

India's Critical Mineral Mission (NCMM)

Introduction

- Critical minerals are essential resources for **clean energy, advanced technology, electronics, transport, and defense**.
- In 2025, India launched the **National Critical Mineral Mission (NCMM)** to reduce import dependence, strengthen supply chains, and ensure mineral security for the **green and digital economy of the future**.
- The Mission is a **strategic blueprint** that goes beyond mining, covering exploration, recycling, R&D, patents, and international cooperation.

Key Features of NCMM

1. Launch & Duration

- Launched: **January 2025**
- Duration: **7 years (2024-25 to 2030-31)**

2. Financial Outlay

- Proposed expenditure: **₹16,300 crore**
- Expected PSU and stakeholder investment: **₹18,000 crore**

3. Incentive Scheme

- **₹1,500 crore scheme** to boost **recycling capacity** from secondary sources like **e-waste, lithium-ion batteries, and end-of-life vehicles**.
- Target:
 - Build **270 kilo ton annual recycling capacity**
 - Produce **40 kilo ton of minerals**
 - Attract **₹8,000 crore investments**
 - Create **70,000 jobs**

4. Institutional Framework

- NCMM is backed by amendments to the **Mines and Minerals (Development & Regulation) Act (MMDR Act)**.
- The **Central Government** has the **exclusive power to auction 24 out of 30 identified critical minerals**.

What are Critical Minerals?

- **Definition:** Minerals that are **economically vital** and **strategically important**, but face **supply chain risks**.
- **Importance:** Key for clean energy, electronics, EVs, telecom, space, and defense.
- **India's Critical Mineral List (2023) – 30 identified minerals:**
Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, Platinum Group Elements (PGE), Phosphorus, Potash, Rare Earth Elements (REE), Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium, Cadmium.

Why Critical Minerals Matter for India

1. Energy Transition

- Vital for solar, wind, and EV industries.
- Without secure supply, India's **renewable and net-zero targets** are at risk.

2. Clean Energy Applications

- **Solar Panels:** Silicon, Tellurium, Indium, Gallium
- **Wind Turbines:** Neodymium, Dysprosium (for high-strength magnets)
- **EV Batteries:** Lithium, Nickel, Cobalt
- **Energy Storage:** Lithium-ion systems (Lithium, Nickel, Cobalt)

3. Strategic Security

- Rare earths and other minerals are critical for **defense equipment, missiles, satellites, and advanced electronics**.

4. Economic Growth

- Ensures India's role in **global supply chains** and strengthens **domestic manufacturing under Make in India**.

Components of NCMM

1. Exploration & Mining

- Launch **1000+ projects** to discover new reserves in India.
- Encourage **overseas acquisitions** of mineral assets by PSUs and private players.

2. Processing & Value Addition

- Develop **processing parks** for critical minerals.
- Promote **domestic refining** instead of exporting raw ores.

3. Recycling & Circular Economy

- Incentivize recovery from **mine tailings, fly ash, red mud, e-waste**.
- ₹100 crore set aside for **pilot projects** on unconventional sources.

4. Research & Innovation

- **Target: 1,000 patents by 2030.**
- Support R&D in **extraction, processing, advanced applications**.

5. Centres of Excellence (CoE)

- **7 CoEs established** at IITs and national labs:
 - IIT Bombay, IIT Hyderabad, IIT (ISM) Dhanbad, IIT Roorkee
 - CSIR-IMMT Bhubaneswar, CSIR-NML Jamshedpur, NFTDC Hyderabad
- Role: Drive **cutting-edge innovation**, supported by **industry and VC funding**.

6. Human Resource Development

- Skill training, upskilling workforce in mining and advanced metallurgy.

7. Strategic Reserves

- Creation of **mineral stockpiles** to ensure uninterrupted supply.

Patent Push under NCMM

- **Objective:** Promote indigenous technology for critical mineral value chains.
- **Progress:**
 - May 2025: 21 patents filed
 - June 2025: 41 patents filed
 - Patents granted: 10 (in two months)
- **Examples of Innovations:**
 - Ytterbium-doped nanoparticles
 - Tungsten-polymer composite molds
 - Tantalum-doped NASICON electrolytes (for sodium-ion batteries)
 - Nickel vanadate thin films
- **Significance:** Strengthens **R&D ecosystem**, reduces import dependency.

Global Dimension

- Critical minerals are at the **center of geopolitics**.
- Countries like **US, EU, Japan, Australia** are forming alliances to secure supply chains.
- India is pursuing **bilateral agreements** and **global partnerships** for mineral sourcing.

Conclusion

- **Critical minerals are the “new oil” of the 21st century.**
- They are scarce, strategic, and vital for **clean energy, digital economy, and defense security**.
- India’s **National Critical Mineral Mission (NCMM)** ensures:
 - Energy security & clean mobility

- Technological self-reliance
- Global competitiveness in green industries
- With **targets for recycling, patents, R&D, and exploration**, the mission is a **game-changer for India's net-zero journey (2070)** and its emergence as a **critical mineral hub**.

UPSC Pointers

- **Launched:** 2025
- **Duration:** 2024-25 to 2030-31
- **Budget:** ₹16,300 crore (Govt) + ₹18,000 crore (PSUs/Stakeholders)
- **Critical Mineral List:** 30 (released in 2023)
- **Incentive Scheme:** ₹1,500 crore (recycling)
- **Targets:** 1,000 patents, 7 CoEs, 270 KT recycling capacity
- **Institutions:** IITs (Bombay, Hyderabad, Dhanbad, Roorkee), CSIR labs, NFTDC

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