victims to sue equipment suppliers even after they had paid the nuclear operator. This international peculiarity deterred Westinghouse, GE-Hitachi, Areva from entering India's nuclear market. SHANTI replaces CLNDA — but the new liability regime's details matter enormously. If supplier liability is not credibly capped and channeled through the operator, private entry will remain theoretical.

2. Fuel Security

India imports ~70% of its uranium from Australia, Kazakhstan, Canada, and Russia. Building 100 GW requires massively scaling fuel imports or accelerating Stage 2 (FBR — using plutonium bred from uranium) and Stage 3 (thorium). The FBR at Kalpakkam is still under commissioning — its commercial replication timeline is unclear.

3. Site Acquisition

Nuclear plants require large coastal/riverside sites with reliable cooling water, seismic stability, and evacuation zones. Post-Kudankulam protests (2011-12), public resistance to nuclear siting has been significant. Environmental clearances and local opposition can delay projects by years.

4. Regulatory Capacity

AERB (Atomic Energy Regulatory Board) currently regulates ~7 sites and NPCIL. Scaling to 10-12 private operators requires a multi-fold increase in AERB's technical capacity, inspection systems, and independent authority — including potential legislative strengthening of AERB's independence.

5. Capital Costs and Financing

Nuclear has high upfront capital costs (₹10-15 crore/MW for large PWRs) and long construction times (8-12 years typically). Private investors require long-term Power Purchase Agreements (PPAs) with creditworthy buyers, and financing at reasonable interest rates — both currently uncertain in India's nuclear context.

SMRS — THE HOPE

Small Modular Reactors (SMRs) address several of these challenges:

- Smaller capital commitment (manageable for private sector)
- Factory manufacturing → shorter construction time
- Easier siting (smaller footprint, lower cooling water needs)
- Can be deployed near industrial clusters (replacing gas/diesel captive power)

India's Bharat Small Reactor (220 MW) is a domestic SMR design. The RFP for private co-financing of BSR fleets is the right first step — but BSR technology maturity and cost competitiveness compared to global SMR peers (Rolls-Royce, NuScale, Holtec) must be established.

UPSC ANGLE

PAPER	ANGLE
GS3 — Environment/Energy	Nuclear energy role in India's energy transition; three-stage programme
GS3 — Economy	SHANTI Act; private sector energy; SMRs
GS2 — Governance	AERB independence; regulatory reform; public consultation in siting

Mains Keywords: SHANTI Act, NPCIL, AERB, CLNDA, three-stage programme, SMR, Bharat Small Reactor, nuclear liability, Kudankulam

Probable Question: "India's 100 GW nuclear target by 2047 requires resolving structural challenges beyond legislative reform. Critically examine." (GS3 Mains)

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