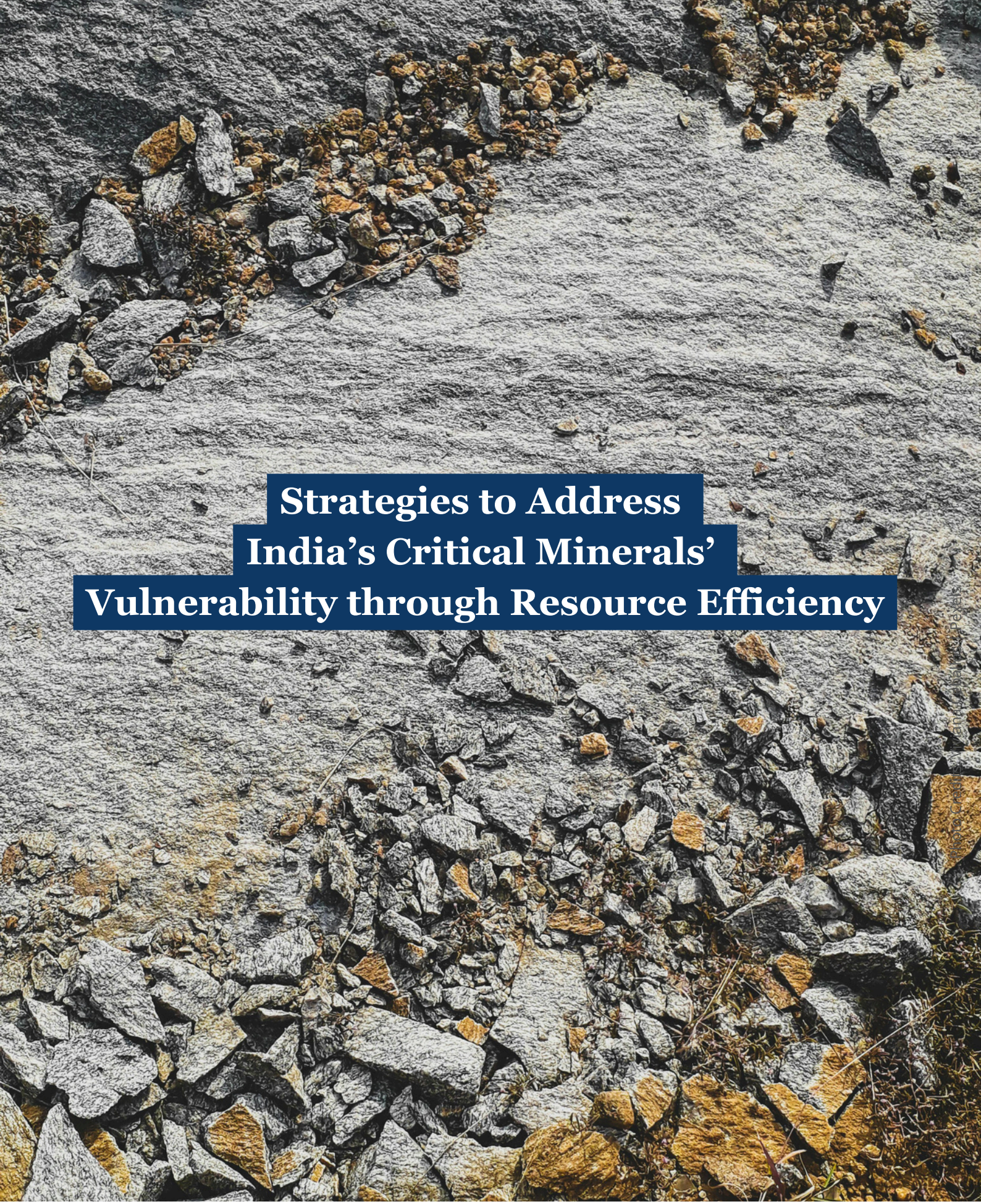


Strategies to Address India's Critical Minerals' Vulnerability through Resource Efficiency

10 YEARS OF EXCELLENCE
ASHOKA UNIVERSITY

CENTRE FOR A
People-centric
Energy Transition

Context

India stands at a crucial crossroads in its journey toward a sustainable future. The Ministry of Mines, Government of India identified 30 critical minerals essential for national security and economic growth, emphasizing their significance for advanced technologies like renewable energy systems that rely on minerals such as lithium, nickel, cobalt, titanium, and rare earth elements (REEs). However, these minerals are becoming scarce. Domestic reserves are minimal compared to the growing domestic demand for strategic minerals, making India heavily reliant on imports to meet its needs. Addressing this resource gap is critical for India's transition to a low-emission economy and achieving its 'Net Zero' targets. Ensuring a reliable supply of these vital minerals is crucial for India to successfully meet its renewable energy ambitions and foster a sustainable development future.

Objectives

Phase I

- Identifying and assessing crucial emerging clean energy technologies for India's Net Zero transition.
- Assessing the requirement for critical minerals in view of increased demand for clean energy technologies and developing techno-economic viability scenarios for critical minerals
- Conduct a resource efficiency pathway analysis to identify optimal resource-efficient technologies and waste recovery strategies.

Phase II

- Formulate policy recommendations for critical mineral management in India, considering three distinct policy scenarios.
- Evaluate virgin mineral resources and projected requirements for critical minerals to support the clean energy transition.
- Assess the availability of secondary or recoverable minerals to enhance resource efficiency and reduce import dependency.
- Identify trade measures and strategies to build strategic reserves and mitigate geopolitical risks.

Timelines

2 (Two) years - FY 2024-25 & 2025-26

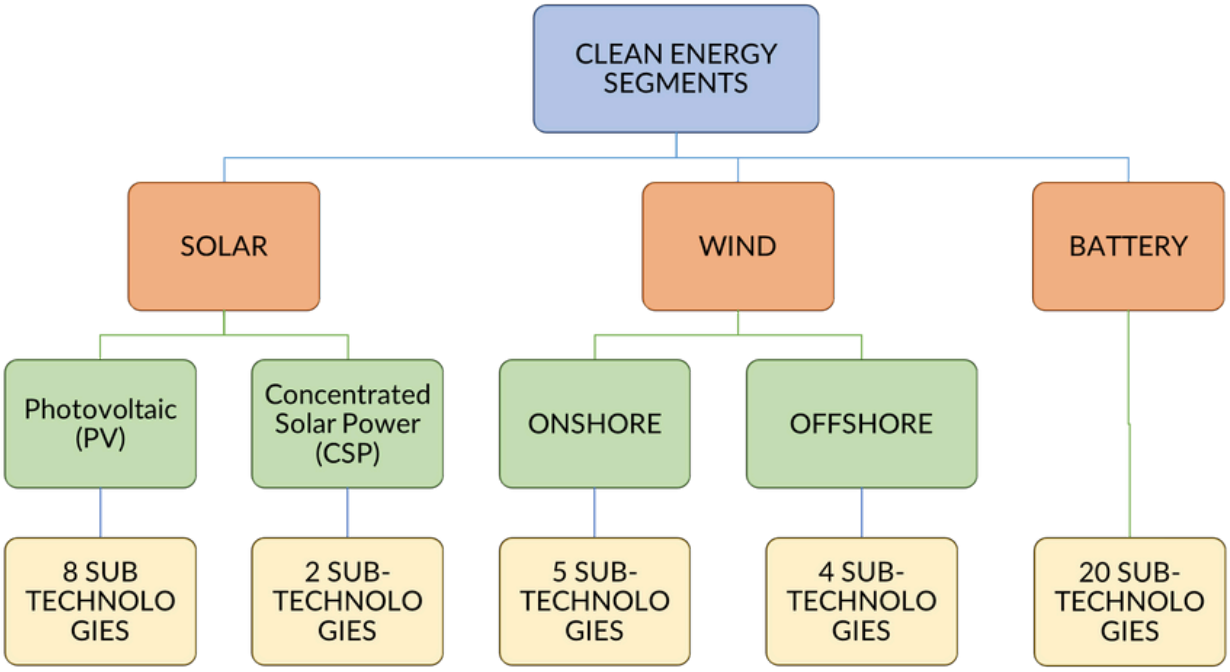
Output

The research seeks to formulate a comprehensive policy roadmap for managing the supply of critical minerals in India. It presents three carefully considered scenarios based on the energy capacity forecasting provided by NITI Aayog.

Outcome

The study outlines a scenario in which India envisions achieving 30-70% self-reliance in critical minerals for clean energy technologies by 2070, primarily through domestic recycling and urban mining.

CLEAN ENERGY TECHNOLOGY CATEGORIZATION



Significant Observations from Ongoing Analysis

- Copper and nickel are extensively used in foundations, towers, and rotors; hence, their requirements are much higher in quantity.
- REEs are mainly used in permanent magnets. As the use of permanent magnet-based technology increases, the requirement for REE is expected to rise.
- In Solar PV, Perovskites are still lab-based technologies but are expected to enter the market in 2030. Perovskites are expected to positively impact demand for Graphite.
- Lithium Batteries: Lightweight, high-energy density, but reliant on China for processing and manufacturing.
- Demand for Vanadium Redox Flow Batteries (VRFBs) grew at a CAGR of 56.7% this decade; hence, they expect to capture a decent market soon. Addressing the country's requirement for Vanadium will also be a concern.
- Advancements in battery energy storage systems (BESS), including lithium-ion, sodium-ion, and flow technologies, drive demand for key materials like nickel, graphite, lithium, cobalt, and copper. This highlights the need for strategic sourcing and sustainable practices in the industry.

Acknowledgement

ACPET acknowledges the support of the following organizations-

सत्यमेव जयते
नीति आयोग
National Institution for Transforming India

SHAKTI SUSTAINABLE ENERGY FOUNDATION

PROJECT TEAM -
Animesh Ghosh, PI -Project & Research Fellow
Soumit Pandey, Junior Research Associate

Campus Location
Plot No. 2, Rajiv Gandhi Education City,
National Capital Region P.O. Rai,
Sonepat Haryana-131029 (India)

Delhi Office
Ashoka University Plot no.222,
Second floor, Okhla Industrial Estate,
Phase III, New Delhi-110020