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Whither the energy transition? **Overcoming the** critical minerals supply challenges

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Critical minerals

Critical minerals

High degree of strategic and economic importance

Potential for supply risks.



Energy transition and critical minerals

Technologies for clean energy transition are resource intensive, even compared to conventional fossil fuel technologies



Source: Author, with images from Flaticon.com

Minerals used in clean energy technologies





Source: Figures regenerated with data from IEA's Critical Minerals Data Explorer

Increasing demand for critical minerals

- Energy transition to stir sharp increase in the demand for critical minerals
- Projections from several agencies including the World Bank (2020), IEA (2021) and IRENA (2021) results vary but all indicate sharp rise
- IEA (2021) Outlook: Achieving net-zero transition will increase mineral demand over six times by 2040 (figure below)

Mineral demand for clean energy technologies by scenario Source: IEA (2021)



Massive demand surge in several key minerals expected by 2040



Source: Based on data from IEA (2021)

Concerns with critical minerals

- Energy transition efforts for decarbonisation are pushing the demand for critical minerals
- If the demand for critical minerals is not fulfilled, progress towards energy transition and decarbonisation will slow down and may lead to a range of issues including export bans and geopolitical conflicts
- The production and supply of critical minerals may also cause additional socioenvironmental challenges
- What should be the role of governments and various international and regional groups in addressing these challenges?



How have governments responded so far

- Many countries have adopted policies for critical minerals
- A common practice: List of critical materials and minerals
- 13 list since 2023 indicating the urgency



Last year an official critical minerals list was published Source: Evenett and Fritz (2023)

Countries	List of Critical Minerals
United States (50 critical minerals as per 2022 list)	Aluminium, antimony, arsenic, barite, beryllium, bismuth, cerium, cesium, chromium, cobalt, dysprosium, erbium, europium, fluorspar, gadolinium, gallium, germanium, graphite, hafnium, holmium, indium, iridium, lanthanum, lithium, lutetium, magnesium, manganese, neodymium, nickel, niobium, palladium, platinum, praseodymium, rhodium, rubidium, ruthenium, samarium, scandium, tantalum, tellurium, terbium, thulium, tin, titanium, tungsten, vanadium, ytterbium, yttrium, zinc, zirconium
European Union (34 critical raw materials as per 2023 list)	Aluminium/bauxite, coking coal, lithium, phosphorus, antimony, feldspar, light and heavy rare earth elements, scandium, arsenic, fluorspar, magnesium, silicon metal, baryte, gallium, manganese, strontium, beryllium, germanium, natural graphite, tantalum, bismuth, hafnium, niobium, titanium metal, boron/ borate, helium, platinum group metals, tungsten, cobalt, phosphate rock, vanadium, copper, nickel
Canada (31 critical minerals as per 2022 list)	Aluminium, antimony, bismuth, cesium, chromite, cobalt, copper, fluorspar, gallium, germanium, graphite, helium, indium, lithium, magnesium, manganese, molybdenum, nickel, niobium, platinum group metals, potash, rare earth elements, scandium, tantalum, tellurium, tin, titanium, tungsten, uranium, vanadium, zinc

Source: US Geological Survey (2022), European Commission (2023), Ministry of Natural Resources Canada (2022).

How have governments responded so far

- Response to geopolitical tensions has been uneven
- Some advanced economies Canada, Italy and Germany – have revamped their efforts to secure critical minerals
- Opposite trend in other developed countries including Japan and the United States



Total number of overseas financing measures related to critical materials Source: Evenett and Fritz (2023)

How can G7 address critical minerals supply chain challenges





Critical Minerals for Net-Zero Transition: How the G7 can Address Supply Chain Challenges and Socioenvironmental Spillovers

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* The views expressed in this policy brief are of the authors and do not reflect those of any organization or government.

• IGES-led Policy Brief for Think 7 2023, the Group of Seven (G7)'s official engagement group of think tanks

• Focus:

Challenges facing energy transition as demand for critical minerals grows
The role that the G7 can play in addressing these challenges

IGES researchers led the development of this T7 Policy Brief, with contributions from researchers and academics from the United Nations University, Institute for Advances Study of Sustainability (UNU-IAS), International Institute for Sustainable Development (IISD), Center for Global Energy Policy of Columbia University, and United Nations Economic and Social Commission for Western Asia (UN ESCWA)

Three major challenges

Challenges to critical minerals supply lines

- Production and processing of critical minerals are based in a small number of countries – raising concerns about supply predictability
- Higher geopolitical risks
- Supply chain disruptions cause price hikes

Socioenvironmental spillovers of the critical minerals value chain

- Meeting the growing demand for minerals may cause "international spillovers" – the negative socio-environmental impacts in the producer/supplier countries
- It is further exacerbated by the lack of effective enforcement of environmentalregulations in some producing countries

Lack of investment, alternatives and recycling

- Recycling and recovery of critical minerals ("urban mining") is very low
- Finding alternatives is limited and difficult
- Insufficient investment in critical minerals value chain



Addressing the challenges

Secure adequate supplies of critical minerals

 Strengthen domestic industries, scientific expertise and human resources

- Reinforce R&D
- Foster cooperation and knowledgesharing among G7

Strengthen circular economy, address socioenvironmental concerns

- Implement sustainable sourcing practices
- Address negative spillovers associated with minerals extraction and supply
- Adopt policies to manage demand and reduce wastage
- Take comprehensive approach to address the environmental challenges



Addressing the challenges

Encourage investment, promote R&D

Encourage R&D into new technologies and substitute products to reduce demand for critical minerals

 Promote public private partnerships to finance large-scale projects in safe, secure and environmentally sustainable manner

Promote broader collaboration

- Foster coordinated efforts for sustainable practices, encourage innovation and address supply chain and environment-related concerns
- Build joint G7-G20 platform, engage stakeholders
- Align national/multilateral strategies to address critical minerals concerns

G7 countries' growing network of critical materials deals

- There is a growing effort from G7 countries to develop collaborations and deals with various countries and regional groupings around the world
- Almost all of them are very recent (on or after 2020)
- Often these deals lack specificity
- Minerals Security Partnership (June 2023) between 10 developed countries and the European Commission – focuses on the entire value chain of critical minerals



*Finland, France, Germany, Sweden, and the European Commission

G7 countries' growing network of critical materials deals Source: Evenett and Fritz (2023)

The role of G20 countries

T20 Policy Brief



SECURING CRITICAL MINERALS SUPPLY CHAINS FOR THE CLEAN ENERGY TRANSITION



May 2023

Task Force 4

uelling Growth: Clean Energy

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- IGES researchers have also contributed to a T20 Policy Brief on critical minerals supply chains
- Focus: gaps in minerals supply and investment challenges
- Recommendations: G20 should develop a working group for promoting sustainable supply chain, facilitating investment and improving environmental, social, and governance (ESG)
- Coordination of efforts among the members as well as with the emerging economies, multilateral investment agencies, NGOs and other stakeholders is emphasised

References

- ESCAP. 2023. "Implications of the Energy Transition on Sustainable Critical Minerals Development in Asia and the Pacific Aligning Extractive Industries With the Sustainable Development Goals Aligning the Extractive Industry With Sustainable Development."
- European Commission. 2023. "Study on the Critical Raw Materials for the EU." https://doi.org/10.2873/725585.
- Evenett, Simon J, and Johannes Fritz. 2023. "The Scramble for Critical Raw Materials: Time to Take Stock? The 31st Global Trade Alert Report." London.
- IEA (n.d). Critical Minerals Data Explorer. https://www.iea.org/data-and-statistics/data-tools/critical-minerals-data-explorer (accessed 6 August 2023)
- IEA. 2021. "The Role of Critical Minerals in Clean Energy Transitions." *World Energy Outlook Special Report*. https://doi.org/10.1787/f262b91c-en.
- Janardhanan, Nandakumar, Mustafa Moinuddin, Simon Høiberg Olsen, Temuulen Murun, Satoshi Kojima, Akio Takemoto, Upalat Korwatanasakul, et al. 2023. "Critical Minerals for Net-Zero Transition: How the G7 Can Address Supply Chain Challenges and Socioenvironmental Spillovers." *T7 Task Force 2 Policy Brief: Wellbeing, Environmental Sustainability, and Just Transition*. Think7. https://kebijakankesehatanindonesia.net/images/2019/policy_brief_wujudkan_keadilan_sosial_dalam_jkn.pdf.
- Ministry of Natural Resources Canada. 2022. The Canadian Critical Minerals Strategy, from Exploration to Recycling: Powering the Green and Digital Economy for Canada and the World.
- Moerenhout, Tom, Pranati Chestha Kohli, Siddharth Goel, Saon Ray, Nandakumar Janardhanan, and Simon Hoiberg Olsen. 2023. "Securing Critical Minerals for the Energy Transition." T20 Policy Brief: Task Force 4 Refuelling Growth: Clean Energy and Green Transitions.
- U.S. Geological Survey. 2022. "2022 Final List of Critical Minerals." 2022 Final List of Critical Minerals. Vol. 2. https://www.usgs.gov/news/national-news-release/us-geological-survey-releases-2022-list-critical-minerals.



Thank you

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