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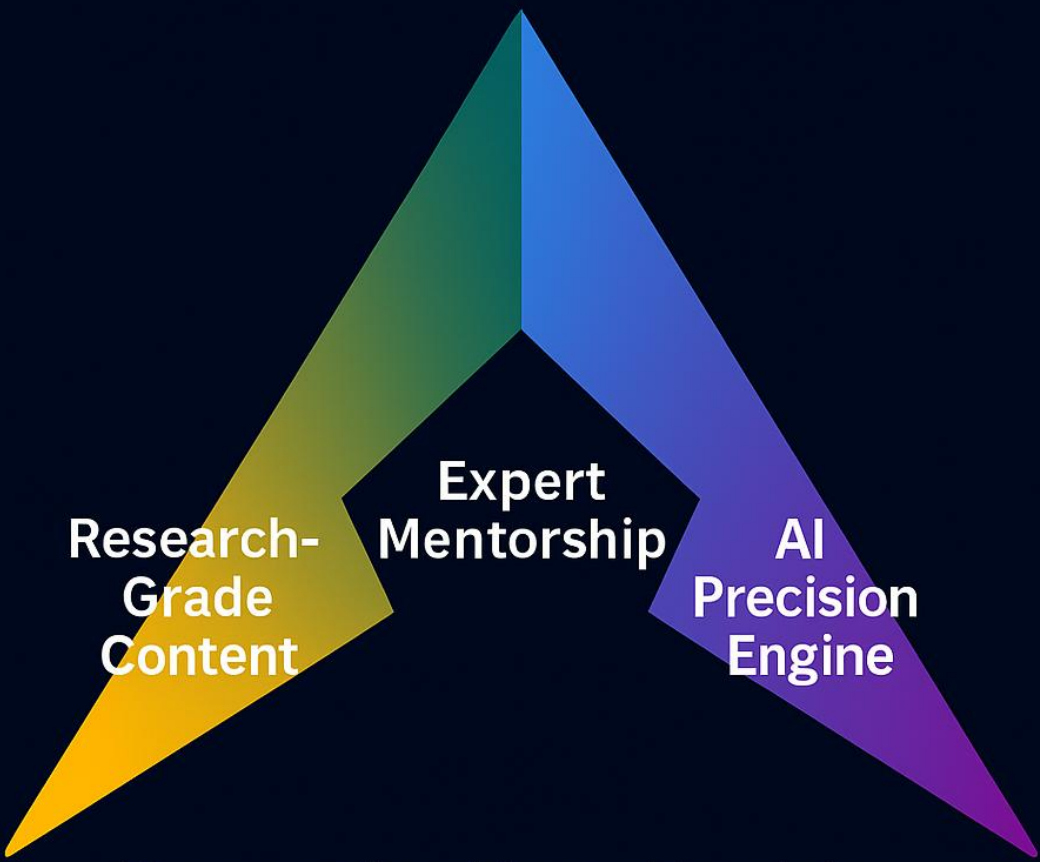

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DAILY CURRENT AFFAIRS DATED 08.03.2026

GS Paper II: International Relations

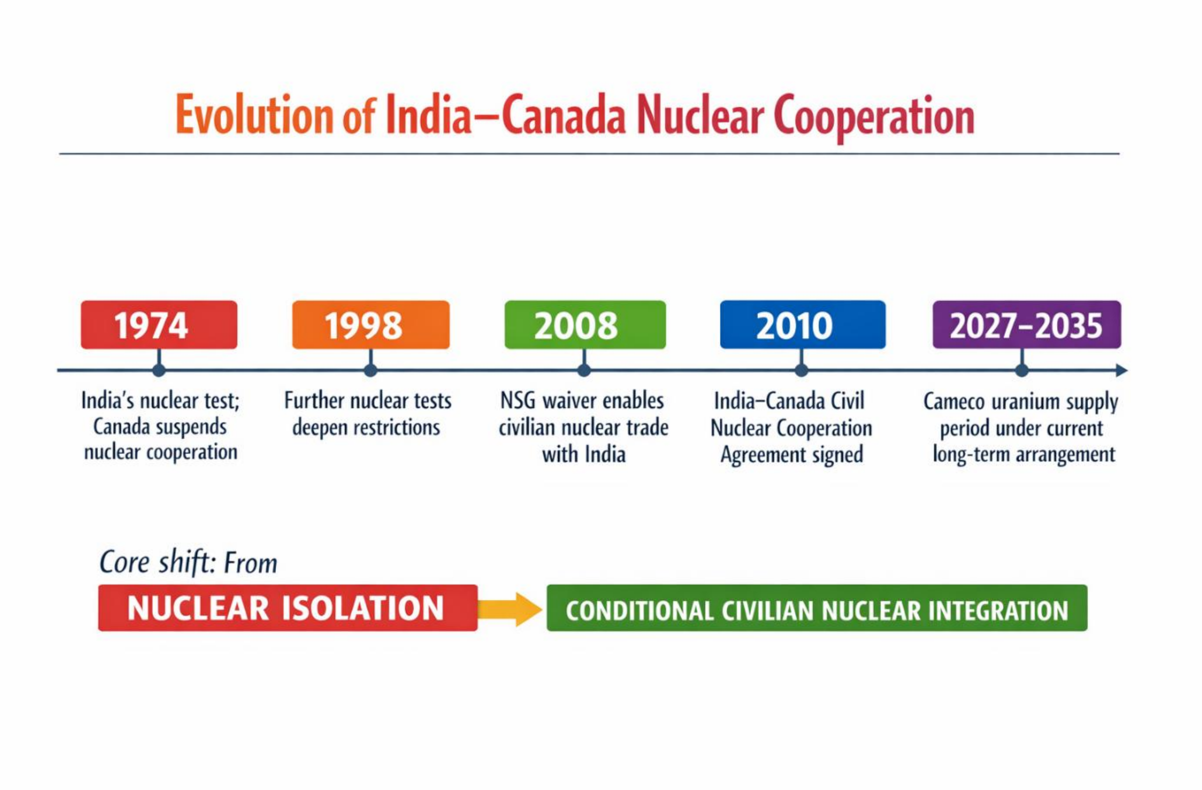
1. Canada's Uranium Deal and India's Nuclear Programme

a. Introduction

India's nuclear energy programme is entering a new phase of expansion as the country seeks reliable and low-carbon sources of electricity. In this context, India has signed a Canadian $2.6 billion uranium supply agreement with Cameco, one of the world's largest uranium producers. The agreement will provide around 10,000 tonnes of uranium between 2027 and 2035, ensuring long-term fuel availability for India's civilian nuclear reactors.

The development is significant because nuclear power forms an important component of India's long-term energy strategy. As the country attempts to expand nuclear capacity and reduce dependence on fossil fuels, securing stable uranium supplies has become a strategic necessity.

This agreement therefore needs to be understood not only as a commercial transaction but also as part of India's broader strategy for energy security, nuclear expansion, and technological self-reliance.



b. Role of the Canada Uranium Deal in India's Energy Strategy

The agreement contributes to India's nuclear programme in several important ways.

i. Strengthening Energy Security

- Nuclear reactors require a continuous and predictable supply of fuel to operate efficiently.
- Interruptions in uranium supply can lead to reduced plant load factors and lower electricity generation.
- The long-term supply commitment from Canada enhances India's energy security by ensuring reliable fuel availability for both existing and upcoming reactors.

ii. Supporting Nuclear Power Expansion

- India presently operates 24 nuclear reactors with a capacity of roughly 9 gigawatts.
- The government has set an ambitious target of increasing nuclear capacity to 100 gigawatts by 2047 as part of the country's clean energy transition.
- Such expansion requires fuel availability to be secured well in advance. Long-term supply agreements therefore allow India to plan reactor construction and commissioning without uncertainty regarding uranium availability.

iii. Reducing Pressure on Domestic Uranium Resources

- India possesses uranium deposits, but most reserves consist of low-grade ores with relatively small concentrations of usable uranium.
- Importing higher-grade uranium from countries such as Canada enables reactors to operate more efficiently.
- At the same time, imports allow India to conserve domestic uranium resources for strategic purposes.

c. India's Uranium Resource Base

India's uranium availability can be broadly understood through two major sources: domestic reserves and imported supplies.

i. Domestic Uranium Resources

India possesses uranium ore deposits estimated at approximately 4.2–4.3 lakh tonnes of ore. Important mining locations include:

- Jaduguda in Jharkhand
- Turamdih in Jharkhand
- Tummalapalle in Andhra Pradesh

However, these figures refer to uranium ore rather than pure uranium metal. After processing and extraction, the amount of usable uranium is estimated to be around 76,000 to 92,000 tonnes.

This difference arises because Indian uranium deposits typically contain only 0.02% to 0.45% uranium concentration. In practical terms, this means that very large volumes of rock must be processed to obtain relatively small quantities of usable uranium.

ii. Imported Uranium Supplies

Because domestic reserves are limited and low in grade, India increasingly depends on imported uranium.

- Around three-fourths of the fuel requirement for civilian nuclear reactors is currently met through imports.
- India maintains uranium supply arrangements with several countries, including Canada, Kazakhstan, Uzbekistan, and Russia.
- To safeguard against disruptions, India has also been developing a strategic reserve of nuclear fuel sufficient for roughly five years of reactor operation.

The ability to import uranium today is largely the result of significant changes in the international nuclear order following the early twenty-first century.

d. Legal Framework: India–Canada Civil Nuclear Cooperation Agreement

The uranium supply arrangement with Cameco operates under the India–Canada Civil Nuclear Cooperation Agreement signed in 2010.

i. Historical Context

For decades after India's nuclear tests in 1974 and 1998, international nuclear trade with India remained restricted.

This situation changed after the Nuclear Suppliers Group granted India a special waiver in 2008, allowing civilian nuclear cooperation with countries around the world despite India not being a signatory to the Nuclear Non-Proliferation Treaty (NPT).

Following this waiver, India and Canada concluded their bilateral civil nuclear agreement in 2010, enabling uranium exports for peaceful purposes.

ii. Safeguards and Accountability

Under this agreement, Canada requires India to maintain detailed records of the use of imported nuclear material.

- These records are referred to as fissionable material accounts.
- They ensure that uranium supplied for civilian purposes is not diverted to military programmes.
- While some analysts view this requirement as intrusive oversight, the arrangement also benefits India because imported uranium supports civilian reactors while domestic uranium can be reserved for strategic needs.

With these legal arrangements in place, uranium plays several important roles within India's nuclear ecosystem.

e. Utilisation of Uranium in India

Uranium serves multiple functions within India's nuclear infrastructure.

i. Electricity Generation

The principal use of uranium is in civilian nuclear power plants.

- Most Indian reactors are Pressurised Heavy Water Reactors (PHWRs), which operate using natural uranium as fuel.
- India currently possesses approximately 9 gigawatts of installed nuclear capacity.
- Nuclear energy contributes roughly three percent of India's total electricity generation.
- The indigenous 700-megawatt PHWR design is increasingly becoming the backbone of India's nuclear expansion.

ii. Scientific Research and Medical Applications

Uranium is also used in research reactors such as Dhruva at Trombay.

- These reactors produce radioisotopes used in medicine and industry.
- Examples include technetium-99m and iodine-131, which are widely used in diagnostic imaging and cancer treatment.

iii. Strategic and Defence Applications

Domestic uranium resources are also essential for India's strategic capabilities.

- They support the nuclear weapons programme.
- Uranium is used in nuclear propulsion systems for submarines, including the Arihant-class ballistic missile submarines.

Given these strategic requirements, India cannot rely exclusively on imported uranium.

f. Why India Cannot Depend Solely on Imported Uranium

Although imported uranium is generally higher in grade and more economical, complete dependence on imports would create vulnerabilities.

- Imported uranium used in civilian reactors is placed under international safeguards, meaning it cannot be diverted for defence purposes.
- Global geopolitical disruptions could also affect long-term supply arrangements.
- Consequently, India follows a dual strategy that combines imported uranium for civilian power generation with domestic uranium production for strategic flexibility.

This strategy aligns closely with the long-term technological roadmap of India's nuclear power programme.

g. India's Three-Stage Nuclear Power Programme

India's nuclear strategy, conceptualised by Homi Jehangir Bhabha, is based on a long-term three-stage development model designed to maximise the country's limited uranium resources and abundant thorium reserves.

i. Stage One: Pressurised Heavy Water Reactors

- The first stage uses natural uranium as fuel in Pressurised Heavy Water Reactors.
- These reactors generate electricity and produce plutonium-239 as a by-product, which becomes fuel for the next stage.

ii. Stage Two: Fast Breeder Reactors

- The second stage involves Fast Breeder Reactors (FBRs) that use a mixture of plutonium-239 and uranium-238 as fuel.
- These reactors can produce more fissile material than they consume, thereby expanding the fuel base.

iii. Stage Three: Thorium-Based Reactors

- The final stage aims to utilise India's vast thorium reserves.
- Thorium-232 is converted into uranium-233, which can then be used as nuclear fuel.

India possesses roughly one-fourth of the world's thorium reserves, making this stage crucial for long-term energy independence.

h. Current Status of the Programme

India is currently transitioning from the first stage toward the second stage of its nuclear programme.

The central project in this transition is the Prototype Fast Breeder Reactor (PFBR) at Kalpakkam.

- The project was originally estimated at ₹3,492 crore.
- By 2019, costs had increased to more than ₹6,800 crore.
- Although the reactor is nearing commissioning, it has faced significant delays and cost escalations.

Several factors have slowed progress:

- Technological complexity
- Financial constraints
- International sanctions following nuclear tests
- Public resistance and land acquisition challenges

These difficulties highlight the gap between strategic vision and operational implementation in India's nuclear programme.

i. The Thorium Challenge

Despite India frequently highlighting its thorium reserves, large-scale thorium-based electricity generation remains a distant goal.

- According to the Department of Atomic Energy, commercial thorium deployment may take three to four decades after fast breeder reactors become widely operational.
- Because the fast breeder stage itself has experienced delays, analysts believe a fully developed thorium economy may emerge only in the latter half of the twenty-first century.
- Former Atomic Energy Commission chairman Anil Kakodkar has explained that a single fast breeder reactor may require 15–20 years to generate sufficient fissile material to fuel another reactor, making expansion inherently gradual.

While the thorium pathway remains long-term, new reactor technologies are emerging that may accelerate nuclear power expansion.

j. Emerging Role of Small Modular Reactors

India has recently begun exploring Small Modular Reactors (SMRs) as a complementary technology for nuclear expansion.

- The Union Budget 2025–26 allocated ₹20,000 crore for the development of SMR technologies.
- These reactors generally use low-enriched uranium containing around 3–5% uranium-235.
- They offer several advantages, including:
    - Shorter construction timelines
    - Lower capital investment per unit
    - Greater flexibility in site selection
    - Possibility of decentralised electricity generation

Long-term uranium supply agreements such as the one with Canada will therefore support the fuel requirements of these emerging reactor systems.

k. Strategic Significance of the Canada Uranium Agreement

Beyond its commercial value, the agreement carries several strategic implications.

- It supports India's transition toward cleaner energy sources.
- It strengthens the reliability of baseload electricity generation.
- Imported uranium for civilian reactors allows India to preserve domestic uranium resources for strategic programmes.

The agreement also complements India's broader plans to expand nuclear capacity, develop small modular reactors, and eventually transition toward thorium-based nuclear power.

l. Challenges in India's Nuclear Energy Expansion

Despite these developments, several structural challenges remain.

- Domestic uranium deposits are low in grade, making extraction expensive.
- Nuclear projects frequently experience delays and cost overruns.
- The three-stage nuclear programme has progressed more slowly than originally envisioned.
- Nuclear energy currently contributes only a small share of India's total electricity generation.

These challenges underline the need for a balanced and carefully calibrated policy approach.

m. Way Forward

A forward-looking strategy is required to realise the full potential of nuclear energy in India.

- India should diversify uranium imports to avoid excessive dependence on any single supplier.
- Technological improvements in mining and processing can enhance domestic uranium extraction efficiency.
- Accelerating the commissioning of fast breeder reactors is essential for advancing the three-stage nuclear programme.
- Parallel investment in Small Modular Reactors could help expand nuclear capacity more rapidly while overcoming land and financing constraints.
- Sustained research in thorium technology remains crucial for long-term energy independence.

Conclusion

The uranium supply agreement with Canada represents an important step in strengthening India's civilian nuclear programme. By ensuring reliable nuclear fuel availability, the deal supports India's ambitions to expand nuclear energy and transition toward cleaner electricity sources.

At the same time, the agreement fits within the broader strategic framework of India's three-stage nuclear programme, which aims to maximise limited uranium resources while eventually harnessing the country's vast thorium reserves. Although technological, financial, and institutional challenges remain, such agreements help sustain the momentum of India's long-term nuclear energy strategy.

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While every effort has been made to balance depth with brevity, please keep the following in mind:

1. Orientation & Purpose

This compilation is curated primarily from the UPSC Mains perspective — with emphasis on conceptual clarity, analytical depth, and interlinkages across GS papers.

However, the PrepAlpine team is simultaneously developing a dedicated Prelims-focused Current Affairs Series, designed for:

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