# Niobium and the EU:
## *Green Dreams or War Machines?*

## Introduction

Launching the European Green Deal (EGD) in late 2019, European Commission President, Ursula von der Leyen, committed the European Union (EU) to net-zero carbon emissions by 2050. To achieve this goal, the EU aims to mobilise substantial fiscal and financial resources towards establishing a 'world-leading' EU-based green technology industry via the Green Deal Industrial Plan. A cornerstone of the Plan is to secure access to critical raw materials (CRMs) needed to produce green technologies. CRMs are minerals and metals needed for supposedly green industrial processes with limited global supplies. However, concerns have been raised that the EU's Green agenda also provides cover to source critical raw materials that are used for carbon intensive and military puposes – including automobiles, aerospace, and weapons.

Assessing whether the EU's Green Deal risks being repurposed to support carbon-intensive and arms industries is not straightforward, because there is little data available on the end uses of critical raw materials nor on the major players in their supply chains. This briefing aims, for the first time, to build a supply chain map for a specific critical raw material (as identified by the EU) from extraction to end use: niobium. Niobium is primarily used to enhance the strength, flexibility, and lightness of steel products. Although the EU underscores its use in green technology, by deploying new research methods and consulting various data sources, this briefing clearly shows that niobium's supply chain is dominated by automotive, aerospace and arms firms. This raises major questions for civil society and policymakers about whether the Green Deal has strayed from its intended purpose.

## Policy background

At the beginning of 2019, the EU presented its flagship EU Green Deal. The Deal initiated a raft of policymaking aimed at achieving its core goal of reaching net-zero by 2050. To this end, recent legislation mobilises substantial fiscal and financial resources towards establishing a 'world-leading' green technology industry. Core to this policy agenda is the EU's Green Deal Industrial Plan (GDIP), announced by the European Commission (EC) President in 2023. Underpinned by a range of financial instruments including a €45bn investment by the European Investment Bank, the GDIP aims

to "secure the EU's industrial lead in the fast-growing net-zero technology sector". Two key legislative proposals of the GDIP are close to entering into force: First, the Net Zero Industry Act (NZIA) is awaiting adoption by the European Council, following political agreement in February 2024. The NZIA adopts targets for achieving 40% domestic production of key green technologies by 2030. Second, and in support of this goal, the Critical Raw Materials Act (CRMA) that "aims at ensuring a diverse, secure, and sustainable supply of critical raw materials for the EU's industry" was adopted by the European Council on 18 March 2024. The CRMA is a core part of the Green Deal Industrial Plan.

The biggest challenge for the EU is its total import dependency on the critical raw materials needed to build a green industrial base – such as copper and lithium for e-mobility and electrification. Recognizing the need to access the necessary primary raw materials and metals, the Critical Raw Materials Act (CRMA) sets out to secure supplies of CRMs. To do so, the CRMA (i) mandates the EU to build comprehensive strategic partnerships with supplier countries, backed up by concrete roadmaps for increasing and diversifying supplies; (ii) secure new trade and investment treaties with resource rich countries that are key trading partners for the EU, and (iii) mobilise public money to promote public-private partnerships through the Global Gateway. It also sets up a European Critical Raw Materials Board to oversee and coordinate implementation of the CRMA with member states.

The CRMA includes a list of 34 critical raw materials, for which the EU intends to enhance and secure its international supplies. Importantly, this CRMA list is not new, but adopted from the 'Critical Raw Materials list' which was first developed in 2008 by the European Raw Materials Initiative. The Initiative's goal was not green transition, but boosting European industry by "[s]ecuring reliable and undistorted access to raw materials... for the EU's competitiveness' '. It identified its critical materials according to their industrial significance, prevalence, substitutability, and concentration of supply. As explained by the European Commission in 2011, "[c]ritical raw materials are those which display a particularly high risk of supply shortage in the next 10 years and which are particularly important for the value chain." The Initiative's Critical Raw Materials list has subsequently been updated every three years according to shifts in these metrics and target industries.

While the EU's Green Deal Industrial Plan (2023) makes no mention of 'aerospace or defence', the EU's Critical Raw Materials Act identifies critical and strategic raw materials required for "strategic technologies" – a category which includes 'aerospace and defence' industries. Indeed, the CRMA explicitly sets out to 'identify the raw materials needed to achieve the EU's twin transition and defence and aerospace objectives'. Both are identified as sectors where demand for CRMs is expected to increase, adjusting its criteria for identifying 'economic importance' to include these sectors. Furthermore, the CRMA reserves the right for policymakers to add 'strategic' CRMs to the list which do not meet the transparent criteria for inclusion.

As such, the list of materials and minerals considered critical and strategic will be largely decided by market demand. This demand will itself be shaped by the EU's 2024-9 strategic agenda which prioritises military spending and militarised security policies, while the ecological transition takes a back seat. In less than five years, the EU has shifted its priorities from the European Green Deal toward the need to bolster the arms and military industries – which themselves require large quantities of CRMs. To that end, former European industry Commissioner, Thierry Breton, has regularly advocated a shift towards 'war economy mode' while the European Commission President has called for the EU to 'turbocharge defence - industrial capacity'. Indications are that the forthcoming five-year institutional cycle will continue along this path of prioritising military spending for arms production, an activity that necessarily relies on CRMs. With militarism and war being one of the most significant contributors to global warming however, the use of CRMs that are apparently for a green transition being diverted to the arms industry, as this briefing shows, is deeply problematic. This means that materials needed for the green transition are ultimately likely to serve as key inputs for polluting fossil fuel, automotive and arms industries. The arms industry in particular is a significant contributor to greenhouse gas emissions. Furthermore, the CRMA does not specify targets on quantities or value of materials to be secured, or for what precise purposes they will be used. As such, a profound lack of transparency on the actual usage of materials secured and procured hangs over the GDIP, the CRMA, and the broader Green Deal.

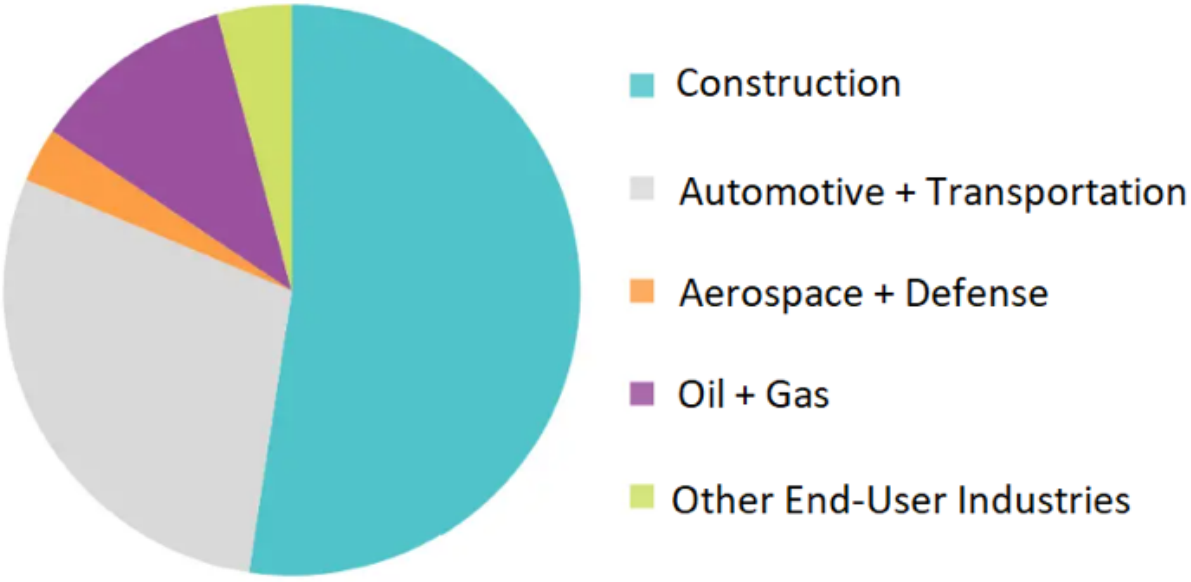
# Niobium

One such critical raw material which is included on the CRMA list is niobium. Niobium was identified by British chemist Charles Hatchett in 1801, and introduced to commercial applications in the early 20th century. Its prime application is in producing strong, flexible and lightweight steel products. These are mainly for use in the transport industry, for oil and gas pipelines, and in the construction sector. Most niobium flows into the global construction industry, with use in the production of automobiles a strong and growing driver of demand. The market for niobium is expected to increase by over two-thirds by 2029. The EU estimates that 92% of the world's niobium is sourced from Brazil, and EU member-state economies are entirely import-dependent for their supplies of the metal.

Niobium has multiple uses for the green transition. Industry emphasises how it reduces the carbon content of steel by making it stronger, requiring less material production. Niobium also has proven uses for solar fuel production, solar cells and electrodes for batteries. The NZIA identifies niobium as a critical raw material in the production of wind turbine frames. It has also been touted as a potential addition to or substitute for lithium-ion batteries to extend their charge and lifecycle, for the production of hydrogen fuel cells, as a coating for advanced batteries, and in 3D printing.

For these reasons, treating niobium as a CRM for the green transition may appear justified. But niobium does not appear on the CRMA list for its green use cases. Instead, it was added to the European Raw Materials Initiative's Critical Raw Materials list in 2011. Reviews at the time noted its utility as an industrial input in steels (vehicles, construction, pipelines) and as a superalloy (some 4% of total annual production is used for heat-resistant superalloys typically used in industrial and aircraft gas turbines). Indeed, around 92% of global supplies are estimated to be used to produce steel. So while its green uses and potential for use in energy grids, storage batteries and wind turbine frames are widely emphasised, it is at present overwhelmingly used for purposes with little relation to the green transition.

## Niobium Market, Volume (%), by End-user Industry, Global, 2020




Source: Mordor Intelligence
https://rockstone-research.com/index.php/en/research-reports/5934-Niobium-and-Rare-Earth-Elements-Building-our-future-with-superalloys,-superconductors-and-supermagnets

Beyond the dubious inclusion of a material on the Green Deal's CRM list which is extensively used in carbon-intensive transportation (autos and aircraft), there is intense and growing interest in the military applications of niobium. Indeed, niobium is far more 'critical' for the aerospace and military sector than in other industry, since it is indispensable for the production of products such as engine turbine blades, aircraft fuselages, drones, and hypersonic missiles. Similar to civilian aircraft, niobium is found in the engines of fighter jets and helicopters. As an alloy with depleted uranium, it is also used in high-impact warheads and military armour. Russia reportedly uses advanced niobium radars in Ukraine, and the United States and China are vying over control of the raw material to develop hypersonic missiles.

According to military experts, hypersonic missiles are considered to be at the forefront of future warfare because of their speed and manoeuvrability, rendering existing air and missile systems redundant. As the U.S. Department of Defense notes, hypersonics "are extremely difficult to detect and counter given the weapons' speed and manoeuvrability, low flight paths and unpredictable trajectories". Niobium is central to the development of such weaponry. The EU is itself increasingly involved in what strategists call "the grand chessboard of defence geopolitics [in which] niobium has emerged as a piece of paramount importance". The European Commission's February 2022 roadmap on critical technologies for security and defence observes that "there is a global race for technological leadership and the associated economic and military advantages" including over critical raw materials. It has launched the European Hypersonic Defence Interceptor Programme (EU HYDEF). Funded with €100 million from the European Defence Fund and managed by the Organisation for Joint Armament Cooperation (OCCAR), the programme aims to develop a defence system against hypersonic cruise missiles and hypersonic glide vehicles. Therefore, the arms industry is keen to include high-performance niobium alloys to create such lethal and resilient materials, capable of withstanding the intense heat of hypersonic flight.

Overall, then, it would seem that claims that niobium is critical for renewable energy and e-mobility obfuscates predominant use in steel production and specialised use in weapons manufacturing. The EU's own Foresight Study (which identified niobium as a key input into both green technology as well as military applications such as drones and combat aircraft) supports this hypothesis.

# Niobium Supply Chain

Given this context, it is important to better understand the major end uses and key corporate players in European niobium supply chains – and to identify the main corporations with direct interests in securing access to the metal. To show how 'green' materials and the EU's green agenda have become entangled with support for the aerospace and military sectors, which are most certainly not green, this report maps, for the first time, the supply chain of niobium at the firm-level. We show that under the cover of pursuing a 'green dream', the EU's much vaunted green industrial policy is substantially aimed at securing EU member state's auto, aircraft and military industries.

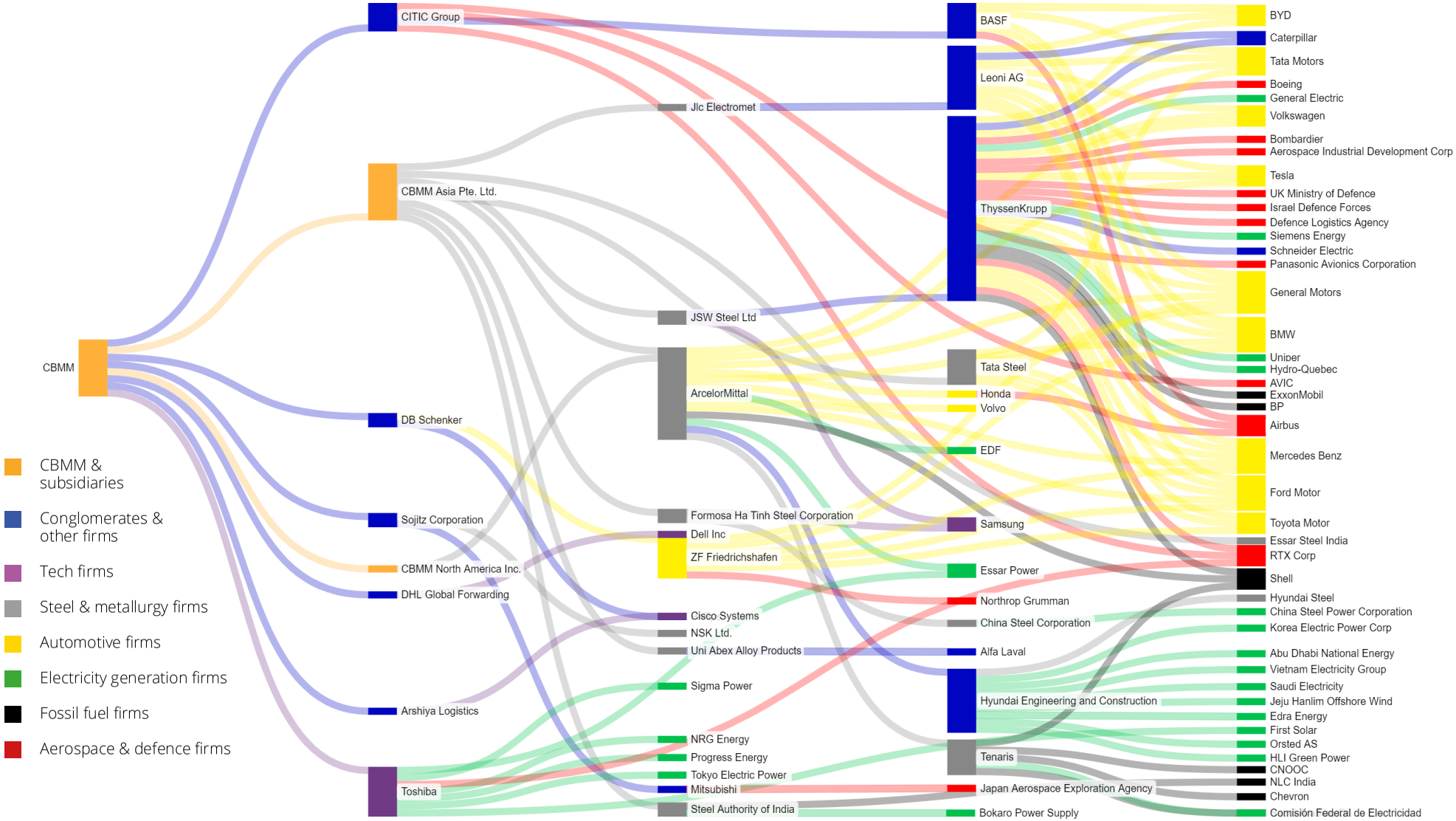
This section maps the supply-chain linkages that connect the world's leading producer of niobium, Brazilian firm Companhia Brasileira de Metalurgia e Mineração (CBMM), to corporate customers across the supply chain to end users. To examine these interfirm links, we draw on supply-chain data from S&P Capital IQ Pro and Bloomberg Professional, data services which help us map supply chains by supplying data collected from a variety of sources including annual company reports, algorithmic estimates, and customs authorities.[1]

The niobium supply chain starts with exploration and mining, extracting niobium ore, primarily pyrochlore. The ore is then crushed, ground, and concentrated. This concentrate is refined into niobium oxide or ferroniobium alloys, which are shipped to manufacturers. Manufacturers use these refined products to produce high-performance materials for industries like aerospace, defence, automotive, and construction.

1 Comprehensive data coverage for Brazil at the 8-digit HS classification level.

FIGURE 1

# The Niobium Supply Chain.




Source: Own elaboration of data from S&P capital IQ and Bloomberg Professional (2024)

The starting point of the Niobium supply chain analysis is CBMM, a Brazilian company that accounts for a staggering 80% of global niobium production. In addition to mining the minerals at its site in Araxá, the company also refines, smelts, and processes niobium into final and intermediate products for export around the world. Given its near-monopoly and vertical integration, the range of its corporate customers give an important picture of the global niobium supply chain and the main users of niobium. While our graphic is not meant to be comprehensive (and the limits of the data mean we cannot say with absolute certainty that niobium is involved in any given supply linkage), it does illustrate important characteristics of the supply chain.

While it does reveal the presence of some 'clean energy' firms which are likely using niobium for energy systems (such as First Solar and Siemens Energy), the data shows that key downstream players in the niobium supply chain are partially or directly at odds with the goals of the EU's Green Deal. Firms like BMW, Mercedes Benz, Volkswagen and Tata are major producers of internal combustion automobiles, and given the uncertain viability of niobium-lithium batteries, they are likely to be acquiring niobium for use in combustion engine autos. Shell, BP and Exxonmobil are amongst the world's biggest extractors and processors of fossil fuels.

The range of military end users of niobium is another striking feature of the supply chain analysis. The UK Ministry of Defence, the Israel Defense Forces (IDF), and the US Defense Logistics Agency are all revealed to be connected to German steel multinational and arms firm ThyssenKrupp. Moreover, arms company RTX Corp,, (formerly Raytheon), which also supplies the IDF, produces missiles, bombs and components for fighter jets, which likely also rely on niobium. RTX was recently revealed to have received a contract from US Naval Air Systems Command to work on an air-launching hypersonic missile. ZF Friedrichhafen (although in Figure 1 labelled as automotive firm given its chief lines of business) also produces the transmission for the whole Boxer family of armoured vehicles (and may be the most important company on the German market for some parts of military land systems). And Airbus also acquired niobium, likely for its jet engines and other aerospace and military uses.

Our research also supports the qualitative analysis presented in the 'Blood on the Green New Deal' report produced by Corporate Europe Observatory and Observatoire des Multinationales, which demonstrates extensive corporate lobbying for expansion of the scope of the EU's CRM list by fossil fuel and arms firms. It raises concerning questions about the direction of EU green policy which should be further investigated by policymakers as the green legislative agenda continues to unfold. Moreover, policymakers should deepen collaboration with social partners to develop new supply chain measures to better understand end uses of CRMs.

# Conclusion and recommendations

Since the launch of its green agenda, the EU has increasingly prioritised military spending and capacity-building over its net-zero ambitions. Analyses of Europe's efforts to secure critical raw materials suggest that the European Union's green industrialization plans are increasingly entangled with industrial and defence interests. Our supply chain analysis shows that niobium, a critical raw material used in steel products, embodies this tension. While touted for its potential in clean energy applications, niobium predominantly serves carbon-intensive sectors such as automotive and aerospace. Moreover, its pivotal role in military technologies, including hypersonic missiles and interceptor systems, underscores its strategic importance beyond green initiatives.

The European Green Deal Industrial Plan and the Critical Raw Materials Act aim to ensure EU-based firms' access to critical raw materials like niobium. However, these efforts risk veering towards supporting industries that perpetuate environmental degradation and deepen geopolitical tensions rather than advancing green industrialization. The lack of transparency surrounding the allocation and utilisation of these materials complicates efforts to ensure they align with the climate agenda.

Finally, the supply chain analysis alludes to the broader new geographies of extraction that are emerging under the so-called green transition with many of the critical raw materials being targeted by the US, EU and China located across the Global South. This raises the question of whether and how states in the Global South can ensure maximum local socio-economic benefit while minimizing environmental harm - instead of replicating historical patterns of elite capture by local and foreign actors. This is particularly important, given how the analysis of the niobium case shows the predominance of transnational corporations—primarily from the US, EU, and China—in these supply chains in the automotive, construction, fossil fuel and arms industry. In this context, whether and how can states and social movements across the Global South ensure that we collectively are moving towards a globally just transition - and what should the EU be doing to support such efforts, rather than undermine them?

To navigate these complexities and to ensure that green initiatives serve their stated purpose, policymakers should consider the following measures:

- **Develop a Transparent CRM List:**
  The EU's Green Deal Industrial Plan should create a new list of critical raw materials, clearly specifying their necessity for the green transition. This list should be transparent and based on the actual end uses of these materials.
- **Implement Comprehensive Tracking Systems:**
  Establish methods for tracking critical raw materials throughout the supply chain, from importation as raw or processed materials to their incorporation in end products. This will ensure that their usage aligns with green transition goals.
- **Enhance Transparency and Accountability:**
  Increase transparency regarding the end uses of CRMs secured under the Green Deal Industrial Plan and the Critical Raw Materials Act. Policymakers should also assess the carbon emissions associated with CRM supply chains.
- **Prioritise Socio-Ecological Transition:**
  Ensure that critical raw materials are used solely for socio-ecological transitions, supporting renewable energy and sustainable technologies and not fossil fuel-intensive and arms industries which deepen the climate crisis. Establish regulations that prevent the diversion of these materials to military applications.

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