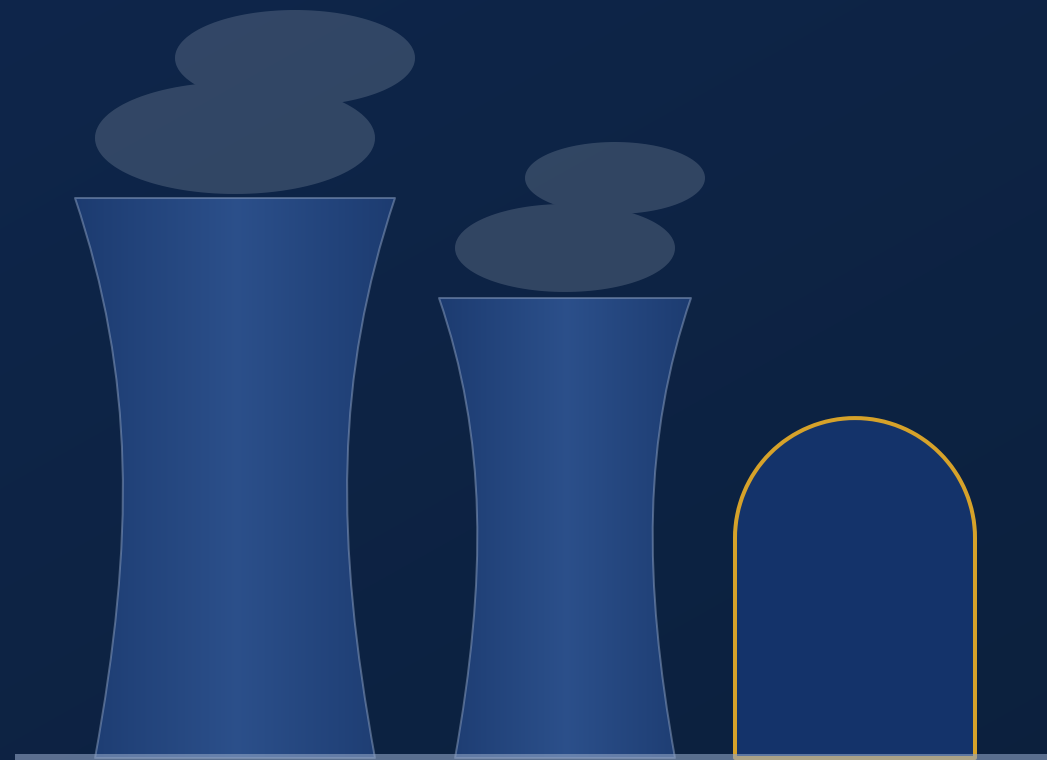


SECTOR: POWER · NUCLEAR ENERGY

India's Nuclear Power Industry

From gigawatts announced to gigawatts commissioned

A 100 GW target for 2047, a new law that lets private companies operate reactors, and a large tender pipeline — on an installed base of just 8,780 MW. The real question is how fast first concrete becomes criticality, commercial operation and cash.



Contents: from first concrete to cash

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8,780 MW

Installed across 24 reactors (DAE, March 2026) — ~3.1% of generation

100 GW

Nuclear Energy Mission target by 2047 —
~4.3 GW a year needed

~15 yrs

RAPP-8: first concrete (Jul 2011) to fuel
loading (Sep 2026)

PAT -28%

NPCIL FY25 — in a record generation year
(ICRA)

01 EXECUTIVE SUMMARY

Policy has moved faster than construction

India now has a 100 GW target, a law that opens reactor operation to private companies and a major tender pipeline. But the installed base is still 8,780 MW. The question is not how many gigawatts are announced — it is how quickly first concrete becomes criticality, commercial operation and cash.

Exhibit 1 Six market signals and what they tell us

Market signal	What it tells us
8,780 MW across 24 reactors (DAE, Mar-2026)	Nuclear is small — ~3.1% of India's generation
22,380 MW expected by 2031–32 (DAE)	~13,600 MW in ~5.5 years — ~1.5x today's fleet
100 GW target by 2047	~4.3 GW a year for 21 years — far above any pace India has delivered
RAPP-7&8: concrete Jul-2011; RAPP-8 fuel load Sep-2026	~15 years from concrete to fuel — build time binds
NPCIL FY25: operating income +7.6%, PAT –28%	A record generation year did not lift profit
Only Hindalco filed a BSR proposal by Mar-2026	Private interest visible; committed capital thin

Source: DAE, ICRA, reported news; pace calculations by Alpha Room Research

8.78 GW

Installed today

100 GW

2047 target

24

Operating reactors

~4.3 GW/yr

Required build pace to 2047

Key finding: the law, targets and tenders are real — but value depends on reactors reaching commercial operation on time, at a tariff discoms will pay.

Follow the industry through first concrete, criticality, commercial operation, load factor and cash — not announcements.

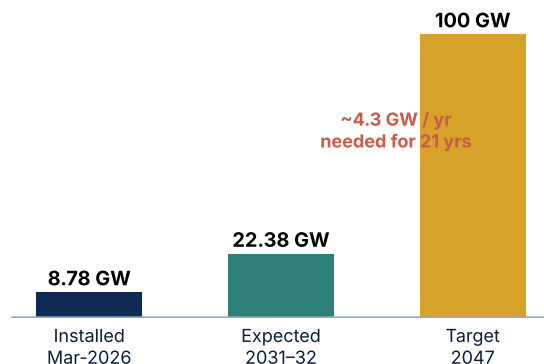
THE TEST FOR EVERY ANNOUNCEMENT



02 STORY IN CHARTS

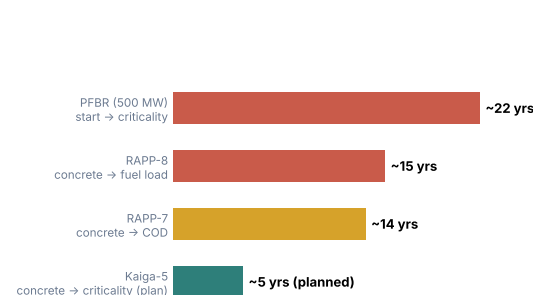
Big targets, slow builds, thinning operator margins

Ex 2 Capacity: today vs plans (GW)



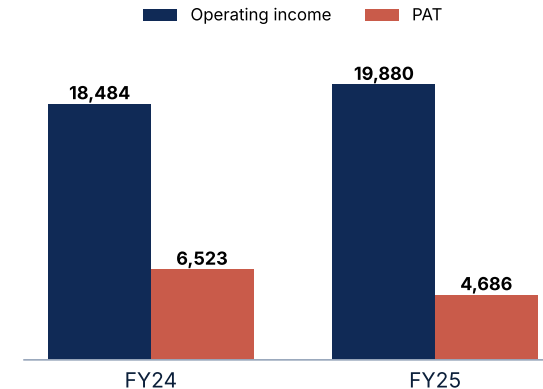
Source: DAE, Nuclear Energy Mission

Ex 3 Concrete-to-milestone times



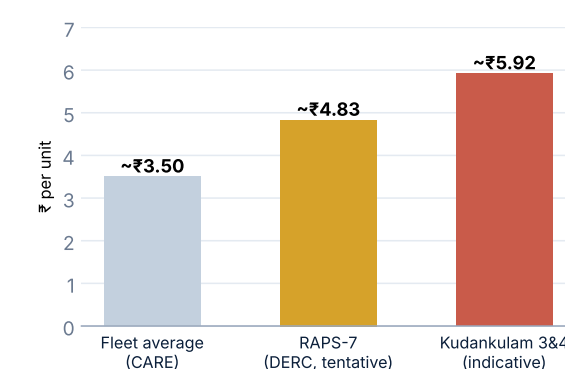
Source: AERB, PIB, Business Standard

Ex 4 NPCIL: income up, PAT down (₹ cr)



Source: ICRA

Ex 5 New-build tariffs are dearer (₹/unit)



Source: CARE, DERC, Rajya Sabha

Targets far ahead of delivery

Reaching 100 GW needs ~4.3 GW a year for 21 years — on a base that has taken decades to reach 8.78 GW.

Build time is the binding constraint

An indigenous 700 MW unit took ~15 years from concrete to fuel; PFBR took ~22 years to criticality.

Cost-plus is being stretched

New-build tariffs of ~₹4.8–5.9/unit vs a ~₹3.50 fleet average test discom appetite.

03 SECTOR OVERVIEW

One dominant state operator, a fleet built on PHWRs

Controlled fission makes heat, steam and power — round-the-clock, low-carbon baseload. This deck covers the civil nuclear power chain: fuel cycle, heavy equipment, construction, reactor owners and power buyers (not weapons, research reactors or isotopes).

Ex 6 NPCIL's commercial fleet

Reactor type	Units
Pressurised heavy water (PHWR)	20
Boiling water (BWR)	2
VVER 1,000 MW (Kudankulam)	2
Total	24

56,681 MU

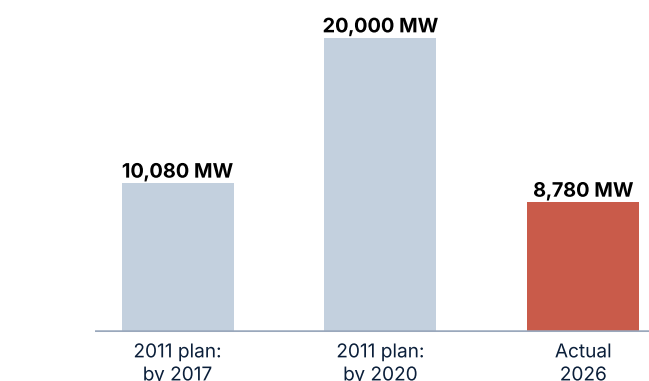
Record NPCIL generation, FY25

Source: NPCIL, DAE

~3.1%

Nuclear share of India's electricity generation

Ex 7 2011 expectations vs 2026 reality (MW)



Source: NPCIL (Jul-2011), DAE (Mar-2026)

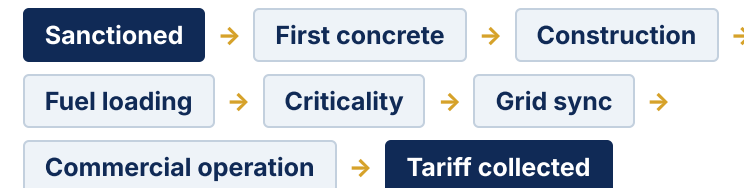
2 × 1,000 MW

VVERs at Kudankulam — the largest units in the fleet

UNTIL THE SHANTI ACT

Only government companies could own and operate reactors; private firms were limited to equipment and construction.

THE CRITICAL GAP



A sanctioned reactor is a plan. A commissioned reactor is an asset. A reactor at a high load factor collecting its tariff is the economic asset.

Dec-2025

SHANTI Act opens reactor ownership and operation to private licensees

04 NUCLEAR POWER VALUE CHAIN

Five layers — and only some are open to private capital

The ecosystem runs from fuel to the buyer. Enrichment, spent fuel and heavy water stay with the Government under the SHANTI Act; equipment, EPC and — once rules are final — operation are where private participation sits.



HOW VALUE FLOWS THROUGH THE CHAIN



Each layer carries a different mix of capital intensity, schedule risk and cash-conversion risk — and each depends on the layer before it reaching its milestone on time.

05 LAYERS 1-2 · FUEL CYCLE & HEAVY EQUIPMENT

Fuel drives load factor; qualified suppliers are few

FUEL CYCLE — URANIUM, FUEL & HEAVY WATER

India's PHWRs run on natural uranium, which needs no enrichment. Domestic uranium is low grade and is supplemented by imports.

~73%

Of NPCIL capacity under IAEA safeguards on imported fuel (Jun-2025, CARE)

8-12 yrs

Lead time from uranium exploration to mine production

Parliament's Standing Committee flagged **single-supplier dependence** for Kudankulam fuel and **under-funded uranium exploration**.



Key metric (fuel): fuel security and plant load factor — not reserves on paper.

HEAVY EQUIPMENT & PRECISION COMPONENTS

Steam generators, calandria, end shields, coolant channels, fuel-handling systems, pumps and turbine-generators — nuclear-grade and qualified by NPCIL.

Ex 8 Two supplier datapoints

Supplier	Evidence
Larsen & Toubro	Seventh 700 MWe steam generator dispatched ahead of schedule (Apr-2026)
MTAR Technologies	Nuclear order-book execution had not yet picked up (Q1 FY27 call)

Source: company releases and call transcript

Orders arrive in batches under fleet mode but execute over many years.



Cash

Key metric (equipment): order-to-dispatch conversion and working capital — not order wins alone.

06 LAYER 3 · NUCLEAR ISLAND & TURBINE ISLAND EPC

NPCIL is moving to “mega EPC” packages

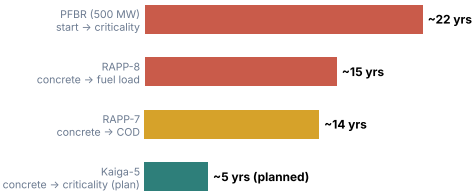
Civil construction and installation of the reactor building and nuclear systems (nuclear island) and the steam-turbine side (turbine island). Packages are getting bigger — and schedule discipline becomes the value driver.

Ex 9 Recent EPC milestones

Project	Milestone
Kaiga 5&6	₹12,800 cr EPC order to MEIL (Apr-2025); first concrete 1 Mar 2026; Kaiga-5 criticality expected ~60 months later
Mahi Banswara	4×700 MW, ~₹42,000 cr; nuclear island package estimated at over ₹28,000 cr — largest in the PHWR programme so far
Mahi Banswara bid	Bid submission extended to 26 Oct 2026; opening 30 Oct 2026
BHEL turbine islands	₹10,800 cr order for 6 units (Aug-2021)

Source: PIB, World Nuclear News

Ex 9b The schedule test: plan vs history



Source: AERB, PIB, Business Standard

₹12,800 cr

Kaiga 5&6 EPC (MEIL)

>₹28,000 cr

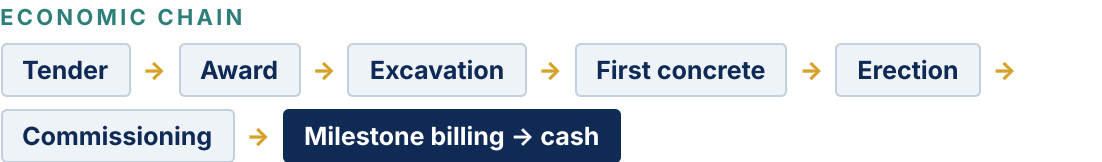
Mahi Banswara nuclear island (est.)

~60 months

Kaiga-5 concrete-to-criticality plan

~₹15 cr/MW

Mahi Banswara implied cost (Alpha Room calc.)



Key metric: time from first concrete to criticality, measured against schedule. Kaiga-5's ~60-month plan vs RAPP-8's ~15 years is the test.

07 LAYERS 4-5 · OWNER-OPERATORS & OFFTAKERS

Decades of cost-plus revenue — after a 10–15 year build

OWNER-OPERATORS

NPCIL, BHAVINI (fast breeder), ASHVINI (NPCIL 51% / NTPC 49%) and, once rules are final, private licensees. Very high upfront capex, then decades of cost-plus revenue.

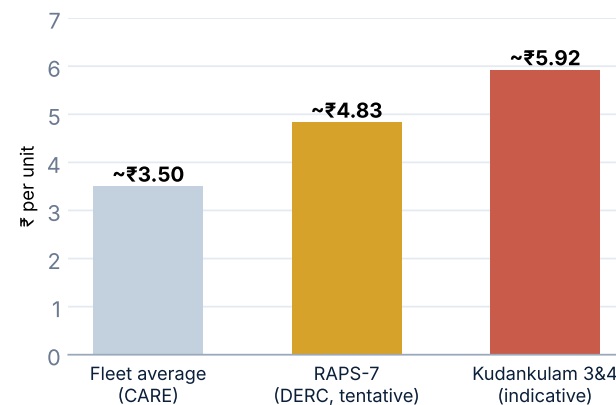
₹19–24k cr

NPCIL annual capex expected over the next three years (ICRA)

~22 yrs

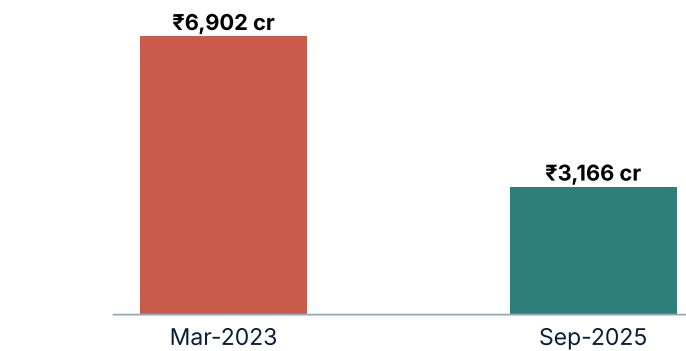
PFBR (500 MWe): construction start to first criticality (6 Apr 2026); ₹8,181 cr; not grid-synced by Jun-2026

Ex 10 Tariffs: old fleet vs new build



Single-part, cost-plus; normative load factor 68.5–80%. Source: CARE, DERC, Rajya Sabha

Ex 11 NPCIL receivables improved



After the late payment surcharge rules. Source: ICRA / CARE

OPERATOR CHAIN



OFFTAKER CHAIN



Key metrics: commissioned MW and load factor above normative levels — and new-build tariff versus discoms' average power purchase cost.

08 VALUE-CHAIN ECONOMICS

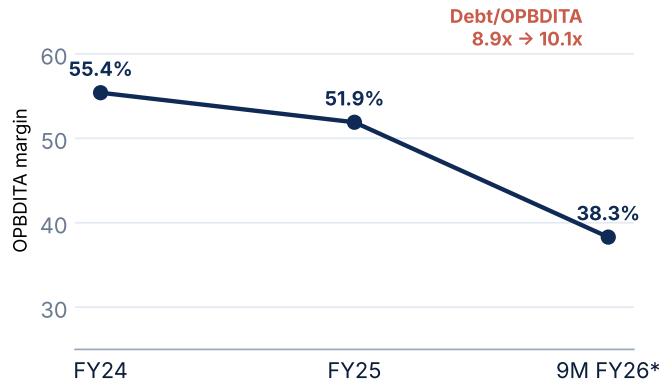
A 700 MW sanction is not 700 MW of capacity

Ex 12 Capital intensity, primary risk and what to track — by layer

Layer	Capital intensity	Primary risk	What to track
Fuel cycle	High; state-funded	Import dependence + exploration lag	Fuel supply, load factor
Heavy equipment	Moderate fixed capex; working capital	Qualification + slow site readiness	Order-to-dispatch, receivables
Nuclear / turbine island EPC	Moderate; milestone-billed	Schedule slip + cost overrun	Concrete-to-criticality time
Owner-operator	Very high; 10–15 yr build	Delay, financing, tariff approval	Commissioned MW, PLF, ROE
Offtaker	Low (buyer)	Tariff affordability + discom credit	Tariff vs APPC, receivables

Source: Alpha Room Research

Ex 13 NPCIL OPBDITA margin

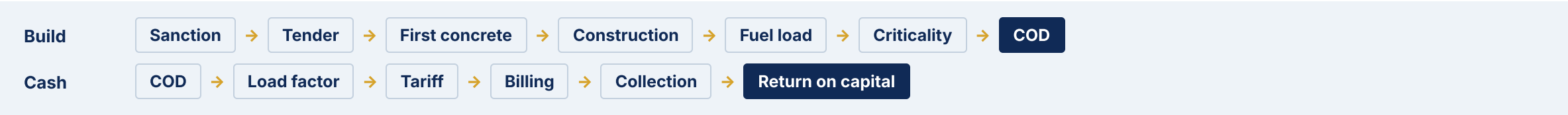


*9M FY26 standalone. Source: ICRA

Ex 14 Capital cost per MW (ICRA, Mar-2025)



Source: ICRA



09 CROSS-COMPANY VIEW · VALUE-CHAIN LENS

Nuclear exposure is not yet nuclear earnings

NPCIL — the largest participant — is unlisted, so listed exposure sits mainly in suppliers and in NTPC. The comparison is structural, not financial.

Ex 15 NTPC vs L&T vs BHEL vs MTAR

Company	Value-chain position	Latest evidence	Core question
NTPC	Owner-operator via ASHVINI (49%) and NPUNL	Targets 30 GW nuclear by 2047; its 2032 plan shows 0.7 GW nuclear	Can site studies become sanctioned, financed reactors?
Larsen & Toubro	Heavy engineering — steam generators, critical equipment	7th 700 MWe steam generator dispatched ahead of schedule (Apr-2026)	Can dispatches turn into revenue if site readiness lags?
BHEL	Turbine island EPC + turbine-generators	₹10,800 cr turbine island order for 6 units (Aug-2021); Kaiga 5&6 first concrete only in Mar-2026	How much of a 2021 order becomes revenue before 2030?
MTAR Technologies	Precision nuclear components	Civil nuclear order book ₹684 cr at Q1 FY27; ~₹130 cr more expected (potential ~₹815 cr); ramp from H2 FY27	Can nuclear orders convert while clean energy drives revenue?

Source: company releases, filings and call transcripts. Illustrative only — not investment advice.

For L&T and BHEL, nuclear is one segment inside much larger order books; MTAR's nuclear ramp comes later; NTPC's plan is long-dated. Ask “when does it reach the income statement?” — not “how big is the opportunity?”

NTPC

Long-dated. 0.7 GW nuclear in its 2032 plan vs a 30 GW 2047 ambition.

L&T

Now. Steam generators already dispatching — revenue timing tied to site readiness.

BHEL

Slow burn. A 2021 order, with Kaiga 5&6 first concrete only in 2026.

MTAR

From H2 FY27. ₹684 cr civil nuclear book; clean energy drives near-term growth.

10 BOTTLENECK → OPPORTUNITY

The constraint is building on time — and financing at a tariff discoms accept

After the SHANTI Act, the constraint is not demand and not mainly the law. Each bottleneck below is also a value pool for whoever can clear it.

01

Construction time

RAPP-8 fuel loading only in Sep-2026, after ICRA expected Q1 FY27 commissioning. Gorakhpur 1&2's 2032 date called "highly optimistic".

Value pool: execution speed

02

Fuel

Most of the fleet depends on imported fuel; uranium exploration funding cut short of requirement.

Value pool: fuel security

03

Regulation & people

Committee asked for a five-year AERB capacity plan; persistent vacancies across DAE units.

Value pool: regulatory throughput

04

Funding & tariff

₹19–24k cr annual capex, debt/OPBDITA near 10x, new-build tariffs ~₹4.8–5.9/unit.

Value pool: low-cost finance

05

Private capital

Of 27 organisations at NPCIL's pre-proposal meeting, only Hindalco filed a BSR proposal by Mar-2026 (reported).

Value pool: committed capital

What becomes scarce first?

Nuclear island construction



Regulatory throughput



Financing at acceptable tariffs



Shorter concrete-to-COD time wins

11 GOVERNMENT POLICY & INFRASTRUCTURE SUPPORT

The Act changes who may build; the rules and tariff decide whether anyone will

Ex 16 Policy levers and status

Lever	What has been committed	Status signal
Nuclear Energy Mission	100 GW by 2047; ₹20,000 cr for SMR R&D and deployment; ≥5 indigenous SMRs by 2033 (BSMR-200, SMR-55)	Budget 2025–26
SHANTI Act, 2025	Replaces the Atomic Energy Act 1962 and CLND Act 2010; private nuclear facilities under licence + AERB authorisation; operator liability ₹100–3,000 cr by size; supplier recourse limited to contract	Assent 20 Dec 2025
Draft SHANTI Rules	Single composite licence, in-principle approval, mandatory insurance, Nuclear Liability Fund, captive use incl. data centres	Draft 14 Aug 2026; final not notified
Customs duty	Basic customs duty exemption for nuclear imports extended to 2035, all plant sizes	Budget 2026–27
Fleet mode & JV	Ten indigenous 700 MW PHWRs in fleet mode; Mahi Banswara first JV of two central PSUs	Under way
Bharat Small Reactors	Industry provides land, water and capital; NPCIL designs, assures quality and operates	One formal proposal

Source: PIB, DAE, Union Budget, Power Line, BW Businessworld

POLICY CHAIN



12 WHAT TO TRACK

Nine milestones that will tell the real story

Ex 17 Monitoring dashboard

#	Metric	Why it matters
1	RAPP-8 criticality and commercial operation	Tests whether FY27 commissioning guidance holds
2	PFBR grid synchronisation	Turns the Stage-2 milestone into generation and revenue
3	Kudankulam-3 commissioning	Largest near-term single addition (1,000 MW); ICRA expects Q4 FY27
4	Mahi Banswara nuclear island award	Bids due 26 Oct 2026; opening 30 Oct 2026
5	Final SHANTI Rules	Set the real terms for private entry, insurance and liability
6	First private licence or BSR agreement	Shows whether interest becomes committed capital
7	NPCIL load factor, margin, debt/OPBDITA	Shows whether operator economics are improving
8	New-build tariff vs discom APPC	Decides whether discoms sign PPAs
9	Supplier order-to-revenue conversion	Shows whether nuclear orders reach earnings

Source: Alpha Room Research

13 THE ALPHA ROOM VIEW

India's nuclear story changed more in eighteen months than in the decade before. The economics still run through a 10–15 year build, a cost-plus tariff and one dominant state operator.

A 100 GW target, a new law, a JV model, private interest and PFBR's criticality — yet NPCIL's profit fell in a record generation year. Follow commissioning dates, concrete-to-criticality time, load factor and tariff — not headline targets.

FINAL CHAIN

Policy → Sanction → First concrete → Criticality → Commercial operation → Load factor → Tariff → Cash

THE VIEW WEAKENS IF

RAPP-8, Kudankulam-3 and PFBR slip further — or new-build tariffs prove too high for discoms to absorb.

ASK INSTEAD

How many reactors have poured concrete, reached criticality, entered commercial operation and are collecting tariff?

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ABOUT THE AUTHOR

Sejal N. Garg

LinkedIn: [linkedin.com/in/sejal-n-garg-456020278](https://www.linkedin.com/in/sejal-n-garg-456020278)

Email: sejalgarg0121@gmail.com