Inside India’s nuclear supply chain

By: **Hindol Sengupta**

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Representational photo: Prime Minister Narendra Modi and Australian Prime Minister Anthony Albanese hold delegation-level talks, in Melbourne on 9 July. DPR PMO/ANI

India has been working to build a resilient nuclear supply chain, including the latest deal with Australia. This is critical if the country has to definitively move away from overwhelming reliance on fossil fuels in a troubled and fractured world.

A few days ago, during the Third India Australia Annual Summit in Melbourne, India and Australia finalised the Administrative Arrangement under their Civil Nuclear Cooperation Agreement. This landmark step unlocked the long-term export of Australian uranium to India for peaceful purposes, concluding an 11-year wait since the initial pact was signed in 2014 and ratified in 2015. While often overshadowed by immediate geopolitical headlines, this arrangement is a watershed moment for India’s economic and environmental future.

By securing a reliable, massive supply of nuclear fuel from the Indo-Pacific, the deal serves as the critical missing piece in India’s dual pursuit of staggering economic growth and rapid decarbonization. To understand its true magnitude, one must look at India’s shifting energy landscape, its soaring capacity targets for 2047, the strategic architecture of its global nuclear fuel supply chain, the intense competition with regional rivals, and the recent legislative reforms that have redefined its domestic nuclear ecosystem.

THE ENERGY TRILEMMA AND INDIA'S CLIMATE IMPERATIVE

India's overarching challenge, the energy trilemma, is to ensure energy security, equity, and environmental sustainability simultaneously. As the world's most populous nation charts its path toward becoming a developed economy ("Viksit Bharat") by 2047, electricity demand is projected to surge. The current per capita electricity consumption in India is roughly 1,395 kWh per annum, which is merely one-third of the global average. Fuelling mass industrialization, rapid urbanization, and a burgeoning digital economy—including power-hungry AI data centres—requires scaling power generation at an unprecedented rate.

At the same time, India has committed to achieving net-zero carbon emissions by 2070 and reaching 500 GW of non-fossil fuel capacity by 2030. While renewable sources like solar and wind have seen exponential growth, they suffer from inherent intermittency. The electrical grid requires firm, dispatchable, round-the-clock baseload power to maintain stability when the sun sets or the wind dies down—a role historically played by coal. Large-scale grid storage solutions remain technologically nascent and financially prohibitive to deploy at a national scale.

Nuclear power, characterized by the lowest lifecycle carbon emissions and the highest capacity factors among all generating technologies, is uniquely positioned to replace coal. Recognising this, the Indian government's ambitious Nuclear Energy Mission has set a target of reaching 100 GW of installed nuclear power capacity by 2047. As of early 2026, India operated just under 9 GW of nuclear capacity across 24 reactors. Scaling this to 100 GW in two decades is a colossal engineering and financial undertaking, requiring massive capital influx, regulatory modernization, and most importantly, an unbreakable, highly resilient fuel supply chain.

DOMESTIC CONSTRAINTS AND THE GLOBAL SOURCING MATRIX

Uranium is the bedrock of civil nuclear generation. India's domestic uranium resources, managed primarily by the Uranium Corporation of India Limited (UCIL) in Jharkhand, are limited and generally of lower grade. The high extraction costs and persistent supply shortfalls caused by poor ore quality meant that, historically, India's Pressurised Heavy Water Reactors (PHWRs) frequently operated well below their peak capacity.

To bridge this domestic deficit and shield its energy transition from external shocks, India has meticulously cultivated a diversified network of international nuclear fuel suppliers. Prior to the operationalization of the Australian deal, India successfully negotiated and sustained long-term supply contracts with a variety of global partners. In Central Asia and Eurasia, India relies heavily on Kazakhstan and Uzbekistan, the central Asian heavyweights in uranium mining, alongside continuous procurement from Russia. And in north America, in a major diplomatic breakthrough in early 2026, India significantly bolstered this network by signing a landmark $1.9 billion agreement with Canada's Cameco Corporation to supply approximately 10,000 tonnes of uranium between 2027 and 2035.

While these agreements established a strong baseline, true mid-to-long-term resilience requires tapping into the world's largest repository. Australia possesses

more than one-third of the globe's known recoverable uranium resources. The July 2026 Administrative Arrangement with Australia acts as the ultimate anchor for India's fuel supply matrix, ensuring that the logistical pipelines have the sheer volume required to feed an expanding fleet.

THE ZERO-SUM GAME: COMPETING WITH CHINA FOR GLOBAL SUPPLY

While India meticulously builds its sourcing matrix, it does not operate in a vacuum. The global uranium market is rapidly tightening into a high-stakes, zero-sum arena, primarily driven by China's aggressive nuclear expansion. Beijing has launched the world's most ambitious atomic energy program, targeting a massive 110 GW of capacity by 2030 and 150 GW by 2035. As of early 2026, China already operates over 60 reactors and has more than 40 under construction.

To feed this colossal pipeline, China employs a highly coordinated, state-backed procurement strategy. Beyond mere commercial market purchases, Chinese state-owned enterprises are aggressively acquiring direct equity stakes in overseas uranium mines, most notably in resource-rich nations like Namibia. This relentless absorption of global supply, combined with constrained output from traditional producers like Kazakhstan and Niger, has squeezed the market significantly. By early 2026, the long-term uranium contract price surged to an 18-year high of roughly $94 per pound.

In this intensely competitive landscape, nations are paying a premium for long-term delivery certainty from reliable jurisdictions. For India, China's rapid market consolidation poses a severe strategic risk: being priced out or structurally locked out of the fuel required for its own 100 GW ambition. The Australia-India deal is, therefore, a vital competitive hedge. By legally binding its supply chain to Australia, India bypasses the increasingly congested spot markets and outflanks Chinese efforts to monopolize emerging mining assets. It ensures that India's nuclear renaissance will not be throttled by its neighbour's insatiable appetite for the same finite resource.

DEEPENING SUPPLY CHAIN RESILIENCE FOR THE 2047 AMBITION

Supply chain resilience is not merely a diplomatic buzzword; it is the mathematical and economic prerequisite for scaling from 9 GW to 100 GW. Nuclear power plants are multi-decade assets. When private investors and government entities commit billions of dollars to construct these facilities, they must confidently price out the risk of stranded assets caused by fuel shortages.

If a nation relies on a single dominant supplier, it remains vulnerable to geopolitical coercion, trade embargoes, or regional conflicts—a lesson many nations recently learned regarding natural gas. By actively fragmenting its sourcing across North America, Central Asia, Eurasia, and now the Indo-Pacific, India has engineered a highly robust, anti-fragile nuclear fuel supply chain. Should logistical hurdles or diplomatic friction disrupt imports from one geographic region, the system can seamlessly pivot to other secured nodes without interrupting power generation.

This strategic resilience was explicitly codified during the Melbourne Summit. Prime Ministers Narendra Modi and Anthony Albanese launched the Partnership for Cyber, Critical Technologies, Supply Chains (PACTS), prioritising the creation of transparent and secure supply networks for critical minerals and clean energy.

This framework guarantees that the sea lanes and trade protocols bringing Australian uranium to Indian ports will be insulated against external disruptions, cementing long-term predictability.

SYNERGY WITH DOMESTIC REFORMS: THE SHANTI ACT AND SMRS

The timing of the AustraliaIndia deal and the broader diversification strategy perfectly synchronize with India's radical overhaul of its domestic nuclear policy. In December 2025, India enacted the Sustainable Harnessing and Advancement of Nuclear Energy for Transforming India (SHANTI) Act. Historically, the Atomic Energy Act restricted nuclear power generation strictly to government-owned entities like the Nuclear Power Corporation of India Limited (NPCIL). The SHANTI Act dismantled this rigid monopoly, enabling Indian private companies to hold up to 49% equity in civilian nuclear projects and participate in building and operating power plants.

Private sector participation is vital for mobilizing the massive capital required to achieve the 100 GW target. Under current policy frameworks, private entities can provide the requisite land, cooling water infrastructure, and capital investments, while NPCIL manages core design and operations. However, private investors abhor supply chain risks. The SHANTI Act's transparent segregation mechanisms not only satisfied Australia's strict tracking requirements but also signalled to private capital that their investments are backed by a globally guaranteed fuel pipeline.

Furthermore, India is aggressively investing in the future of modular nuclear technology. The government has prioritised the research, design, and deployment of indigenous Small Modular Reactors (SMRs), dubbed 'Bharat Small Reactors', based on the 220 MW PHWR platform. SMRs offer lower upfront capital costs, factory-based manufacturing, and faster construction times. They are ideal for industrial decarbonisation, directly replacing captive coal plants in heavy industries like steel, cement, and data centres. The government aims to operationalize at least five indigenous SMRs by 2033. A steady, diversified supply of imported uranium is absolutely crucial to fuelling these distributed modular units alongside the larger, gigawatt-scale conventional reactors.

FUELLING THE THREE-STAGE NUCLEAR PROGRAMME

While imported uranium is essential for India's immediate energy transition, its strategic importance extends deeply into India's long-term quest for absolute energy independence. India's civil nuclear strategy is governed by a visionary three-stage programme conceptualized decades ago by Dr. Homi Bhabha, aimed at eventually utilizing the country's vast coastal reserves of thorium.

Stage One: Relies on PHWRs fuelled by natural uranium. The spent fuel from these reactors yields plutonium.

Stage Two: Uses this extracted plutonium in Fast Breeder Reactors (FBRs) to produce more fissile material than they consume. Crucially, these reactors also irradiate thorium to breed Uranium-233.

Stage Three: Will utilize U-233 and thorium in Advanced Heavy Water Reactors, unlocking a practically inexhaustible, indigenous energy source for centuries.

A momentous milestone in this journey was achieved in April 2026, when India's indigenously built 500 MWe Prototype Fast Breeder Reactor (PFBR) at Kalpakkam attained first criticality, officially marking the start of the second stage. However, the success of this entire three-stage cycle is dependent on aggressively scaling up the first stage to generate a sufficient plutonium inventory.

By securing massive quantities of uranium from Australia, Canada, and Central Asia to rapidly expand the first-stage PHWR fleet, India is effectively accelerating the timeline for its thorium-based future. In essence, importing foreign fuel through a resilient global supply chain today serves as the necessary bridge to complete fuel autonomy tomorrow.

GEOPOLITICAL DIVIDENDS AND STRATEGIC TRUST

Beyond electrons, emissions, and megawatt capacities, the operationalization of this civil nuclear deal is a profound testament to the maturation of the India-Australia Comprehensive Strategic Partnership. For decades following its initial nuclear tests, India faced strict global technology denial regimes. Australia's decision to unlock the uranium trade—despite India not being a signatory to the Non-Proliferation Treaty (NPT)—reflects deep international confidence in India's impeccable non-proliferation record and its highly responsible stewardship of sensitive nuclear technology.

This arrangement serves critical strategic interests for both nations within the Indo-Pacific architecture. For Australia, it diversifies its export market, linking its resources sector directly to the world's fastest-growing major economy and reducing its singular dependence on China. For India, it dramatically strengthens its energy supply chains, ensuring that its nuclear renaissance is immune to economic soft coercion or geopolitical blackmail.

Furthermore, Australia has explicitly reaffirmed its steadfast support for India's membership in the Nuclear Suppliers Group (NSG). This vocal backing from a major uranium exporter adds significant diplomatic weight to India's ongoing efforts for full integration into the global nuclear order.

The July 2026 finalisation of the Australia-India civil nuclear Administrative Arrangement is far more than a delayed bilateral trade protocol; it is an architectural pillar of India's 21st-century growth story.

As India races toward its monumental 100 GW nuclear target by 2047, driven by the historic private sector enablers of the SHANTI Act and indigenous breakthroughs in modular and fast breeder technology, the absolute guarantee of fuel security is paramount. By purposefully weaving a highly resilient and diversified supply web across Canada, Central Asia, Russia, and now Australia, India has shielded its green transition from both geopolitical volatility and intense resource competition from China. Australian uranium will help power the baseload of India's modern grid, stabilise an economy increasingly reliant on intermittent renewables, and generate the vital fissile material needed to eventually unlock India's vast thorium reserves. Ultimately, this deal demonstrates that true energy security requires not just ambitious domestic targets, but profound, diversified, and trust-based international partnerships.

**Hindol Sengupta is a professor of international relations at O.P. Jindal Global University.*