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NLC India and CSIR to Extract Critical Minerals from Mine Waste

12 June 2026 · SCIENCE & TECH · ECONOMY · GS3

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12 June 2026 · 4 min read · ·

Source: ujiyari.com — Free UPSC & State PCS Current Affairs

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WHY IN NEWS

NLC India Limited (NLCIL), a Navratna public-sector undertaking, has signed a Memorandum of Understanding with the **CSIR-Central Electrochemical Research Institute (CSIR-CECRI), Karaikudi**, to develop technology for extracting **rare earth elements (REEs) and critical minerals from mining waste**, the overburden and tailings at its Neyveli lignite mines. The tie-up, signed at Neyveli in June 2026, supports India's drive for self-reliance in critical minerals under the **National Critical Mineral Mission**.

WHAT THE TIE-UP DOES

ASPECT	DETAIL
Partners	NLC India Limited (Navratna PSU) and CSIR-CECRI, Karaikudi
Goal	Extract rare earths and critical minerals from mine waste (overburden and tailings)
Site	The Neyveli lignite mines, Tamil Nadu
Significance	Recovers value from waste and reduces import dependence
Policy frame	National Critical Mineral Mission

The project is a form of "**mine-waste (secondary-resource) recovery**," extracting valuable minerals from material previously discarded, and turning a waste liability into a strategic resource. (This differs from "urban mining," which means recovering metals from electronic waste and end-of-life products.) CSIR-CECRI brings the electrochemistry, since recovering trace REEs from lignite overburden and ash relies on electrochemical and hydrometallurgical processing.

WHAT ARE CRITICAL MINERALS AND RARE EARTHS?

TERM	MEANING
Critical minerals	Minerals essential to the economy and national security whose supply is at risk (for example lithium, cobalt, nickel, graphite)
Rare earth elements (REEs)	A group of 17 elements vital to magnets, electronics, EVs, wind turbines and defence systems
Overburden / tailings	The waste rock and residue left after mining

These minerals are the backbone of the **clean-energy transition** (EV batteries, solar panels, wind turbines) and of modern electronics and defence. A useful distinction is between **light REEs** (such as neodymium and praseodymium) and the scarcer **heavy REEs** (such as dysprosium and terbium), both used in the **Nd-Fe-B permanent magnets** that drive EV motors, wind turbines and defence guidance systems. Despite the name, rare earths are **not geologically rare**; the difficulty lies in finding concentrated deposits and, above all, in **separating and processing** them.

THE CHINA CHOKEPOINT

The strategic problem is concentration. **China controls roughly 60 per cent of rare-earth mining and 85 to 90 per cent of global processing and refining**, and the bulk of magnet manufacturing, so the chokepoint is **processing, not ore**.

- In **April 2025**, China placed several **heavy rare earths and magnets** under export licensing, a reminder that critical-mineral supply chains can be **weaponised** as geopolitical leverage.
- This is why India is racing to build domestic exploration, processing and recovery capacity, and to "friend-shore" supply through partnerships, rather than depend on a single dominant supplier.

WHY IT MATTERS

- **Strategic autonomy:** Domestic extraction and processing reduce reliance on a few foreign suppliers, especially China, for minerals vital to energy and defence.
- **The circular economy:** Recovering minerals from mine waste embodies a circular-economy approach, extracting value while reducing the environmental burden of tailings.
- **Backing the mission:** It operationalises the **National Critical Mineral Mission**, which aims to secure India's critical-mineral supply chains through exploration, recovery, recycling and overseas acquisition.

India also has institutions such as **Khanij Bidesh India Limited (KABIL)** for overseas mineral assets and has joined the **Mineral Security Partnership**, a multi-country effort to build resilient supply chains.

THE POLICY AND LEGAL ARCHITECTURE

India's critical-minerals push rests on a recent, layered framework:

ELEMENT	DETAIL
30 critical minerals	A Ministry of Mines expert committee identified India's list of **30 critical minerals** in 2023
MMDR Amendment Act, 2023	Removed six minerals (including lithium) from the atomic-minerals list to allow **private mining**, introduced an **exploration licence**, and enabled the auction of critical-mineral blocks
National Critical Mineral Mission	Approved in **January 2025**, with an outlay of about **Rs 16,300 crore (plus around Rs 18,000 crore expected from PSUs)** over seven years, covering the whole value chain
KABIL	Signed lithium-exploration blocks in **Argentina** (2024)
Reasi (J&K)	The Geological Survey of India reported an inferred lithium resource at Reasi (announced 2023)

UPSC RELEVANCE

Prelims

- **NLC India (NLCIL)** is a **Navratna** PSU (lignite mining and power); it tied up with **CSIR-CECRI, Karaikudi**
- The goal is to extract **rare earths and critical minerals from mine waste** (mine-waste recovery, not "urban mining," which is e-waste)
- **Rare earth elements** are a group of **17 elements**; **China controls ~60% of mining and 85-90% of processing** (the chokepoint is processing)
- The **National Critical Mineral Mission** (approved Jan 2025, ~Rs 16,300 crore) and the **MMDR Amendment Act, 2023** (opened lithium etc. to private mining)
- India has **30 critical minerals** (2023 list); **KABIL** acquires overseas assets; India is in the **Mineral Security Partnership**

Mains Angles

1. **GS3 Resources / Economy:** “Critical minerals are the oil of the 21st century.” Examine India’s strategy for securing critical-mineral supply chains.
2. **GS3 Strategic Autonomy:** “China’s control of rare-earth processing is a strategic chokepoint.” Analyse India’s dependence and the steps, including friend-shoring, to reduce it.
3. **GS3 Science and Technology:** Discuss mine-waste recovery and recycling as a circular-economy route to mineral self-reliance.

FACTS CORNER

FACT	DETAIL
Partners	NLC India (Navratna PSU) + CSIR-CECRI, Karaikudi
Goal	Critical minerals and REEs from mine waste (Neyveli)
NCMM	Approved Jan 2025, ~Rs 16,300 crore, 7-year value chain
Legal frame	MMDR Amendment Act, 2023; India’s 30 critical minerals (2023)
Rare earths	17 elements; light (Nd/Pr) vs heavy (Dy/Tb); Nd-Fe-B magnets
China chokepoint	~60% mining, 85-90% processing; April 2025 export curbs
Overseas / global	KABIL (Argentina lithium); Mineral Security Partnership
Concept	Mine-waste recovery (not e-waste “urban mining”); circular economy

Sources: CSIR-CECRI, Ministry of Mines, The Tribune

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