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Critical Minerals and the New Geopolitics of the Green Transition

Insights from Energy Talk 2026

The green transition promises to reduce Europe's dangerous dependence on fossil fuels often produced in autocratic states, but it may also create new strategic dependencies. Technologies central to decarbonization — such as batteries, wind turbines, electric vehicles, and solar panels — rely on critical minerals whose mining and processing remain highly concentrated.

At the 2026 Energy Talk, "Critical Minerals and the New Geopolitics of the Green Transition", organised by the Stockholm Institute of Transition Economics (SITE) in collaboration with the FREE Network, leading researchers and industry representatives examined these tensions from three perspectives: the geopolitical significance of Ukraine's mineral endowment; the regulatory and distributional challenges of Sweden's mining sector; and the sustainability and competitiveness pressures facing European firms in critical mineral supply chains. This policy brief summarises the main takeaways from the event.

Background

A central promise of the green transition is to reduce Europe's exposure to geopolitical risk. For decades, dependence on fossil fuels — concentrated in a handful of autocratic or semi-autocratic states — had made European democracies structurally vulnerable to political coercion. Russia's full-scale invasion of Ukraine in 2022 brought that vulnerability into sharp relief, accelerating a shift toward renewable energy that climate advocacy alone had struggled to achieve. For the first time, the moral case for decarbonisation and the strategic case for energy security pointed in the same direction.

Yet as the transition accelerates, a new question has moved to the centre of European policy debate: are we escaping one dependency only to construct another? The technologies at the heart of decarbonisation — batteries, wind turbines, electric vehicles, solar panels — depend on critical minerals whose deposits are geographically concentrated and whose processing is dominated, to a degree that should give pause, by a single external power. The logic is uncomfortably familiar. The material has changed; the structural problem has not.

At the same time, many of the raw materials needed for the green transition are known to exist in Europe. What is lacking is not geological potential but a clear idea of how to navigate trade-offs between economic and possibly environmental costs in developing capacity in Europe, and potential future strategic vulnerabilities.

This policy brief grows out of the 2026 Energy Talk, Critical Minerals and the New Geopolitics of the Green Transition, organised by the Stockholm Institute of Transition Economics (SITE) in collaboration with the FREE Network. The event brought together leading researchers and industry representatives to examine these tensions from three angles: the geopolitical stakes surrounding Ukraine's significant but embattled mineral endowment; the regulatory and distributional obstacles that prevent Sweden — despite its considerable deposits — from translating geological wealth into production; and the sustainability and competitiveness pressures bearing down on European firms operating in critical mineral supply chains.

From Fossil Fuel Dependency to Mineral Dependency: The Geopolitical Stakes

Jesper Roine, Adjunct Professor at Stockholm School of Economics and Deputy Director of SITE, opened by framing critical minerals as a central geopolitical challenge of the green transition. As Roine noted, Russia's full-scale invasion of Ukraine in 2022 succeeded in making resource dependency an urgent political issue in a way that years of climate advocacy had not. The transition to renewables offers structural relief: unlike fossil fuels, often concentrated in autocratic states, wind and sunlight are globally distributed. Yet the minerals required to build renewable infrastructure are themselves geographically concentrated, and their processing is, to an alarming degree, dominated by a single power. Europe risks replacing one form of dependency with another unless it navigates this landscape carefully.

Jiayi Zhou, Senior Researcher at the Stockholm International Peace Research Institute (SIPRI),

provided a broader geopolitical perspective, drawing on two recent SIPRI reports. She argued that critical minerals have undergone a threefold transformation: politicisation, securitisation, and militarisation. What began as industrial policy to reduce dependence on Chinese processing has increasingly shifted toward zero-sum security arguments and, more recently, into direct links with conflict dynamics — in Ukraine, the DRC, and in Trump-era manoeuvres around Greenland and Venezuela. This fragmentation risks slowing the green transition globally and squeezing resource-rich developing countries caught between great powers. One discussed example was the US reportedly considering withholding HIV aid to Zambia unless it expanded access to minerals for American investors — a dynamic Zhou called a race to the bottom.

Ukraine's Mineral Potential and the Imperative of Industrial Integration

Zhou went on to argue that Ukraine sits at the intersection of these pressures. Russian-occupied territories are estimated to contain 40 to 50 per cent of the assessed value of Ukraine's critical mineral deposits. Russia's 2024 Minerals Development Plan explicitly targets integrating those resources into the Russian economy, while the US-Ukraine Reconstruction Investment Fund extends preferential access to American investors amid simultaneous US outreach to Russia on business opportunities. Zhou concluded that the EU is the least equipped among the great powers to compete in a world of militarised resource mercantilism, though it retains normative and standards-based appeal. Ukraine risks becoming a casualty of great-power competition rather than a beneficiary.

Olha Evstigneeva, PhD researcher in climate economics at the Institute for Economics and Forecasting of the National Academy of Sciences of Ukraine, Development Director at the Ukrainian Association of Renewable Energy, and Decarbonisation Expert, spoke from Kyiv. She described Ukraine as undergoing an accelerated and involuntary transition that other countries have yet to fully engage with. The EU's Carbon Border Adjustment Mechanism already affects roughly 20 per cent of Ukraine's exports, with around 70 per cent now directed to the EU. "This is no longer about going green," she noted, but about "controlling value chains, markets, and industrial competitiveness." Despite losing 30 to 40 gigawatts of generation capacity as a result of the war, Ukraine has continued to advance its climate and EU integration agenda. This includes 61 per cent implementation of EU renewable energy legislation, roughly 85 per cent alignment with its 2030 targets, and the fastest deployment of energy storage in Europe.

On minerals, Evstigneeva urged realism. Ukraine holds significant reserves of lithium, graphite, titanium, manganese, and iron ore, but much of the underlying geological data dates from the 1980s and 1990s and falls short of current investment standards. Confirming a single deposit requires USD 100-300 million and 10-12 years, an especially difficult task under wartime conditions. Ukraine's lithium is hard-rock spodumene, which requires more energy-intensive processing at a time when the electricity system is severely damaged. The strategic question, she argued, is not whether Ukraine has resources, but whether it

will remain a raw material supplier or become part of Europe's industrial base. She proposed a phased model: extraction and primary processing first, refining and components next, and full battery value-chain integration over time. She also noted that Ukraine's rapidly expanding drone industry and broader military technology sector are creating domestic demand for many of these same materials. In this sense, critical minerals are no longer just about energy transition but also about technological sovereignty.

Sweden: The Gap Between Mineral Potential and Mining Reality

Sweden holds some of Europe's most significant mineral deposits, including rare earth elements, iron ore, copper, nickel, and lithium. Alongside Finland, Norway, and Greenland, it has the potential to supply a substantial share of the critical raw materials Europe requires. Yet turning that geological potential into production has proved persistently difficult. The presentations by **Maria Sunér**, CEO of Svemin, the Swedish Association of Mines, Mineral and Metal Producers, and **Daniel Spiro**, Professor of Economics at Uppsala University, pointed to a common diagnosis: Sweden has the geology, the institutions, and the technological capactity, but lacks a regulatory and distributional framework that allows mining to work for investors, local communities, and the state alike.

Sunér set Sweden's mining sector within a broader European context. Europe produces only around 3 per cent of the raw materials it consumes, while accounting for 25 per cent of global production. Sweden alone accounts for 90 per cent of the EU's iron ore production, yet Europe still imports 70 per cent of its iron ore needs. China, meanwhile, dominates key processing stages, including over 60 per cent of cobalt processing and more than 90 per cent of rare earth refining. The EU's Critical Raw Materials Act set targets of 10 per cent domestic extraction and 40 per cent domestic processing, but Sunér argued that these are unlikely to be reached under current conditions. Sweden has just 13 active metal mines, and the most recent opened only two years ago, the first in more than a decade. Environmental permitting alone can take seven years, and a full mining project typically takes 15 to 35 years from exploration to production. Four fully permitted mines are currently still seeking final financing. According to Sunér, the main obstacles are the regulatory framework and limited access to capital, particularly for early-stage projects, an area in which Sweden lacks the financing culture found in countries such as Canada or Australia.

Spiro approached the issue from an economic perspective and identified two structural barriers. First, local communities and landowners have little incentive to support extraction. Under Sweden's current system, landowners receive only 0.15 per cent of the value of minerals extracted from their land, while bearing the environmental costs of hosting a mine. Their main source of leverage, therefore, lies in delaying projects through the regulatory process rather than in negotiated compensation. Second, private investment is discouraged by a hold-up problem: exploration involves high upfront costs and uncertain returns, while a highly profitable discovery may trigger political pressure to revise the tax or royalty regime after the fact. Such uncertainty weakens incentives for long-term investment. The result is a paradox:

Sweden has favourable geology, political stability, high human capital, and one of the world's more generous investor profit-sharing systems, yet private investment remains limited, and firms still argue that conditions are not attractive enough.

To break this deadlock, Spiro outlined three regulatory alternatives. The first is state-led exploration and extraction, with revenues redistributed to local communities. This could help address both the hold-up problem and local opposition, though potentially at the cost of efficiency. The second would require local communities and landowners to conduct exploration themselves, giving them ownership of any discoveries and thereby aligning their interests with project outcomes. The third — Spiro's preferred approach — adapts elements of the Norwegian model: exploration and investment would be susbsidised by a set percentage, matched by an equivalent excess-profit tax to preserve investment neutrality; a nationally owned company would participare as co-investor to increase transparency and reduce the risk of retroactive rule changes; revenues would be shared with host communities; and projects would be required to carry comprehensive environmental insurance covering long-term liabilities after mine closure.

In the discussion, Sunér challenged some of Spiro's premises. She noted that Sweden's environmental code is already among the strictest in the world, and cited polling suggesting that around half of Swedes would accept living near a mine. She also emphasised that 90 to 97 per cent of mine employees at most Swedish sites are local residents. Still, both speakers agreed that the core question remains unresolved: how to ensure that host communities genuinely benefit from large extractive investments. In this respect, mining reflects a broader challenge that Sweden shares with other sectors affected by large-scale industrial projects.

European Firms: Navigating Competitiveness, Sustainability and Geopolitics

Aaron Maltais, Senior Research Fellow at the Stockholm Environment Institute (SEI), presented findings from a 2026 paper in *Business Strategy and the Environment*, based on interviews with companies downstream in critical mineral supply chains, including utilities, wind and solar firms, battery manufacturers, EV producers, and defence companies. He began with a striking illustration of the material intensity of modern technologies: a single 171-gram smartphone requires around 125 kilograms of mined rock. Scaled to the batteries and clean technologies needed for the green transition, the resulting material demands are staggering.

The firms interviewed were broadly committed to sustainable supply chain management and often saw synergies between sustainability and competitiveness. As one battery-sector respondent put it: "You can't sell on one end a product for the energy transition and pollute endlessly on the other." Companies identified human rights, conflict minerals, forced labour, and carbon emissions as key priorities, although the discussion also revealed a tendency to focus more heavily on carbon, partly due to data availability. Corporate practice has also evolved, from reactive controversy management to more systematic risk prioritisation, and from auditing first-tier suppliers

to engaging more directly with upstream mining companies. Recycling of critical raw materials was widely viewed as important, but current capacity remains far below what is needed. Europe has roughly one-tenth of the recycling capacity required to meet its 2031 targets, and many planned projects face financing and technical barriers.

EU legislation was broadly welcomed for harmonising standards and reinforcing the credibility of sustainability requirements. At the same time, companies pointed to an overlapping and sometimes contradictory regulatory landscape. For example, pressure to meet EU fleet-emissions targets could lead automakers to relax supply chain sustainability standards to source enough vehicles quickly. Geopolitical dependency was another major concern, particularly where firms saw little real alternative to Chinese suppliers. Firms are responding through vertical integration and longer-term purchase agreements, but these measures do not eliminate underlying structural dependencies. Maltais concluded that the EU needs greater policy coherence across industrial strategy, due diligence legislation, and sustainability objectives, alongside stronger international standards and more credible multi-stakeholder initiatives with genuine civil society participation.

Concluding Remarks

The picture that emerges from the day's discussions could easily be read as cause for alarm — yet the event pointed toward pragmatism rather than pessimism. The trajectory of Europe's green transition, while broadly positive, is neither assured nor without risk. Resource endowments are the easier part. Governance, institutions, investment frameworks, distributional fairness, and political will are what determine whether mineral wealth becomes a foundation for resilience — or a new source of vulnerability.

Speakers

Jesper Roine – Adjunct Professor, Stockholm School of Economics; Deputy Director, SITE

Jiayi Zhou – Senior Researcher, Stockholm International Peace Research Institute (SIPRI)

Olha Evstigneeva – PhD Researcher in Climate Economics, Institute for Economics and Forecasting, National Academy of Sciences of Ukraine; Development Director at the Ukrainian Association of Renewable Energy and Decarbonisation Expert

Maria Sunér – CEO, Svemin, the Swedish Association of Mines, Mineral and Metal Producers

Daniel Spiro – Professor of Economics, Uppsala University

Aaron Maltais – Senior Research Fellow, Stockholm Environment Institute (SEI)

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Jesper Roine is Professor at the Stockholm School of Economics and the Deputy Director at the Stockholm Institute of Transition Economics (SITE). Most of his research concerns income and wealth distribution and long-run development, but he has also worked on political economy and the impact of natural resources on the economy.

In addition to his research, Roine participates widely in the policy debate. He is one of the

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founders and a regular contributor to the economics blog ekonomistas.se (written in Swedish). Roine has written a number of reports on issues such as globalisation and income distribution, the future of the Swedish welfare state, and how the Swedish government should manage its mineral resources. He is currently a member of the government's commission on the future of work.