

# The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

April 29 - 30, 2024  
India Habitat Centre, New Delhi

## PROCEEDINGS REPORT



## Acknowledgement

The summit was made possible by the combined efforts of the teams at Shakti Sustainable Energy Foundation (Shakti), Council on Energy, Environment and Water (CEEW), International Institute for Sustainable Development (IISD) and Ministry of Mines, Government of India. We express our deep gratitude to the Ministry of Mines, particularly to Secretary **Shri VL Kantha Rao** and the Joint Secretary **Dr Veena Kumari D.**, for their vision, unwavering support, and guidance.

We extend our sincere thanks to the CEEW team for organising and moderating the panel discussion on “Building India's capability in processing and beneficiation technologies”. Our gratitude also to the IISD team for organising and moderating the panel discussions on “Strategies for Scaling: Processing for Domestic and Global Markets” and “Policy Incentives and Benefits of Investing in India”.

We are grateful to LOHUM and their team for hosting the summit participants at their battery recycling facility and providing us with a very informative tour. We also appreciate the IA Meetings team for their excellent support in event management.

Most importantly, we thank all the speakers and participants, especially those who joined us from outside India, for their interest and contributions to the ongoing discussion on the beneficiation and processing of critical minerals in India.

## Organising Teams

Shakti Sustainable Energy Foundation:

Vivek Chandran, Director; Anurag Mishra, Senior Program Manager; Meghana M, Intern

Council on Energy, Environment and Water:

Rishabh Jain, Senior Programme Lead; Sunil Kumar, Research Analyst

International Institute for Sustainable Development:

Siddharth Goel, Lead; Saumya Jain, Policy Analyst

Ministry of Mines, Government of India:

Madhumita Banerjee, Senior Geologist; Mohammad Sadiq, Superintending Geologist.

## Disclaimer

The views expressed in this document do not necessarily reflect the views of the organising teams or their respective institutions. We do not guarantee the accuracy of any data included in this document nor accept any responsibility for the consequences of its use.

## Table of Contents

Overview.....	1
Highlights of Sessions from Day One .....	2
1. Inaugural Session .....	2
2. Panel Discussion on “Building India's capability in processing and beneficiation technologies” .....	5
3. Panel Discussion on “Strategies for Scaling: Processing for Domestic and Global Markets” .....	7
4. Technology Session.....	8
5. Special Remarks by Dr Veena Kumari Dermal.....	13
6. Exhibitions:.....	15
Highlights of Sessions from Day Two .....	16
1. Panel Discussion on “Policy Incentives and Benefits of Investing in India” .....	16
2. Closing Plenary.....	17
3. Site Visit to LOHUM .....	18
Appendix 1: Agenda of the Workshop .....	19
Appendix 2: Participation Summary .....	21

### Overview

#### Objective of the Workshop:

The 'The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities' was organized by the Shakti Sustainable Energy Foundation (Shakti), Council on Energy, Environment and Water (CEEW), and International Institute for Sustainable Development (IISD), with support from the Ministry of Mines, Government of India. The event convened government officials, industry leaders, civil society organizations, research labs and academic institutions to foster collaboration, share knowledge, and drive innovation in the field of critical mineral beneficiation and processing—a key component in securing India's energy future and its strategic position in the global supply chain of Critical Raw Materials (CRMs). The summit facilitated discussion, dialogue and partnership between Indian and international companies, including start-ups, and research institutions on accelerating the development of India's CRM sector.

#### Overview of Sessions:

Day 1 commenced with the inaugural session, outlining the summit's objectives. Panel discussions delved into building India's capability in processing and beneficiation technologies and strategies for scaling: processing for domestic and global markets. Technology sessions explored India's geological potential, resource/reserves of critical and strategic minerals, shaping the future in terms of critical minerals auction, technical specifications of ores and minerals and innovative technologies for processing and beneficiation. The panel discussions

on Day 2 focused on policy incentives and benefits of investing in India. Day 2 concluded with a site visit to LOHUM Battery Recycling Facility. The full agenda of the workshop is attached as annexure.

The summit provided a comprehensive platform for dialogue and collaboration, addressing India's critical mineral challenges and opportunities. The closing plenary highlighted key takeaways and outlined future actions, underscoring the summit's significance in shaping India's critical mineral policies and practices. Overall, the event ensured that both the Indian government and industry stakeholders were equipped with the knowledge and connections needed to advance the domestic production of CRMs thereby supporting India's economic growth and sustainability objectives.



Photo 1 Organizers from Shakti, CEEW, IISD and Ministry of Mines

# The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

## Highlights of Sessions from Day One

### 1. Inaugural Session

#### Welcome Remarks by Shri Nitin Desai, Board Member, Shakti

Shri Nitin Desai, Member of the Board of Directors, of Shakti Sustainable Energy Foundation, expressed his enthusiasm for addressing the crucial issue of critical minerals. He highlighted the organization's evolving focus, which has transitioned from merely raising awareness about the need for energy transition, to actively advancing renewable energy, tackling climate issues and enhancing energy security.



Photo 2 Welcome Remarks by Shri Nitin Desai, Board Member, Shakti

Shri Desai emphasised the critical point that producing renewable energy requires developing technologies that are dependent on minerals and rare earth resources that have not been extensively explored or utilised. Although the idea of not depending on external

resources has traditionally contributed to the sense of energy security, Shri Desai mentioned, that it is critical we accept technologies that depend on critical minerals and rare earth resources to achieve energy security.

#### Introductory Remarks by Dr Arunabha Ghosh, CEO, CEEW

Dr Arunabha Ghosh, CEO of CEEW, provided a detailed overview of critical minerals required for the energy transition, and the importance of prioritising sustainable development.



Photo 3 Introductory Remarks by Dr. Arunabha Ghosh, CEO, CEEW

The key takeaway from his remarks is as follows:

- Dr Ghosh emphasised the need for a sustainable approach to mineral development, that ensures future generations to inherit the planet are as well-equipped with resources as us.
- The criticality of minerals was examined from both the supply and demand perspectives. Historically, supply has been the



primary focus in assessing the criticality of minerals, focusing on the economic importance and supply risks associated with any given mineral. However, demand plays an equally important role, as it is a much more dynamic factor that can change over time as technology evolves.

- The extreme levels of concentration in the production and processing of minerals were underscored. Specifically, only 15 countries account for between 70% to 95% of mineral production. Additionally, processing is even more heavily concentrated, with only three countries accounting for 98% of lithium processing, 65% of nickel processing, 90% of cobalt processing, and 100% of rare earth elements processing. The importance of understanding criticality in three key dimensions – i) from the perspective of sustainable development, ii) in terms of supply, and iii) in terms of demand, was emphasised. Enhancing beneficiation and processing capabilities in India to leverage the performance-linked incentive (PLI) scheme to boost domestic value addition.
- The importance of value addition and beneficiation, particularly for developing countries, was highlighted. It was mentioned that developing countries are often home to mines but do not reap the benefits of value addition downstream.
- The concerns of companies involved in the mineral processing supply chain, who are worried about concentrations of processing capabilities and potential disruptions was also discussed.

Overall, Dr Ghosh emphasised the need to develop and enhance beneficiation capabilities to ensure that more value is retained at

home. The performance-linked incentive (PLI) scheme was identified as a key tool to achieve this goal, stressing the importance of intermediate steps between mining and the final product.

### Keynote Speech by Shri VL Kantha Rao

Shri VL Kantha Rao, Secretary of the Ministry of Mines, Government of India, in his keynote speech emphasised that the summit is focused on the issue of achieving self-sufficiency in the critical minerals sector within the country.



Photo 4 Keynote Speech by Shri VL Kantha Rao, Secretary, Ministry of Mines, GoI

Shri Rao highlighted the diverse participation by a range of industry professionals, R&D institutions, think-tanks, CSOs, and representatives from various embassies who have gathered to share their expertise and discuss how best to proceed in this important area. He outlined the significant efforts made by the Ministry of Mines, Government of India in the critical minerals sector as follows:

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

- **Auctions:** The government has been conducting auctions for critical minerals blocks for a period of five to six months, resulting in promising developments and numerous companies have shown interest in the auctions.
- **Blocks:** Over 100 blocks have been identified for critical minerals mining, and the auction process for these blocks is ongoing. The government has also intensified exploration efforts and adopted a revenue share model to encourage private sector expertise in critical minerals exploration.
- **Challenges in Mineral Processing:** Shri Rao acknowledged concerns raised by prospective bidders regarding the processing of extracted minerals. This underscored the need for enhanced facilitation of efforts towards the processing and extraction within the country.
- **Conference Objective:** To address these challenges, the government organised this conference to bring together experts to foster collaboration and solutions-finding for processing and extraction of critical minerals.
- **Funding for Critical Mineral Processing:** The government is actively seeking proposals for funding under the Science and Technology scheme, aimed at critical minerals processing and beneficiation. This scheme is open to start-ups, with the government funding up to 80% of the project costs. To date, five start-ups have received one crore each and new proposals are being invited.

Shri VL Kantha Rao concluded by noting that the summit provides a valuable opportunity for industry professionals to engage with experts in the value chain of processing and beneficiation, including

international companies, learn from their experience, and forge business-to-business deals. He expressed his hope, that these interactions would significantly advance nation's journey towards greater self-sufficiency in critical minerals.

### Signing of MoU

A Memorandum of Understanding (MoU) was signed and exchanged between the Ministry of Mines, Government of India and Shakti Sustainable Energy Foundation. This MoU signifies a collaborative effort under which Shakti along with Council on Energy, Environment and Water (CEEW) and The Energy and Resources Institute (TERI) will provide knowledge support to Ministry of Mines on areas of Critical Minerals, crucial for India's economic development, national security and low carbon energy transition.



Photo 5 Signing of MoU between Ministry of Mines and Shakti Sustainable Energy Foundation

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

### Context Setting by Vivek Chandran

Mr. Vivek Chandran, Director at Shakti, acknowledged the signing and exchange of the MoU, which marks a significant commitment from civil society towards the cause of critical minerals, and highlighted its importance for economic development, national security, and low carbon energy transition. He also highlighted the following points:

- The summit, organised by Shakti in collaboration partners CEEW and IISD exemplifies a shared dedication towards sustainability and economic development.
- The summit aims to enhance the beneficiation and processing capabilities, a crucial component in the supply chain of critical raw materials.
- The summit features a diverse array of participants, including industry, start-ups, government agencies, scientists,

researchers, academicians, representatives from embassies, and public policy experts.

- The summit offers various avenues for engagement, such as panel discussions, technology sessions, exhibitions, and site visits.
- The focus is on collaboration, dialogue, and discussion to identify actionable recommendations and insights that can be taken forward to accelerate the development of critical raw materials.

Mr. Vivek Chandran concluded by expressing gratitude to all participants for their commitment to this vital cause. He looked forward to two days of productive discussions that could shape the future of Indian industry and contribute significantly to global sustainability efforts.



Photo 6 Context Setting by Mr. Vivek Chandran, Director, Shakti

## 2. Panel Discussion on “Building India's capability in processing and beneficiation technologies”

### Background:

There is an urgent need for India to establish a domestic capacity for the processing of critical and strategic minerals, essential for clean energy technologies, defence applications, electronics, pharmaceuticals and agriculture. Considering the global shift towards clean energy, it is necessary to ensure a sustainable and resilient supply chain of critical and strategic minerals. Currently, out of 24 critical and strategic minerals, most of these minerals are not produced in India, and the domestic requirements are being entirely met through imports.



## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

To reduce this import dependence on critical and strategic minerals, India has already taken significant steps, with the identification of critical minerals and auctioning of these mineral blocks by the Ministry of Mines. At present, 38 critical mineral blocks have been put for auction which includes 13 minerals in 14 states. Some of these blocks will go online for mine production and metal extraction in the next five to seven years. To process these minerals domestically, there is a pressing need to accelerate efforts towards domestic processing capabilities.

### Key Highlights of the Discussion/Actionable:

- The panel discussed the importance of building domestic process capabilities, given that the sector is still in the nascent stage of development in India and learnings that can be incorporated from various industries working in the sector.
- The session specifically discussed the challenges in rare earth sourcing and handling, and what worked and what did not in the Indian context.
- Important elements needed for the development of the sector such as skilled manpower, technology adoption and data availability were also discussed.
- The session also focused on the equipment needed for the processing of critical minerals and the sourcing challenges when it comes to catering to the machinery, sparking a discussion on overseas procurement of processing equipment vs local development for industrial use.
- The status of critical minerals projects in the Indian labs, IITs and research institutes were discussed. The speakers from Indian government laboratories highlighted the importance of

extracting critical minerals from secondary sources like fly ash, and red mud.

- The session focused on the localization of technology and equipment at an industrial scale and the steps needed to be taken by the Ministry of Mines to create and develop indigenous equipment for critical mineral processing.
- There was also an important discussion on ways to actualise the industry-academia and how trust and positive institutional temperament might pave the way. The importance of timely deliverables by academia and innovation facilitation by the industry was noted.
- The panel also discussed the importance of a skilled workforce in the critical minerals sector and how Indian institutions like IITs and government laboratories are bridging the gap with several key initiatives being taken with the support of the Government of India.

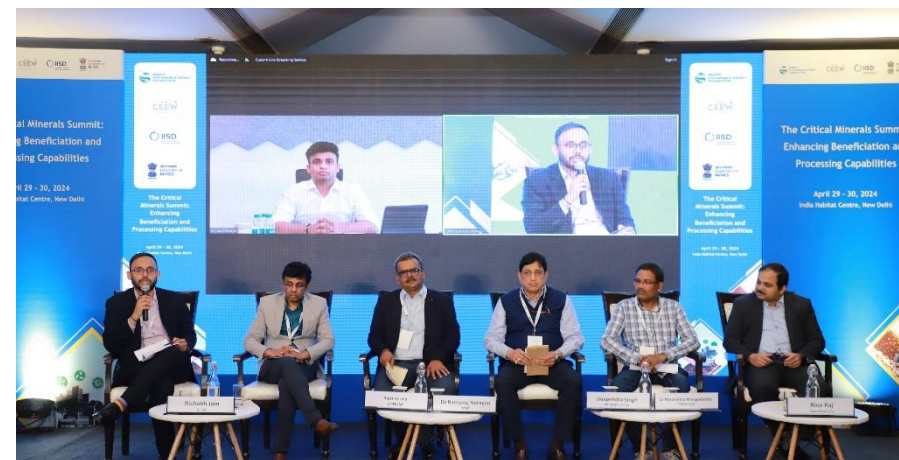


Photo 7 Panel Discussion on "Building India's capability in processing and beneficiation technologies"

### 3. Panel Discussion on “Strategies for Scaling: Processing for Domestic and Global Markets”

#### Background:

India's rapid economic growth and ambitious clean energy targets have underscored the urgent need for securing a domestic supply of critical raw materials (CRMs), which are essential for scaling up the deployment of renewable energy, electric vehicles, and other clean energy technologies. However, there are several bottlenecks faced in developing a domestic supply chain, particularly in mineral processing. This challenge isn't unique to India, with the processing of critical materials highly concentrated in specific geographies, creating vulnerabilities across the global supply chain. Any economic or geopolitical shocks can disrupt supply, as witnessed during the Covid crisis. Hence, it has become imperative for countries to collaborate on mineral processing as well as diversify processing hubs. India, with its inherent advantages, including access to infrastructure, skilled labour, low-cost renewable energy, and a competitive chemical processing industry, could play a potentially bigger role as a processing hub for CRMs for both domestic as well as global demand markets. However, the country has limited experience in the relatively niche segment of commercial beneficiation and processing of CRMs. In this panel, we looked to understand global trends in mineral processing and explored ideas and thoughts on how India could play an important role in the global CRM supply chain through the development of a robust and sustainable processing value chain in the country.

#### Key Highlights of the Discussion/Actionable:

The discussion centred on several issues essential for unlocking India's potential in the Critical Minerals Sector for scaling processing:



Photo 8 Panel Discussion on “Strategies for Scaling: Processing for Domestic and Global Markets”

- **Emphasising Collaborative Partnerships:** Panellists underscored the importance of forming strategic partnerships with nations possessing advanced expertise and technical prowess in the complex processes necessary for mineral processing, as well as countries with a large existing demand for CRMs that were looking for diversified supply sources. These collaborations can aid India to leapfrog to more advanced stages of technological innovation and access offtake markets while the country's domestic industry develops. Furthermore, discussions revolved around initiatives like the Mineral Security Partnerships (MSP), wherein India could advocate for the interests of the global south to foster confidence among emerging economies. A practical approach, including pilot projects, were emphasised to facilitate learning and progress in technology and investment systems.

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

- **Integrating ESG Standards:** The discussion delved into the importance of adhering to Environmental, Social, and Governance (ESG) standards within the mining and processing industry. Panellists emphasized the need for procurement of Critical Raw Materials (CRM) to be in alignment with global sustainability benchmarks. Notably, the significance of voluntary standards like the Initiative for Responsible Mining Assurance (IRMA) was discussed, that emphasised on community engagements, site-level assessments, and transparency.
- **Need for financing mechanisms:** Acknowledging the capital-intensive nature of CRM processing, there was a discussion on the potential to connect suppliers and buyers of technologies on a common platform to fund CRM projects. Moreover, the need for increased investment in infrastructure was emphasized, to bring down costs and increase India's global competitiveness for CRM processing.
- **Engaging with Africa:** Panellists discussed India's long-standing ties and potential to engage with Africa for accessing mining resources, while stressing the importance of understanding and addressing the needs of African nations. Panellists suggested that India could leverage existing bilateral investment treaties, offtake agreements, or broader Free Trade Agreements (FTAs) to integrate its CRM objectives. Additionally, the establishment of dedicated CRM taskforces involving academia, industry, and government entities between India and African countries was proposed. Recognising the importance of skill development in fostering

partnerships with Africa was also discussed with the need for India to adopt an approach that aligns its commercial and strategic interests.

- **Harnessing Secondary Sources and comparative advantages:** The conversation extended to exploring the potential of recovering CRM from non-conventional sources, such as mine tailings and by-products resulting from the processing of minerals such as aluminium. The panel also highlighted a few minerals that India could focus on leveraging its comparative advantages to build a processing industry, such as Graphite and Manganese.

### 4. Technology Session

The technology session featured a presentation by members from the Geological Survey of India on India's geological potential, resource/reserves of critical and strategic minerals as well as critical minerals auction and technical specifications of ores and minerals. This was followed by presentations by private companies, research labs and academy institutions on innovative technologies that are cost effective and reduce environmental and societal impacts.

**Mr. Dinesh V. Ganvir**, Additional Director General & Head of National Mission-II, Geological Survey of India provided a detailed account of the geological potential of India, with a special focus on the five Archean cratons - Aravalli, Bundelkhand, Singhbhum, Bastar, and Dharwar, that are considered the main areas where mineralisation is most likely to occur. The Geological Survey of India database provides the Obvious Geological Potential (OGP) areas for each commodity based on previous investigations.



## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

Mr. Ganvir also mentioned the resources and reserves of various minerals in India based on the data from the Indian Bureau of Mines. The data highlights the import and export trends for minerals like graphite, molybdenum, and chromite. India has significant mineral reserves, but they need to be converted into resources. For instance, India has a high requirement for graphite, which is mostly imported, despite having potential blocks in Arunachal Pradesh and Madhya Pradesh. He highlighted the crucial role played by the NMI (National Mineral Inventory) of the Indian Bureau of Mines in identifying the 30 critical minerals. He provided a comprehensive list of the commodities for which the government has gone for auction during the first, second, and third tranches since November 2023.

Mr. Ganvir also discussed the mineralisation potential of different minerals in different regions of India including the occurrence of glauconite in the Vindhyas, graphite in Arunachal Pradesh and

Madhya Pradesh, lithium in pegmatites, molybdenum in Tamil Nadu, Karnataka, and Madhya Pradesh, nickel and PGE in ultra-basic rocks, potash in the evaporite basin of Rajasthan, REEs in various mineral phases in Gujarat, Tamil Nadu, and Karnataka, and tungsten in scheelite and wolframite mineral phases in Degana.

**Dr K Balasubramanian**, Distinguished Scientist & Director of Nonferrous Materials Technology Development Centre, India, in his special address, spoke of three solution paths.

First, to compress the existing seven years' timeline - from inference of reserves to actual production - down to three years. He mentioned that CSIR, Ministry of Mines and NFTDC have together suggested the potential of doing concurrent R&D for flow sheets specific to a mine within 6 months. This would allow concurrent initiation of TRL 3 level research as well as TRL 7 level pilot planning, as opposed to the



Photo 10 Presentation by Mr. Dinesh V. Ganvir, Additional Director General, GSI



Photo 9 Special address by Dr K Balasubramanian, Director, NFTDC, India



## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

traditional sequential approach, possible with the application of Artificial Intelligence.

Second, he mentioned the necessity for every state to have a designated urban mine to enhance recovery from end-of-life products.

Third, is to allow the free import of scrap containing critical minerals such as Cobalt, Nickel, Tungsten, Molybdenum, Niobium and Tantalum. He also suggested to incentivise Indian companies to set up processing plants outside India until the intermediate stage then import it based on techno-economics.

He concluded by saying that all technological processes for extracting minerals are known, and requires no more of the basic R&D, instead the focus should shift on utilising artificial intelligence to fastrack the production process.



Photo 12 Presentation by Dr Abhilash, Senior Principal Scientist, CSIR-NML, Jamshedpur

**Dr Abhilash**, Senior Principal Scientist & Group Leader of secondaries and recycling at CSIR-NML Laboratory, Jamshedpur, provided an overview of the indigenous feeds and processes as well as the plethora of metals which CSIR-NML has worked on since 2003. Through his presentation, he reinstated that the technology necessary for critical minerals processing has been available in India for many years now and technical support required for its implementation is available as well. He also mentioned that the most important aspect of dealing with Critical Minerals is to have a circular economy loop.

**Dr Shivakumar Angadi**, Principal Scientist at CSIR-IMMT, through his presentation reiterated the significance of critical minerals and discussed the projects being carried out at CSIR-NMNT aimed at beneficiation minerals such as Tungsten, Lithium, REEs and PGEs. He addressed the challenges in processing low-grade ores, beneficiation



Photo 11 Presentation by Dr Shivakumar Angadi, Principal Scientist, CSIR-IMMT

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

of rare earth elements from Indian Resources and highlighted the need to develop sustainable supply chains. He mentioned the need for government policies to encourage innovators and investors as well as the need to develop technologies necessary for exploration, procession, beneficiation and product development.

**Dr Pankaj Kumar Jain**, Assistant Professor at IIT Dhanbad who is currently working on designing and developing an enhanced gravity concentrator to recover critical minerals. He presented his ongoing research in Critical Minerals Processing including old ore processing, recovery of PG metals, Lithium ore processing, etc. with special emphasis on Graphite ore beneficiation.

Having worked extensively on equipment design and development, Dr Jain along with his department have developed mineral processing equipment that utilises gravity for fine particle processing, also



Photo 14 Presentation by Dr Pankaj Kumar Jain, Assistant Professor, IIT Dhanbad

involving advanced stage - enhanced gravity concentration. It is expected to launch commercially by the end of the year.

**Dr Soobhankar Pati**, Co-Founder and Director R&D at Cellark Powertech Private Limited, discussed the importance of renewable energy and energy storage technology in achieving a net-zero target by 2070. He emphasizes the critical role of storage technologies in achieving this goal, particularly the use of graphite material in lithium-ion batteries. He delved into the challenges and environmental impact associated with graphite, and the potential of silicon as an alternative material. He highlighted the benefits of silicon over graphite, such as higher energy density, faster charging capacity, and potential for cost reduction while also addressing the challenges in the supply chain. He also highlighted the importance of material for LFP can be sourced through mining and urban mining in India. This approach he argued could contribute to achieve self-sufficiency.



Photo 13 Presentation by Dr Soobhankar Pati, Co-Founder, Cellark Powertech Pvt Ltd

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

**Mr Riju Bhatnagar**, Technical Advisor and **Mr Shashank Jain**, Director at Saru Smelting Private Limited, shared their extensive experience in non-ferrous metal alloys and semimetals, particularly focused on Lithium-ion based chemistries in the form of alloys, compounds and solvents for the EV battery and non-battery sectors.

Mr Bhatnagar presented a technology developed by BARC for the production of lead lithium that is poised to play a crucial role in India's commitment at the International Thermonuclear Experimental Reactor (ITER) project, specifically for the Lead-Lithium Cooled Ceramic Breeder (LLCB) Fast Breeder Reactor. In this context, lead-lithium is to be used as a coolant. Further, he provided a comparison

of the physical properties of various coolants, highlighting the advantages of lead lithium as a coolant.

**Mr Joe Walsh**, Managing Director at Lepidico Limited, has more than 30 years of experience working in the mining and exploration industry and investment banks in mining related roles. He presented the proprietary process technologies of Lepidico namely L-Max and LOH-MAX, which he mentioned were sustainable process alternatives.

L-Max process is notable for its common, inexpensive reagents, operates at atmospheric pressure and modest temperature, making it energy efficient. It boasts of 25% lower GHG emissions compared to a typical integrated spodumene operation and can be best in class when combined with green hydrogen, producing no solid process waste.



Photo 15 Presentation by Mr. Shashank Jain, Director, Saru Smelting Pvt Ltd



Photo 16 Presentation by Mr. Riju Bhatnagar, Technical Advisor, Saru Smelting Pvt Ltd

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

LOH-Max has broad application including spodumene conversion; it produces high purity lithium hydroxide with excellent morphology from lithium sulphate, avoiding the generation of undesirable sodium sulphate. This method enhances metallurgical recovery of lithium to over 4% over conventional spodumene processing, maintains modest energy consumption, which supports low greenhouse gas emissions.

He emphasized Lepidico's exceptional ESG record, and highlighted parameters including low water intensity, competitive carbon intensity, land use intensity and no material impacts on biodiversity as per ESIA. In terms of social responsibility, he mentioned jobs creation, water supply to local farmers and other community development activities.

**Mr Aditya Dalmia**, Director Projects at CVMR Corporation, through his presentation discussed the eco-friendly processing and



Photo 17 Presentation by Mr. Aditya Dalmia, Director of Projects, CVMR Corporation

production of critical metals through vapour metallurgy as a refining process.

He detailed the use of Carbonyl process, which is century old technique that CVMR has optimized for metal extraction. This process uses no acids or solvents for extraction and produces no affluent toxic residue at the plant. Additionally, this process does not involve melting of the metals which is typical in traditional smelting, thereby avoiding greenhouse gases. CVMR has also converted these gases into graphene and graphite through this process. He emphasised the environmental benefits of the process, particularly the lack of any cyanide or leaching in the extraction of gold.

### 5. Special Remarks by Dr Veena Kumari Dermal

At the end of Day 1 of the Summit, Dr Veena Kumari Dermal, Joint Secretary of the Ministry of Mines, Government of India, delivered special remarks and highlighted the following key points:

- The Ministry of Mines in India has been working tirelessly to ensure the supply of critical minerals for downstream industries. The Ministry worked closely with CEEW during the G20 negotiations as part of the energy transition working group. Despite the difficulties, they managed to garner the support of all the G20 nations, resulting in unified – one paragraph statement on the significant role of critical minerals in energy transition.
- The Ministry identified 30 minerals critical for India's downstream industries working closely with CSEP, the



## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

International Energy Association, and CEEW, as well as GSI, to identify these minerals. This process considered the resources available in the country, import dependence, and the role of these minerals in emerging technologies.

- A legislative amendment granted these minerals the status of critical minerals. Out of 30 minerals identified, 24 minerals in which India has some resources available were taken into MMDR Act and given the status of critical and strategic minerals.
- The authority to auction these minerals was centralised to the union government, allowing the mineral blocks to be auctioned by the centre. This is notable, as India is one of the few countries globally where mineral concessions are allotted through an auction process.
- India is one of the initial countries, followed by Brazil, where the power of auction is given to the state governments, but in the case of critical minerals, the power to auction is taken by the central government. Amendment to the MMDR Act in August 2023 led to the auctioning of 20 blocks in November 2023, followed by another 18 blocks in February 2024, and again another seven blocks from the first lot in the month of March 2024. The Ministry is waiting the conclusion of model code of conduct to announce the result of these auctions.
- Addressing supply chain vulnerabilities of critical mineral, involves ensuring the availability of critical mineral to the industry along with the availability of adequate technology for beneficiation, processing and downstream products.
- The ministry's strategy incorporates both the domestic supply, as it is limited by geological constraints, of mineral

concentration, and international sources, particularly in Latin American and African regions.

- In Africa, the focus is on contribution to the local economy and community development, ensuring companies take the local community along their corporate growth. For Latin America, maintaining high production standards are crucial. These considerations are essential for fostering partnerships with countries like Congo, Zambia, or Zimbabwe, and meeting Latin American expectations.
- The ongoing dialogues aim to crystallise actionable strategies and proposal culminating in a comprehensive document to guide government and research organizations in managing critical mineral resources effectively.



Photo 18 Special Remarks by Dr Veena Kumari Dermal at the end of Day 1

## 6. Exhibitions:

Private companies, research labs and government agencies set up exhibitions/booths at the summit to showcase their expertise in the Critical Minerals domain. The exhibitors are as follows:

### 1. CSIR - Institute of Minerals and Materials Technology

CSIR-IMMT, Bhubaneswar showcased the activities of its sister organizations (CECRI, CIMFR, and NIIST, and NML) in processing critical minerals. Cobalt, copper, gallium, germanium, graphite, indium, lithium, platinum group elements (PGE), phosphorus (P), rare earth elements (REE), tungsten, silicon, and others play crucial roles in various industries, from electronics to renewable energy. The exhibition stall highlighted the processing technologies of both primary and secondary resources. The exhibition shed light on the innovative research and technologies being developed to extract, refine, and utilize these minerals effectively.

### 2. Geological Survey of India

Geological Survey of India showcases critical and strategic mineral samples and ores from different parts of India. These included specimens of Glauconitic Sandstone (K-Potash), Phosphorite, Lepidolite Pegmatite (Li-ore), Ilmenite (containing Titanium), Graphite (containing Vanadium), Heterogeneity (Cobalt ore), Chalcopyrite (Copper ore), Psilomelane (Manganese ore), spodumene (Li-ore), REE among others which have been collected from different geological formations in the country.

### 3. Mineral Exploration Corporation Limited

MECL, an autonomous Public Sector Company under the Ministry of Mines, Government of India showcased its expertise in mineral exploration, machinery and hi-tech labs that the company operates in the critical mineral domain. The stall highlighted MECL's technical support auction of critical and strategic mineral blocks that have been put out for auction by the Ministry of Mines recently. The MECL exhibition also included samples of Rock Phosphate, Copper, Potash, Beryl, Wolframite, Scheelite, REE-bearing rocks, and PGE-bearing rocks collected by the company from different parts of India. The hall also provided space for knowledge exchange and discussions on possible partnerships and business-to-business collaborations.



Photo 19 Exhibition booth of Geological Survey of India

## Highlights of Sessions from Day Two

### 1. Panel Discussion on “Policy Incentives and Benefits of Investing in India”

#### Background:

Keeping in view India's vision of becoming self-reliant (or 'Atmanirbhar'), the Government of India has announced Production Linked Incentive (PLI) Schemes for 14 key sectors with an outlay of INR 1.97 lakh crore (over US\$26 billion) to enhance India's manufacturing capabilities and exports. The purpose of the PLI Schemes is to attract investments and cutting-edge technology in key sectors, such as automobiles and auto components, solar PV, batteries, electrolyzers etc. These are all industries that can provide strong long-term off-take to critical minerals produced in the country. It can help increase efficiency and bring economies of scale to the country, making its manufacturing sector globally competitive. Although critical mineral processing isn't explicitly covered under the PLI scheme, various state governments in India offer a comprehensive range of incentives and benefits, including tax exemptions, to attract investors and enhance the competitiveness of manufacturing and processing facilities. This panel examined the current investment landscape, potential challenges, and policy responses to accelerate the development of the country's CRM processing industry.

#### Key Highlights of the Discussion/Actionable:

The discussion revolved around state and national policy incentives and benefits for investing in India, and how to leverage them effectively.



Photo 20 Panel Discussion on “Policy Incentives and Benefits of Investing in India”

- **Leverage India's economic growth:** India is one of the fastest growing economies and has made strides in creating a conducive business ecosystem through business reforms, robust infrastructure, the development of a digital economy, and the creation of the third largest start-up ecosystem, along with other steps. Such an ecosystem could benefit companies planning to create processing and beneficiation capabilities in the country.
- **Financing solutions for CRM processing and beneficiation:** The panellists discussed the need to reassess the existing financial instruments available and modify them to fit the needs of the CRM processing industry. The requirement of long-term attractive financing was discussed, which is imperative for the growth of this sector.

- **Ensuring investor confidence:** The panellists discussed the importance of building investor confidence through regulatory certainty, financing frameworks, and adopting ESG standards across the value-chain.
- **Cluster-based approach:** The need for a cluster-based approach between states in India was highlighted with a potential to promote synergies between mineral-rich states and neighbouring states that specialize in manufacturing low-carbon technologies and recycling infrastructure. The presence of Petroleum, Chemical, and Petrochemical Investment Regions (PCPIRs) overlapping with battery production states presents opportunities for integrated manufacturing setups.
- **Central and state-level incentives:** The discussion highlighted the presence of significant central-level incentives that ranged from PLI schemes covering 14 sectors as well as ambitious EV and renewable energy targets. State-level incentives were also highlighted, including capital subsidies, concessional power tariffs, SGST reimbursement, etc. Panellists highlighted how facilitation services offered by central and state-level organizations like Invest India and the Industrial Promotion and Investment Corporation of Odisha (IPICOL) could better support investors seeking to participate in the establishment of processing and beneficiation capabilities in India.
- **Market Potential of By-products:** The discussion also highlighted that the exploration of by-products from mineral processing is imperative to enhance economics and promote circularity.

Overall, the discussion highlighted the pivotal role played by state governments in providing incentives and facilitating downstream value addition, transitioning from upstream mining to processing and battery production.

## 2. Closing Plenary

The moderators of the panel discussions held over the two days - Mr. Rishabh Jain, Dr Tom Moerenhout and Mr. Siddharth Goel concluded the session by summarising the key insights from their respective discussions. They emphasised the significance of such forums in advancing our collective understanding on Critical Minerals. They expressed appreciation for the diverse participation, which included representatives from Central and State Government agencies, research institutions, industry as well as the academia in the panel discussions that spanned across the two days of the Summit.

### Closing Remarks by Dr Veena Kumari Dermal

In her closing remarks, Dr Veena Kumari Dermal reflected on the extensive discussions held over the two days on critical minerals and highlighted the following key takeaways from the discussions:

- The importance of education in building a skilled workforce was stressed, emphasising the need for developing curriculum for improving exploration, processing, and developing downstream products in the country.
- The potential of alternate sources such as recycling and tailing to augment the supply of minerals was emphasised along with



## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

the importance of incentivising the processing of associated minerals to increase domestic supply.

- The internal capability and capacity of research labs in supporting the processing of critical minerals in the country was acknowledged, highlighting the need for greater collaboration between industry and research lab in future to enhance these efforts.
- The vulnerabilities in the supply chain, due to the lack of responsible practices was acknowledged, underscoring the overarching importance of adopting sustainable development practices throughout the critical minerals value chain.
- She noted the government's initiatives on offshore mining and expressed confidence in future leadership in this area.

Dr Dermal concluded by expressing gratitude to the organisers of the workshop and the stakeholders for their support. She underscored that this summit was merely the first step towards greater coordination and information sharing between stakeholders, essential to fostering a sustainable and robust critical minerals sector in India.

### 3. Site Visit to LOHUM

Day 2 of “Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities” culminated with a visit to the LOHUM Battery Recycling Facility in Greater Noida. LOHUM is renowned as India's largest producer of sustainable energy transition and battery raw materials and holds the distinction of being the only integrated lithium-ion battery lifecycle management company that encompasses battery recycling, repurposing, and material refining.



*Photo 21 Site Visit to LOHUM Battery Recycling Facility on Day 2*

During the site visit, attendees were introduced to the various processes and products involved in recycling, reuse, and manufacture of battery materials. The attendees, comprising representatives from industry, civil society organisations, government research labs, and various embassies received a detailed tour of LOHUM's advanced Cobalt Recycling Facility and Lithium Refinery.

## Appendix 1: Agenda of the Workshop

Time	Day 1: April 29, 2024
09:30 AM	Registration
10:00 AM	<b>Inaugural Session</b> <ul style="list-style-type: none"> <li>Welcome Remarks: Shri Nitin Desai, Board Member, Shakti</li> <li>Introductory Remarks: Dr Arunabha Ghosh, CEO, CEEW</li> <li><b>Keynote Speech: 'The Future of Critical Minerals in India'</b> - Shri VL Kantha Rao, Secretary, Ministry of Mines</li> <li><b>Signing of MoU</b> on Knowledge Support</li> <li>Context Setting: Vivek Chandran, Director, Shakti</li> </ul>
11:00 AM	<p>Panel Discussion: <b>'Building India's capability in processing and beneficiation technologies'</b></p> <p><b>Panellists:</b></p> <ul style="list-style-type: none"> <li>Dr Deependra Singh, CMD, Indian Rare Earths Limited</li> <li>Dr Ramanuj Narayan, Director, Institute of Minerals and Materials Technology, Bhubaneswar</li> <li>Dr Narasimha Mangadoddy, Professor, IIT Hyderabad</li> <li>Mr Rino Raj, CEO Energy and Battery Business, Tata Chemicals</li> <li>Mr Anjani Sri Mourya Sunkavalli, Founder and MD, ALTMIN</li> <li>Mr Rajat Verma, Founder &amp; CEO, LOHUM</li> </ul> <p><b>Moderator:</b> Rishabh Jain, Senior Programme Lead, CEEW</p>
12:00 PM	<b>Tea Break and Networking</b>
12:15 PM	<p>Panel Discussion: <b>'Strategies for Scaling: Processing for Domestic and Global Markets'</b></p> <p><b>Opening remarks on India's potential to address global bottlenecks in critical mineral processing</b> - Dr Tom Moerenhout, Critical Minerals Lead, Columbia University Centre on Global Energy Policy</p> <p><b>Special video address:</b> Anand Sheth, Founding Chairman, International Lithium Association</p> <p><b>Panellists:</b></p> <ul style="list-style-type: none"> <li>Rajib Maitra, Partner, Deloitte Consulting</li> <li>Dandara Ataide Salvador, Research Scientist, Geological Survey of Finland GTK</li> <li>Kristi Disney Bruckner, Law &amp; Policy Director, The Initiative for Responsible Mining Assurance</li> <li>Amit Chatterjee, Chief R&amp;D Officer, Vedanta Limited</li> <li>Veda Vaidyanathan, Associate Fellow, Centre for Social and Economic Progress</li> </ul>

## The Critical Minerals Summit: Enhancing Beneficiation and Processing Capabilities

	<b>Moderator:</b> Dr Tom Moerenhout, Critical Minerals Lead, Columbia University Centre on Global Energy Policy
<b>01:30 PM</b>	<b>Lunch Break</b>
<b>02:15 PM</b>	<b>Technology Session</b> <ul style="list-style-type: none"> <li>• <b>India's geological potential, resource/reserves of critical and strategic minerals &amp; Shaping the Future: Critical Minerals Auction and Technical Specifications of Ores and Minerals:</b> Mr. Dinesh V. Ganvir, Additional Director General &amp; Head, National Mission-II, GSI</li> <li>• <b>Address:</b> Dr K Balasubramanian, Distinguished Scientist &amp; Director, Nonferrous Materials Technology Development Centre, India</li> <li>• <b>Presentations on innovative processing technologies – 15 mins each (10 mins presentation and 5 mins Q&amp;A)</b> <ul style="list-style-type: none"> <li>➤ Dr Abhilash, Senior Principal Scientist &amp; Group Leader, CSIR-NML</li> <li>➤ Dr Shivakumar Angadi, Principal Scientist, CSIR-IMMT</li> <li>➤ Dr Pankaj Kumar Jain, Assistant Professor, IIT Dhanbad</li> <li>➤ Dr Soobhankar Pati, Co-Founder and Director R&amp;D, Cellark Powertech Pvt Ltd., Cuttack</li> <li>➤ Mr Riju Bhatnagar, Technical Advisor, Saru Smelting Pvt. Ltd., &amp; Mr Shashank Jain, Director, Saru Smelting Pvt. Ltd., Meerut</li> <li>➤ Mr Joe Walsh, Managing Director, Lepidico Ltd</li> <li>➤ Aditya Dalmia, Director Projects, India, CVMR Corporation</li> </ul> </li> </ul>
<b>04:00 PM</b>	<b>Tea break</b>
<b>04:15 PM</b>	Continuation of Technology Presentations
<b>05:30 PM</b>	<b>Special Address</b> Dr Veena Kumari D., Joint Secretary, Ministry of Mines
<b>06:30 PM</b>	<b>Networking Dinner</b>
<b>Time</b>	<b>Day 2: April 30, 2024</b>
<b>10:00 AM</b>	Panel Discussion 'Policy Incentives and Benefits of Investing in India'  Presentation by <b>Romil Ravi, Principal Investment Specialist, Invest India</b> (15 min) <b>Panellists:</b> <ul style="list-style-type: none"> <li>• Shri Bhupendra Singh Poonia, Managing Director, IPICOL &amp; IDCO</li> <li>• Shri V. G. Venkata Reddy, Director of Mines and Geology, Government of Andhra Pradesh</li> <li>• Mayur Karmarkar, Managing Director, India, International Copper Association</li> <li>• Sameer Guduru, Director for Technology, Manufacturing and Supply Chains, US-India Business Council</li> </ul> <b>Moderator:</b> Siddharth Goel, Senior Policy Advisor, International Institute for Sustainable Development

11:30 AM	Tea Break
11:45 AM	<b>Closing Plenary:</b> <ul style="list-style-type: none"> <li>Report out on key takeaways and learnings</li> <li>Concluding Remarks: Secretary Ministry of Mines – Dr Veena Kumari D., Joint Secretary, Ministry of Mines</li> </ul>
12:30 PM	Lunch
01:30 PM	<b>Site Visit</b> (Through registration and confirmation by organizers) Site visit location: LOHUM Battery Recycling Facility
07:00 PM	Close of Day 2

## Appendix 2: Participation Summary

TYPE OF ORGANIZATION	Count
Academic Institutions	7
CSO (Think-tank, non-for-profits)	46
Government Agency	18
PSUs	21
Embassies	11
CSIR Labs	4
Research Institutions	9
Exploration and Processing Industry	29
Private Company	31
<b>Total Participation</b>	<b>176</b>



