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Stage 2 Success and the Hydrogen Journey: India's Twin Energy Bets

1 May 2026 ·

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Stage 2 Success and the Hydrogen Journey: India's Twin Energy Bets

 **Science Reporter** Chapter 1 · 2 min read

Published: Science Reporter, May 2026 (covers “Stage 2 Success” by Sudip Karmakar and Love Sharma, and the issue’s two green hydrogen features)

The May issue pairs India’s two boldest energy bets: the fast breeder reactor that unlocks the thorium pathway, and the green hydrogen economy that decarbonises what electricity cannot.

STAGE 2: THE BREEDER MILESTONE

The **Prototype Fast Breeder Reactor (PFBR)** at Kalpakkam attained **first criticality on April 6, 2026**, formally opening **Stage 2** of Homi Bhabha’s three-stage nuclear programme.

- **500 MWe, sodium-cooled**, operated by **BHAVINI**, fuelled by **Uranium-Plutonium MOX** made from reprocessed PHWR spent fuel
- A breeder produces more fissile material than it consumes; its blanket can convert **Thorium-232 into fissile Uranium-233**, the gateway to Stage 3
- The resource logic: India holds about **25 percent of the world’s thorium** but only 1-2 percent of its uranium; the three-stage plan turns that imbalance into energy security
- India becomes effectively the **second country after Russia** to operate a commercial-scale fast breeder

THE HYDROGEN JOURNEY

The **National Green Hydrogen Mission** (January 2023, **Rs 19,744 crore**) targets about **5 MMT of annual green hydrogen production by 2030**, with around 125 GW of associated renewable capacity and roughly 50 MMT of CO2 abatement.

HYDROGEN COLOUR	SOURCE
Green	Electrolysis of water powered by renewables (zero carbon)
Grey	Natural gas reforming (no capture)
Blue	Natural gas with carbon capture

The **SIGHT** programme funds electrolyser manufacturing and production incentives; hard-to-abate users (refineries, fertiliser, steel, long-haul transport) are the demand anchors.

MAINS ANGLE

The common thread: both bets trade near-term cost for strategic autonomy: breeders multiply scarce uranium, green hydrogen substitutes imported gas and coking coal. **The risks:** global FBR economics remain unproven, sodium systems demand exacting safety engineering, and green hydrogen at scale needs electrolyser costs and round-the-clock renewables that do not yet exist at Indian prices. **Way forward:** sequence deployment behind firm offtake (fertiliser PSUs for hydrogen, grid-firming contracts for nuclear) rather than capacity targets alone.

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PFBR / STAGE 2:

First criticality April 6, 2026; Kalpakkam; 500 MWe; sodium-cooled; MOX fuel; BHAVINI operates

Three stages: PHWR, FBR, thorium reactors; Th-232 breeds U-233

India: ~25 percent of global thorium; second country after Russia with a commercial FBR

GREEN HYDROGEN:

Mission launched January 2023; Rs 19,744 crore; 5 MMT/year by 2030; ~125 GW renewables; ~50 MMT CO₂ abatement

SIGHT funds electrolyzers and production; green vs grey vs blue defined by energy source

National Technology Day: May 11 (Pokhran-II, 1998)

Sources: [Science Reporter / CSIR-NIScPR](#), [PIB](#)



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