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GS Paper II: Current Affairs

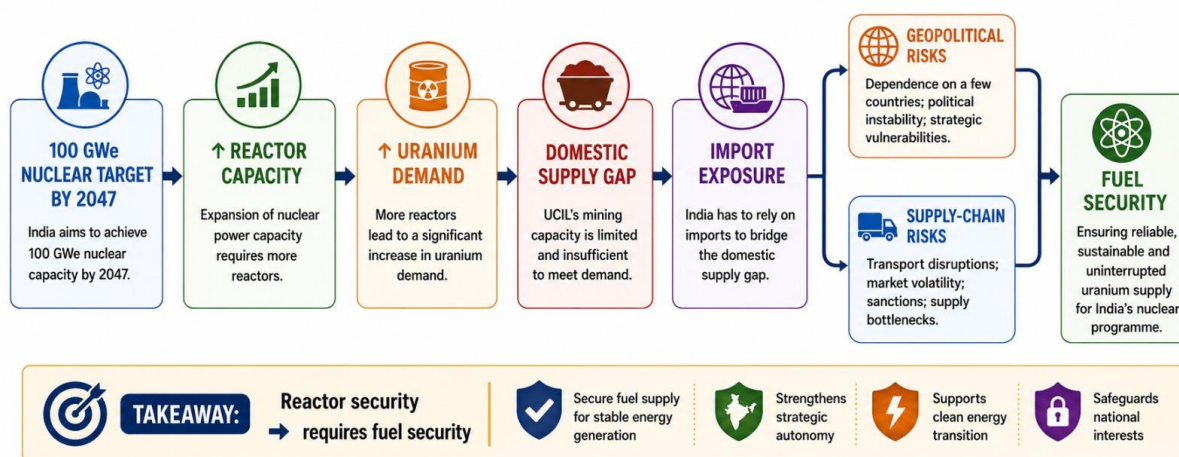
1. Uranium Security and Private Participation in Mining

a. Introduction

A Parliamentary committee has recommended a policy framework for allowing Mine Developer-cum-Operators (MDOs) to participate in uranium mining under strict Department of Atomic Energy (DAE) oversight. The proposal assumes significance as India targets expansion of nuclear capacity from around 8.7 GWe to 100 GWe by 2047.

India's indigenous Pressurised Heavy Water Reactors (PHWRs) use natural uranium. Uranium mining and processing is currently undertaken exclusively by the state-owned Uranium Corporation of India Ltd (UCIL). Fuel requirements are met through domestic production supplemented by imports, while enriched uranium for India's operating Light Water Reactors (LWRs) is imported.

INDIA'S NUCLEAR EXPANSION: THE URANIUM FUEL-SECURITY CHALLENGE



b. Why Uranium Supply Has Become Critical

India's nuclear expansion creates a potential fuel-security mismatch.

For around 25 GWe of PHWR capacity, annual requirements could reach approximately 5,400 tonnes of uranium oxide (U₃O₈), while UCIL estimates domestic production could meet only about 30% of this requirement.

Hence:

Nuclear capacity expansion → Higher uranium demand → Domestic supply gap → Greater import exposure

Without corresponding fuel security, additional reactor capacity may not translate into reliable electricity generation.

c. Why MDO Participation is Proposed

An MDO is a contractor engaged by the mine owner to develop and operate mines on its behalf.

Allowing specialised contractors could:

- accelerate development of identified uranium deposits;
- bring modern mining technologies and managerial expertise;

- supplement UCIL's limited implementation capacity;
- improve efficiency in deep and technically difficult mines; and
- enable faster scaling of domestic uranium production.

The proposed model is therefore operational participation rather than unrestricted privatisation, with strategic control remaining under DAE oversight.

d. Analysis/ Observations

Uranium security is becoming part of energy security

Nuclear power can provide low-carbon, round-the-clock electricity, complementing variable solar and wind power. But dependence on imported nuclear fuel creates an external vulnerability similar, though smaller in scale, to dependence on imported hydrocarbons.

India currently sources uranium from countries including Kazakhstan, Russia, Uzbekistan and Canada. Diversification therefore remains essential to reduce geopolitical and supply-chain risks.

Three-layered fuel-security strategy is required

India's uranium security needs to rest on:

Domestic production + Diversified overseas sourcing + Strategic stockpiles

The Parliamentary panel has consequently recommended:

- faster domestic production;
- acquisition of stakes in overseas uranium assets; and
- strategic uranium reserves calibrated to reactor refuelling requirements.

This resembles India's broader strategy of combining domestic capacity with external resource diplomacy and strategic reserves.

Geological availability does not equal usable supply

India has substantial identified uranium resources, but commercial exploitation faces structural constraints:

- relatively low ore grades (around 0.02–0.045%);
- deep ore bodies;
- high extraction and processing costs;
- land-acquisition difficulties;
- public opposition; and
- large quantities of mining and processing waste.

Hence, resource security depends not simply on reserves but on economically, technologically and socially viable extraction.

Strategic-sector participation creates a regulatory dilemma

Contractor participation may improve efficiency, but uranium is a strategic and sensitive mineral associated with nuclear security.

Greater participation therefore requires:

- strict licensing and DAE supervision;
- physical security and material accounting;
- personnel and cybersecurity safeguards; and
- clear liability and accountability mechanisms.

The objective should be to leverage private operational efficiency without diluting sovereign control over nuclear materials.

Environmental and Social Dimension

Low-grade uranium ores require processing larger volumes of material, increasing tailings and environmental-management challenges.

Mining expansion can also generate land, livelihood and health concerns among surrounding communities. Failure to address these transparently can produce local resistance and delay projects.

Therefore, faster uranium extraction must not come at the expense of environmental safeguards, community participation and rehabilitation.

e. Way Forward

- Develop a tightly regulated MDO framework under DAE control, clearly separating operational contracting from strategic ownership.
- Accelerate UCIL's brownfield expansion and adoption of automation, sensor-based ore sorting and advanced beneficiation.
- Diversify long-term uranium imports and expedite acquisition of overseas uranium assets.
- Develop adequate strategic uranium stockpiles against geopolitical and supply disruptions.
- Strengthen exploration and speed up transfer of commercially viable deposits for development.
- Ensure rigorous environmental monitoring, tailings management and community consultation in uranium-mining regions.

Conclusion:

India's ambition of 100 GWe nuclear capacity by 2047 requires fuel security to expand alongside reactor capacity. A calibrated combination of domestic mining, specialised MDO participation, technological modernisation, diversified imports and strategic stockpiles can reduce vulnerability. However, uranium's strategic and environmental sensitivities require efficiency to remain firmly anchored in sovereign oversight and robust regulation.

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

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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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- Prelims-style MCQs
- objective pattern analysis

This Prelims Edition will be released separately as a standalone publication.

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3. Format Flexibility

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- lists
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