

Critical Energy Transition Mineral Value Chain

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Agenda

- Net-zero and material needs
- Geopolitics
- Equitable Transition
- Responsible sourcing and closing the loop
- Issues and Policy Challenges

Climate

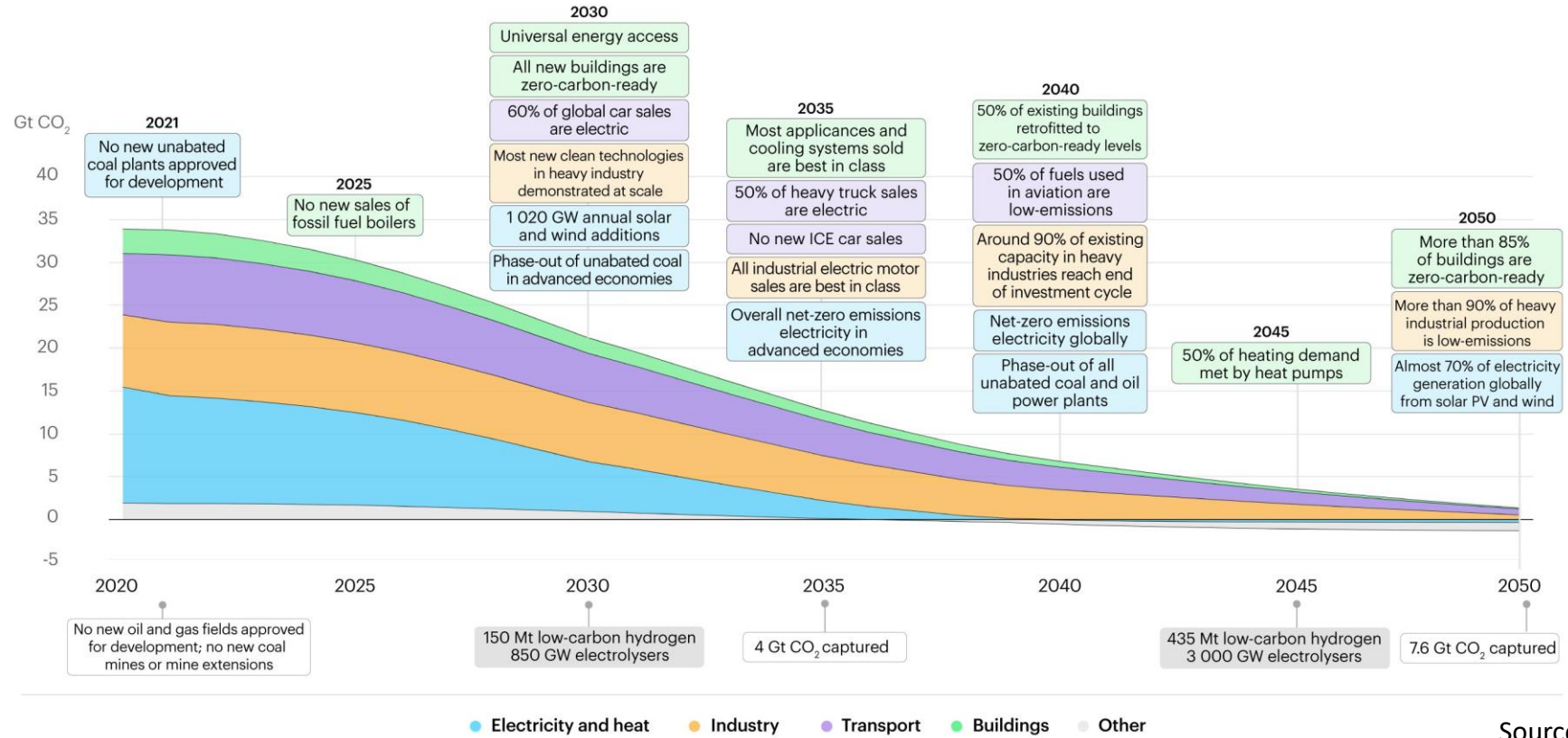
80% likelihood.

Annual average global temperature will temporarily exceed 1.5°C above pre-industrial levels for at least one of the next five years (2024-2028)

WMO Global Annual to Decadal Climate Update Report: 2024



Uninterrupted supply of 'critical materials' is important for transition



Source: IEA, 2021

Critical Minerals

CMs are metals and non-metals that are vital for national security and for enabling low-carbon energy transition, yet their supply may be at risk due to geological scarcity, geopolitical issues, trade policies etc.



Automobile



Renewable Energy



Batteries



Medical



Hydrogen



Nuclear



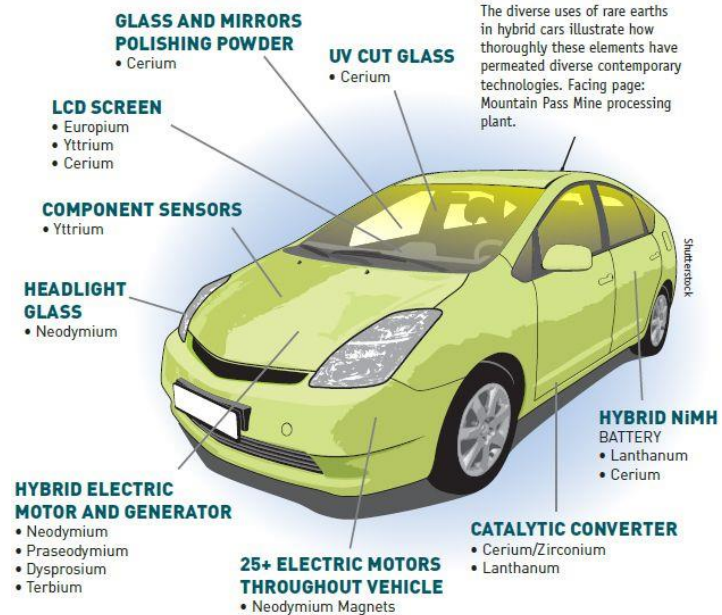
Electronics



Defence

‘Critical Minerals’ for energy transition are termed ‘**Critical Energy Transition Minerals**’ in the UN SGs report.

Usage Example



Source: <https://minesmagazine.com/1737/>

Image source: Microsoft online images

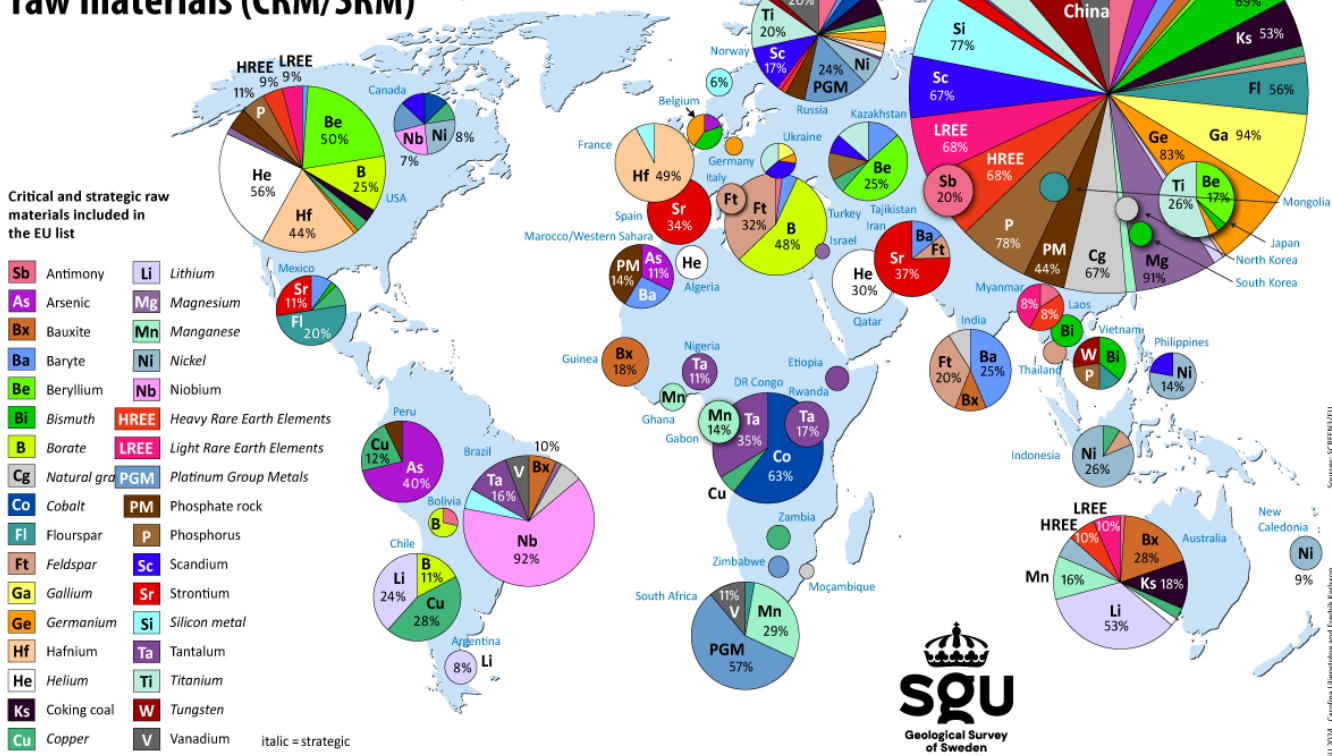
Critical mineral needs for clean energy technologies

	Copper	Cobalt	Nickel	Lithium	REEs	Chromium	Zinc	PGMs	Aluminium*
Solar PV	●	●	●	●	●	●	●	●	●
Wind	●	●	●	●	●	●	●	●	●
Hydro	●	●	●	●	●	●	●	●	●
CSP	●	●	●	●	●	●	●	●	●
Bioenergy	●	●	●	●	●	●	●	●	●
Geothermal	●	●	●	●	●	●	●	●	●
Nuclear	●	●	●	●	●	●	●	●	●
Electricity networks	●	●	●	●	●	●	●	●	●
EVs and battery storage	●	●	●	●	●	●	●	●	●
Hydrogen	●	●	●	●	●	●	●	●	●

Importance	High	●	Moderate	●	Low	●
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Source: IEA

Global production of critical and strategic raw materials (CRM/SRM)



Circle = estimates of each country's average production between the years 2016 and 2020, calculated on a percentage by weight basis.

Production = primary production

The percentages = share of world production

The map shows, among other things, that China completely dominates the total production, even if they do not produce all critical raw materials.

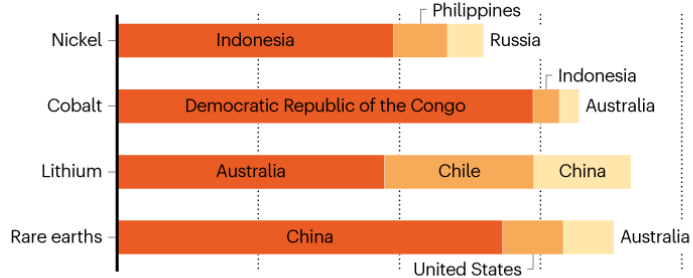
Source: <https://www.sgu.se/en/mineral-resources/critical-raw-materials/>

Mining and Processing of CMs

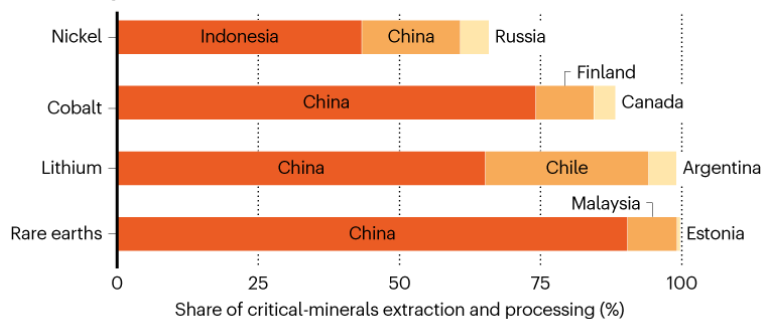
RARE SOURCES

The top three extractors and processors of various critical minerals by country in 2022. According to the International Energy Agency, there has been limited progress in diversifying these sources since 2019.

Extraction



Processing



©nature

- Energy transition undeniably hinges on the secure supply of critical minerals.
- China currently holds a near-monopoly in the global critical minerals market.
- There are growing concerns about potential geopolitical risks due to China's control over these vital resources.

Image source: <https://www.nature.com/articles/d41586-023-02330-0>

Geopolitics

Major Players

- China
- Australia
- Canada
- Africa

Supply Restrictions

- 2010: China Restricted rare earth exports to Japan.
- 2023: China Imposed export bans on gallium and germanium, retaliation against U.S. chip restrictions.
- Nickel Ban (2020): Indonesia Banned raw nickel ore exports to attract domestic processing, securing Chinese investments in refining.
- Russia-Ukraine: Disrupted palladium and titanium supply chains, affecting global markets.

Strategies

- EU's Critical Raw Materials Act (CRMA): Aims to boost domestic mining, processing, and recycling while securing deals with Chile, Namibia, and Indonesia.
- U.S. Inflation Reduction Act (IRA, 2022): Incentivizes domestic mineral sourcing and partnerships with Australia, Canada, and Japan.
- U.S.-Japan Critical Minerals Agreement (2023): Grants Japan access to IRA incentives for EV battery production.
- Japan's Diversification Efforts: Invested in rare earth recycling and alternative sourcing.

Germany's demand on international raw materials markets

Selected raw materials and their major producing countries in 2018

- Ag: Silver ore
- Al: Bauxite
- As: Arsenic
- B: Boron
- Ba: Baryte
- Be: Beryllium
- Cr: Chromite ore
- Cu: Copper ore
- F: Fluorite
- Fe: Iron ore
- Ga: Gallium
- Ge: Germanium
- Li: Lithium carbonate
- Mg: Magnesium
- Mn: Manganese ore
- Ni: Nickel ore
- P: Phosphate
- PGE: Platinum group elements
- Pb: Lead ore
- S: Sulphur
- Se: Selenium
- REE: Rare-earth elements
- Sb: Antimony
- Si: Silicon
- Te: Tellurium
- Ti: Titanium ore
- W: Tungsten
- Zn: Zinc ore
- Zr: Zircon

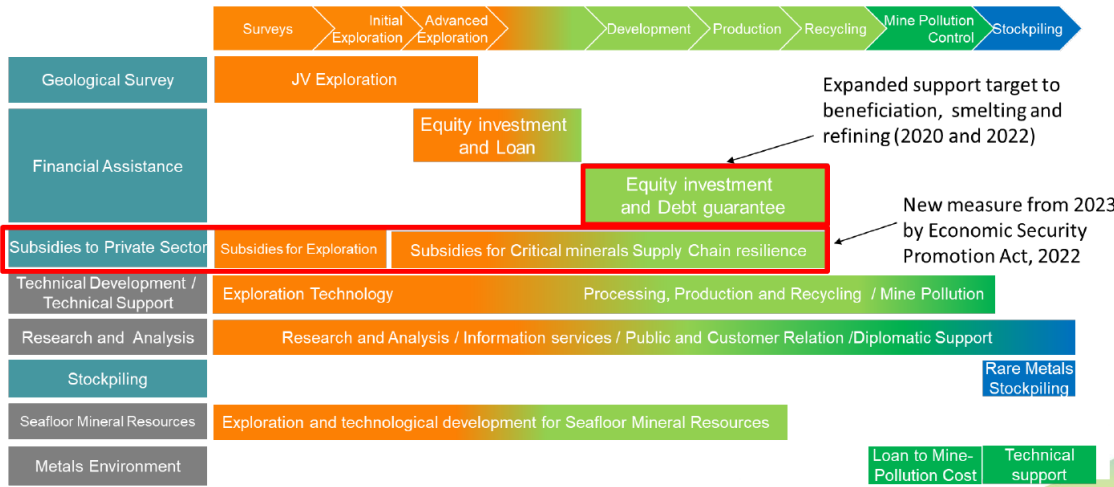


- IEA, May 2024
- Maintain friendly trade and investment ties
 - Reduce critical dependencies in critical sectors by diversifying its supply chains.
 - Export control procedures to ensure that German products are not misused for human rights violations

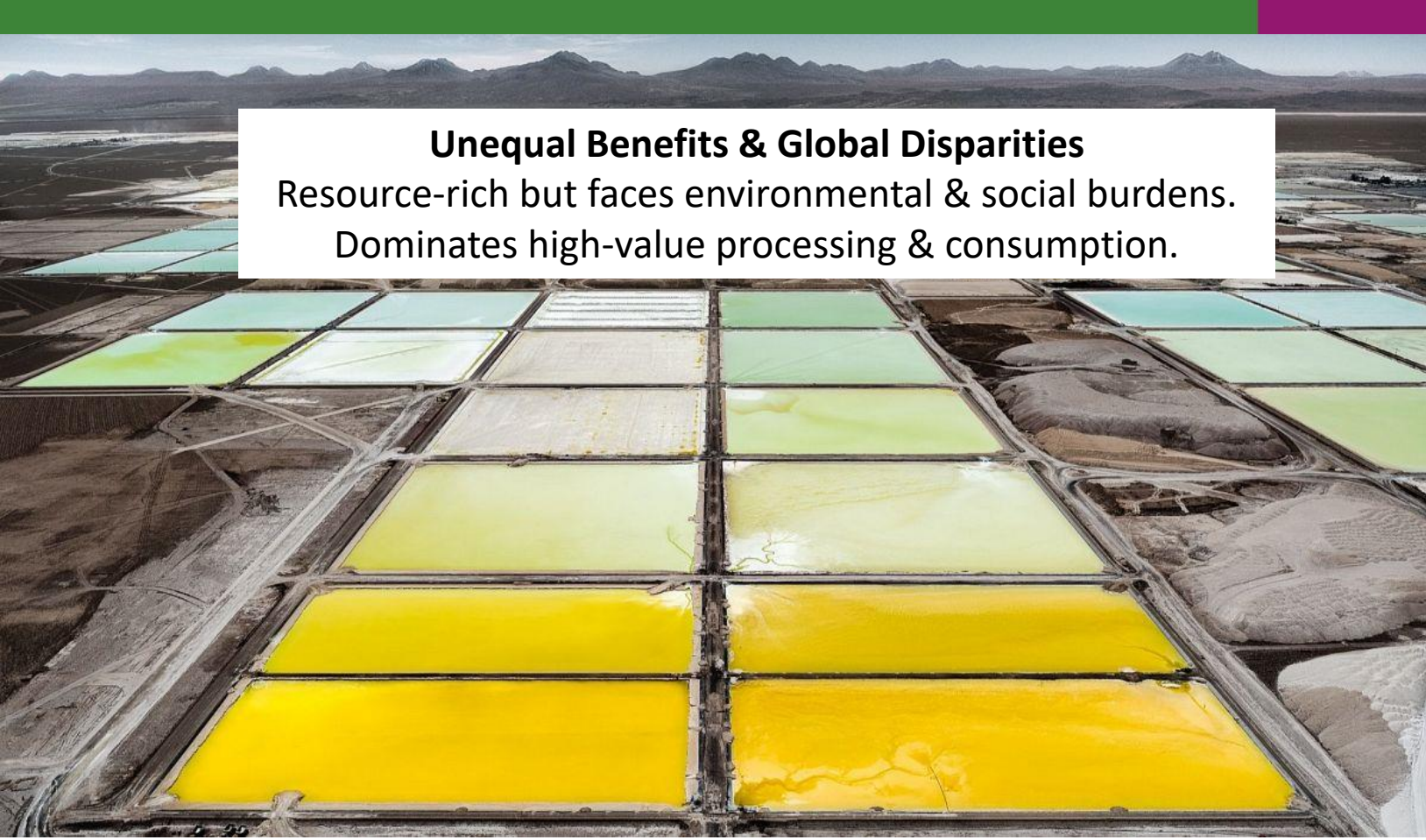
Japan's critical minerals list for stockpiling

Antimony	Nickel
Barium	Niobium
Beryllium	Platinum group metals
Bismuth	Rare earth elements
Boron	Rhenium
Carbon	Indium
Cesium	Rubidium
Chromium	Selenium
Cobalt	Silicon
Fluorine	Strontium
Gallium	Tantalum
Germanium	Tellurium
Hafnium	Thallium
Lithium	Titanium
Magnesium	Tungsten
Manganese	Vanadium
Molybdenum	Zirconium

- Japan's International Resource Strategy 2020
- Stockpiling (authorised under Article III.11(xiii) of the Act on Japan Oil, Gas and Metals National Corporation (JOGMEC)
- Stockpiling for 60 Days and 180 Days



Source: JOGMEC

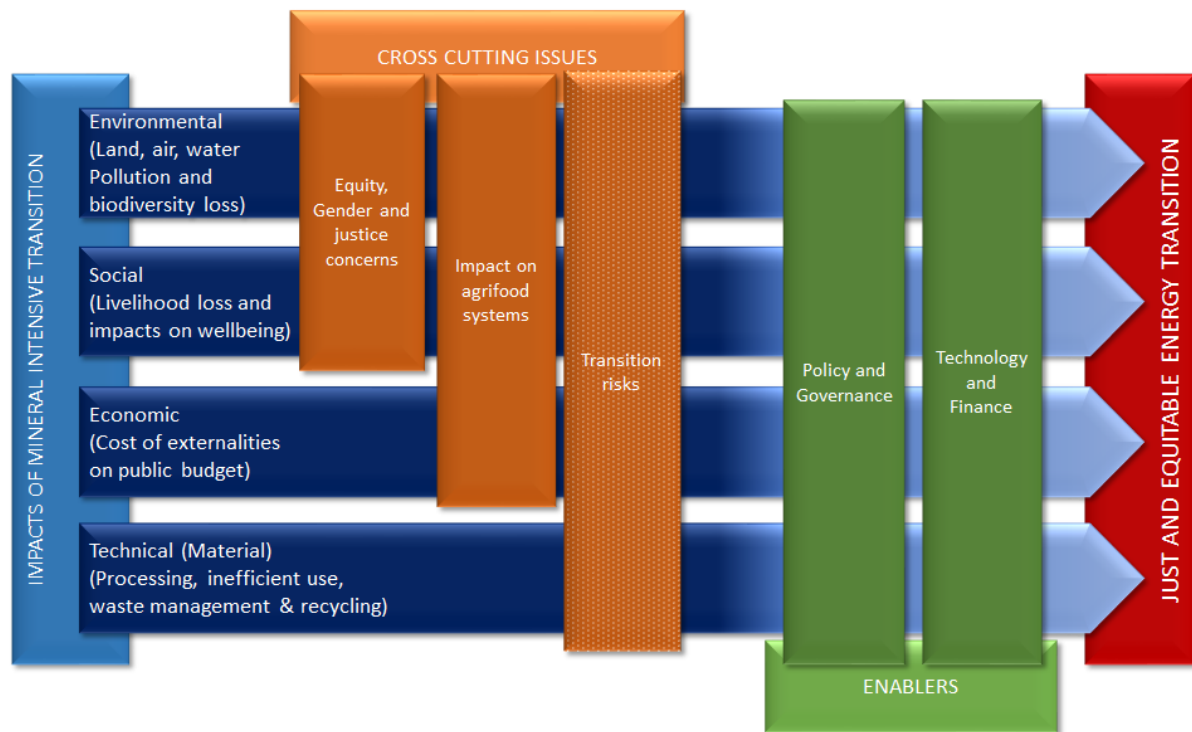


Unequal Benefits & Global Disparities
Resource-rich but faces environmental & social burdens.
Dominates high-value processing & consumption.

'Lithium Fields' in the Salar de Atacama salt flats in northern Chile.

Image source:
<https://www.euronews.com/green/2022/02/01/south-america-s-lithium-fields-reveal-the-dark-side-of-our-electric-future>

Energy Transition Minerals: Key challenges and cross-cutting issues



- Prioritise environmental protection, social justice, and fair trade.
- Uphold labour rights & governance to prevent inequalities.
- Align with planetary justice perspectives.

Image source: Janardhanan & Tamura (2024)
<https://tinyurl.com/4chutd7f>

Circularity in ETM Value Chain can address supply & environmental challenges

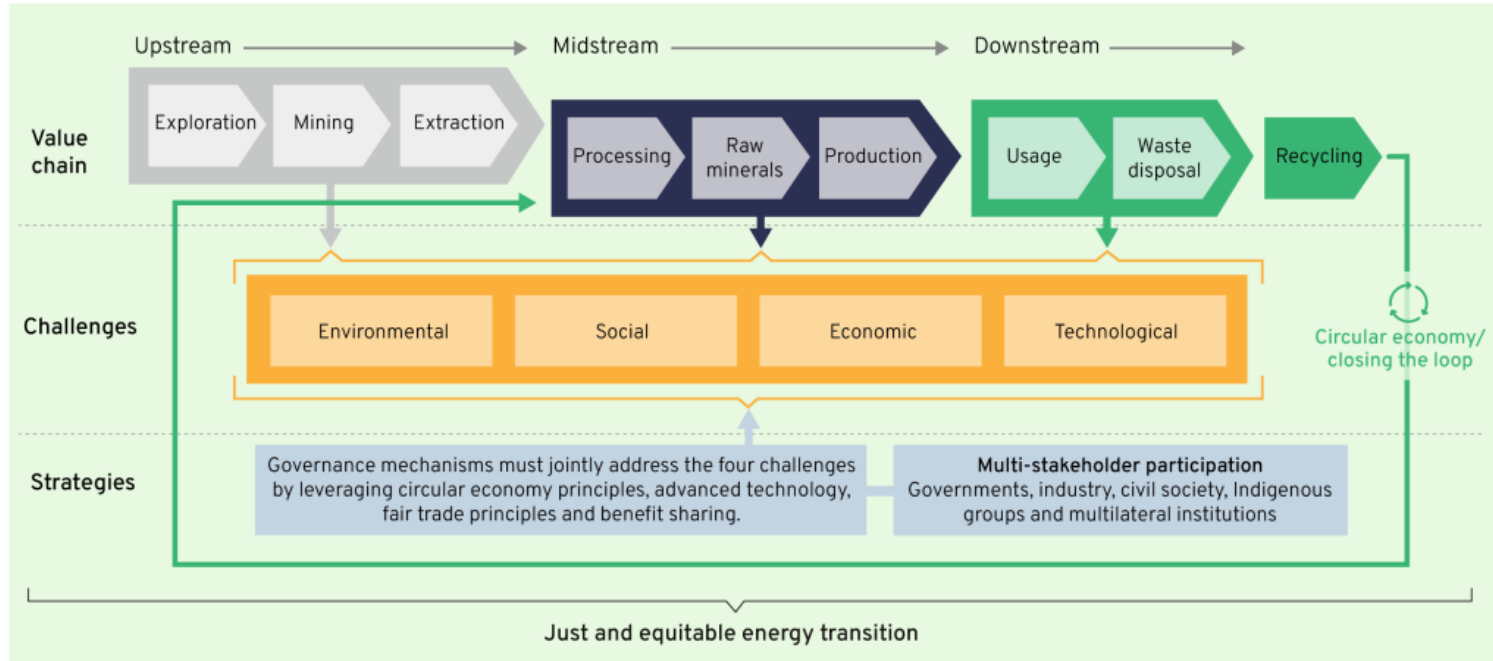


Image Source: Janardhanan et.al, 10NICS, (2024)



11 SEPTEMBER 2024

RESOURCING THE ENERGY TRANSITION

PRINCIPLES TO GUIDE CRITICAL
ENERGY TRANSITION MINERALS
TOWARDS EQUITY AND JUSTICE

Seven Principles: UN Secretary-General's Panel on Critical Energy Transition Minerals

- **Human rights** must be at the core of all mineral value chains.
- The **integrity** of the planet, its environment and biodiversity must be safeguarded.
- **Justice and equity** must underpin mineral value chains.
- Development must be fostered through **benefit sharing**, value addition and economic diversification.
- Investments, finance and trade must be **responsible and fair**.
- Transparency, accountability and anti-corruption measures are necessary to ensure **good governance**.
- Multilateral and international **cooperation** must underpin global action and promote peace and security.

Policy Challenges

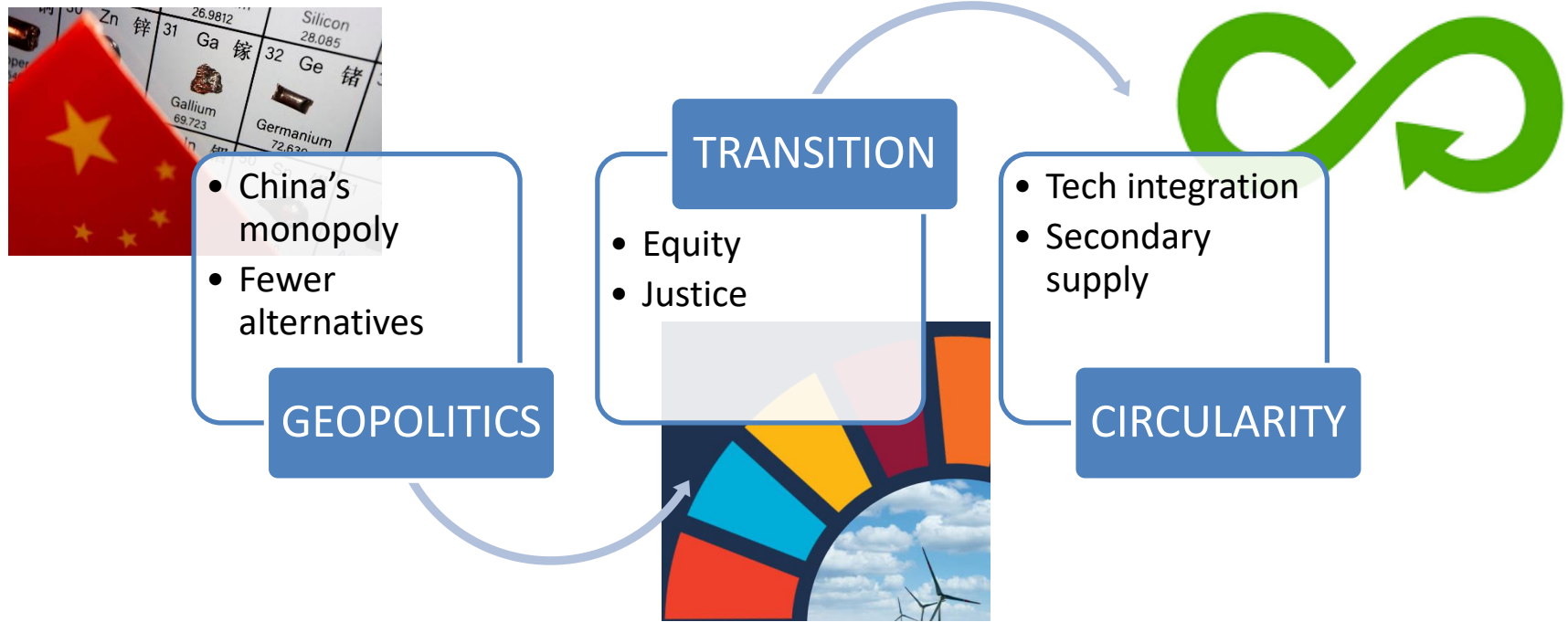


Image source: Microsoft online images

Way forward

- Governance towards accessibility and availability- 'Onshoring and friend shoring'



Geopolitical challenges



Price Volatility



Transparency in Supplies
& Blockchain

Way forward

- Finance mechanisms towards just and equitable transition- 'Benefit Sharing'



Environmental Impacts



Indigenous Community



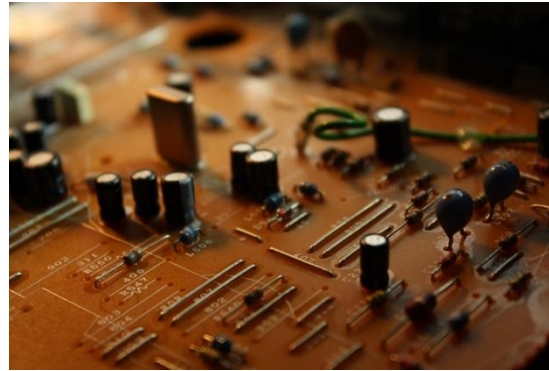
Sustainability

Way forward

- Accelerating technology integration- 'Circularity'



Recycling and
urban mining



Demand side
management-
design &
technology



Research and
Development

Need for a Multi-stakeholder Global Mechanism



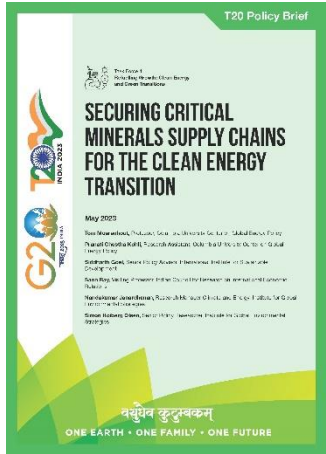
Voluntary frameworks are helpful- danger of ‘selective adoption’ of least restrictive standards. [**Extractive Industries Transparency Initiative (EITI)** and **OECD Due Diligence Guidance for Responsible Mineral Supply Chains**]

Partnerships- National regulations, Regional or Country Grouping. [**MSP, EU Critical Raw Materials Act** and **U.S. Inflation Reduction Act**]

Gaps in global coordination and trade disputes

Time for another Paris Agreement –a UN led mechanism?

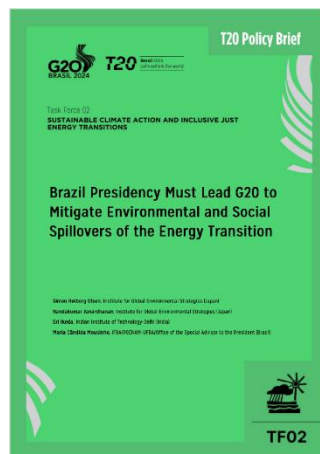
IGES Research on Critical Minerals



Policy Brief
G20 2023



Policy Brief
G7 2023



Policy Brief
G20 2024



Report
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Report
7th GEO (UNEP)

Thank
You

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