Demand for Critical Minerals Across the Globe

This editorial is based on **Critical mineral supplies vital to clean energy shift** which was published in The Hindu BusinessLine on 13/07/2023. It talks about the increasing demand for critical minerals across the globe and the associated challenges.

For Prelims: Minerals, Critical Minerals, Electric Vehicles, Solar Panels, Wind Turbines, KABIL

For Mains: Significance of Critical Minerals, Current Scenario for Critical Minerals Around the Globe

As the world rapidly **embraces clean energy technologies and transitions towards a sustainable future,** the demand for **critical minerals** has soared to unprecedented levels. These **essential minerals, including lithium, cobalt, nickel, and copper, play a pivotal role in powering** electric vehicles**, solar panels, wind turbines, and other clean energy devices.** However, **the surge in demand has outpaced the supply of these critical minerals, giving rise to significant challenges.**

China **holds a dominant position in the supply of certain crucial materials for the** green transition , which is seen as a potential supply risk. An example of this is the **recent restrictions imposed by China** on the **export of important metals like Gallium and Germanium.** This highlights **the concern about relying heavily on a single country for the supply of these essential materials.**

What are Critical Minerals?

- **Minerals:**
  - Minerals **are natural substances that are formed by geological processes.** They have a **definite chemical composition and physical properties.**
  - They are **classified into metallic and non-metallic minerals** based on their characteristics and uses.
    - Metallic minerals are **those that contain metals or metal compounds**, such as iron, copper, gold, silver, etc.
    - Non-metallic minerals are **those that do not contain metals,** such as limestone, coal, mica, gypsum, etc.
- **Critical Minerals:**
  - Critical minerals are those **minerals that are essential for economic development and national security.** The **lack of availability** of these minerals or concentration of extraction or processing in a few geographical locations may lead to supply chain vulnerabilities and even disruption of supplies.

Critical Minerals for India:

- Expert Committee under Ministry of Mines has **identified a set of 30 critical minerals for India.**
- These are Antimony, Beryllium, Bismuth, Cobalt, Copper, Gallium, Germanium, Graphite, Hafnium, Indium, Lithium, Molybdenum, Niobium, Nickel, PGE, Phosphorous, Potash, REE, Rhenium, Silicon, Strontium, Tantalum, Tellurium, Tin, Titanium, Tungsten, Vanadium, Zirconium, Selenium and Cadmium.
- India **has set up** KABIL or the Khanij Bidesh India Limited**, a joint venture of three public sector companies, to ensure a consistent supply of critical and strategic minerals to the Indian domestic market.**
    - It ensures **the mineral security of the nation; it also helps in realising the overall objective of import substitution.**

What is the Current Scenario for Critical Minerals Around the Globe?

- **Rapid Surge in Demand and Market Growth for Energy Transition Minerals (Critical Minerals):**
    - From 2017 to 2022, **the demand for lithium tripled, cobalt increased by 70%, and nickel rose by 40%,** primarily driven by the **energy sector.**
    - According to the **International Energy Agency (IEA)**, the **market for energy transition minerals reached $320 billion in 2022** and is expected to continue growing rapidly.
- **Global Efforts through Policy Measures:**
    - The availability of critical mineral supplies will greatly impact the affordability and speed of energy transitions. To **mitigate uncertain global supply chains, countries are implementing new policies** to diversify their mineral supplies.
        - The **United States (US)**, **Canada**, the **European Union (EU)**, and Australia **have enacted regulatory legislation**, while resource-rich nations like Indonesia**, Namibia, and Zimbabwe have imposed restrictions on the export of unprocessed mineral ores.**
- **Industry's Role through Vertical Integration:**
    - To secure mineral supplies, industries such as automakers, battery cell makers, and equipment manufacturers are **becoming more actively involved in the critical minerals** value chain.
        - This **includes engaging in activities like** mining **and refining,** along with **establishing long-term agreements** for purchasing minerals.
- **Geopolitical Tensions and Resource Nationalism:**
    - It is important to address these challenges because **global relations between nations have become more polarised**, especially due to events like the **US-China trade war** and the **Russia-Ukraine war.** These conflicts have **led to sanctions and disruptions in established trade patterns.**
    - Additionally, **there is an increasing trend of resource nationalism**, where countries prioritise **their own resources and impose restrictions on exports. These factors contribute to uncertainties in** global trade flows.
- **Supply-Demand Dynamics:**
    - As the prices of critical industrial metals, such as copper, are expected to increase in the coming years due to growing **demand surpassing supply. This rise in material prices will likely disrupt the production costs of devices like solar panels and electric vehicles.**

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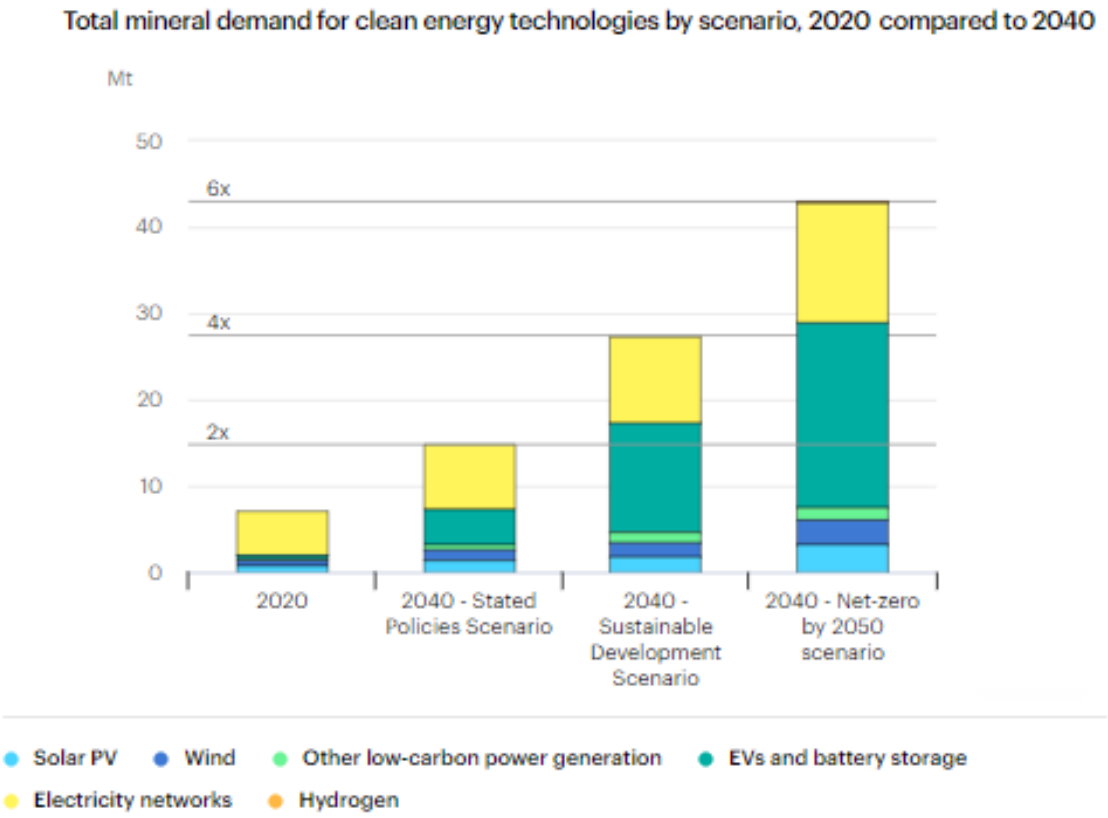

What are the Challenges Related to Critical Minerals in India?

- India is **currently confronted with both global and domestic challenges in ensuring reliable supply chains for critical minerals.** Internationally, **there are few major risks to consider:**
  - **Covid-19 Impact:** China, which holds a dominant position in critical mineral supply chains, continues to struggle with **Covid-19**. Consequently, **there is a significant risk of a slowdown in the extraction, processing, and exports of critical minerals.**
  - **Russia-Ukraine War:** The conflict has implications for critical mineral supply chains. **Russia is a major producer of** nickel, palladium, titanium sponge metal, and the rare earth element scandium.
    - Ukraine is a **significant producer of** titanium and has reserves of lithium, cobalt, graphite, and rare earth elements.
      - The **ongoing war between the two countries raises concerns about the stability and availability of these critical minerals** in the global supply chains.
  - **Impact of China-Russia Partnership and Disparity in International Initiatives:** The evolving balance of power between countries and continents poses a risk to critical mineral supply chains**, primarily due to the strategic partnership between China and Russia.**
    - This **alliance could have implications for the stability and availability of critical minerals.** In response, developed countries have formed collaborative **strategies such as the** Minerals Security Partnership (MSP) **and the** G7's Sustainable Critical Minerals Alliance.
      - However, developing countries **have not been actively involved in these initiatives, potentially missing out on the benefits and protection offered by these partnerships.**
- However, **India does not have many of these mineral reserves, or its requirements may be higher than the availability, necessitating reliance** on foreign partners to meet domestic needs.

What are the Recommended Strategies to Mitigate Challenges Regarding Critical Minerals?

- **Keeping up with Rapid Demand Growth:** To ensure that future supplies of critical minerals can meet the rapidly growing demand driven by climate-driven scenarios. It is **crucial to assess whether the global supply of these minerals can keep pace with this surge in demand.**
- **Diversifying Sources of Supply:** Currently, the reliance on a limited number of countries for these minerals poses risks to the supply chain. By **diversifying the sources, countries and industries can reduce vulnerability** to disruptions in supply caused by geopolitical factors, trade restrictions, or other uncertainties.
- **Ensuring Clean and Responsible Sourcing:** Ensuring that the volumes of critical minerals required for energy transitions **can be supplied from clean and responsible sources.** Mining and refining processes can have environmental and social impacts, including issues such as pollution, habitat destruction, and human rights concerns.
    - It is **important to promote sustainable and responsible practices throughout the critical minerals value chain** to minimise these impacts and ensure a sustainable energy transition.

Way Forward

- **Ensuring Resource Availability:** Addressing the resource aspect is crucial. It is necessary to assess the availability and accessibility of critical materials required for clean energy technologies. This **includes evaluating the domestic reserves of critical minerals and exploring opportunities for their sustainable extraction** or sourcing from diverse international markets.
    - Additionally, **there should be strategies to ensure a steady supply of these materials, mitigating risks** associated with potential disruptions in global supply chains.
- **Financial Considerations:** The transition to clean energy often necessitates significant investments in **infrastructure development, research and development, and policy support.** There is a need for **financing mechanisms, incentives, and funding models that can attract both** public and private investments.
    - Identifying **avenues for international collaborations and exploring innovative financing options** will also be vital in mobilising the required capital for a successful energy transition.
- **Technology as the Key Driver:** Technology plays a critical role in achieving our energy goals. It is **required for the world to focus on fostering domestic technological capabilities**, promoting research and development, and fostering innovation in clean energy technologies.
    - There is a need for technology transfer, collaborations with academia and industry, and the **creation of an ecosystem that supports the development, adoption, and scaling up of innovative clean energy solutions.**

Conclusion

India needs to draw important lessons from the global scenario. While aiming for a rapid decarbonisation and energy transition, India may face challenges due to the limited availability of key minerals and metals required for a swift transition. The success of India's efforts in achieving its goals will be dependent on the uncertainties and fluctuations of the world market for these critical resources.

Drishti Mains Question

Considering the uncertainties of the global market, discuss the potential implications of limited access to critical minerals on India's ability to achieve an accelerated transition towards clean energy.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. Recently, there has been a concern over the short supply of a group of elements called 'rare earth metals'. Why? (2012)

1. China, which is the largest producer of these elements, has imposed some restrictions on their export.
2. Other than China, Australia, Canada and Chile, these elements are not found in any country.
3. Rare earth metals are essential for the manufacture of various kinds of electronic items and there is a growing demand for these elements.

Which of the statements given above is/are correct?

(a) 1 only
(b) 2 and 3 only
(c) 1 and 3 only
(d) 1, 2 and 3

Ans: (c)

Mains

Q. Despite India being one of the countries of Gondwanaland, its mining industry contributes much less to its Gross Domestic Product (GDP) in percentage. Discuss. **(2021)**

Q. "In spite of adverse environmental impact, coal mining is still inevitable for development". Discuss. **(2017)**