# **Circular Economy for transition minerals:** Supporting a just social-ecological transition in Latin America or perpetuating global inequalities?

November 2026

FARN
FUNDACIÓN AMBIENTE Y RECURSOS NATURALES

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To reference this document:

Fundación Ambiente y Recursos Naturales (2026). Circular Economy for transition minerals: Supporting a just social-ecological transition in Latin America or perpetuating global inequalities? Buenos Aires. Available at: https://farn.org.ar/documentos/circular-economy-transition-minerals-position-paper/

# Abstract

The promotion of a Circular Economy (CE) has gained momentum over the past decade particularly among resource-intensive economies in the Global North in order to secure its access to minerals, to reduce dependency on resource-rich countries -mostly from the Global South- and to support their sustainability agenda.

Although there is not a single definition of CE, most approaches emphasize extending the life-cycle of products through measures such as reuse, remanufacturing and recycling as means of minimizing waste. Yet the concept usually remains rooted on business-as-usual approaches, following a paradigm of "sustainable" growth and market efficiency that focuses on technical solutions, efficiency gains and recycling over strategies to reduce absolute primary raw materials consumption. These approaches fail to acknowledge planetary boundaries and fall short in addressing the systemic change needed to tackle the multiple ecological crises and social inequality the world faces.

While metal recycling and efficiency measures are important, continued growth of the total production will also drive-up overall extraction and emissions, exacerbating the degradation of ecosystems and human rights violations associated with mineral value chains. Moreover, recycling of metals, such as metals gained from Li-ion batteries, to date tends to be energy and emissions intensive, and often requires using hazardous chemicals in the process.

Current CE approaches and implementation policies lack a comprehensive, global, and territorial perspective. Most of the knowledge and research on CE is produced in so-called developed countries in the Global North, which have the highest material footprints and largely shape dominant CE narratives and strategies. As a result, debates on CE tend to be disconnected from the resource base on which this economy depends, lacking a territorial perspective in its implementation strategies. CE is primarily associated with finished products at the end of their useful life and with recycling. However, this framing disregards the initial impact of mineral extraction and product manufacturing. It treats products as if they had no origin nor impacts, despite the huge negative environmental and social costs they have on the territories where the raw materials are extracted.

Moreover, CE is expected to generate jobs, (re-)industrialisation, value creation and economic growth, while the geographic distribution of investments and employment gains is mostly overlooked. Although some economic sectors are expected to grow and emerge, such as secondary material production, repair and remanufacturing, waste management and recycling activities, early adopting countries in the Global North might capture a disproportionate share of most benefits by exporting CE expertise and technology. CE initiatives led by developed economies risk harming workers and industries in countries where the extractive sectors are the basis for the economy. While slower production cycles, less consumption of natural resources especially in Global North countries are more than ever needed, they must be addressed with a holistic approach that leads to the wellbeing of societies and global wealth distribution.

CE can provide positive incentives if it is implemented with a comprehensive, global, equitable, and territorial perspective. This requires expanding the concept beyond the management of materials, recognizing its potential as a strategy for the structural transformation of North–South economic relations. Such a transformation should include the reduction of primary raw materials consumption especially in Global North countries, while respecting planetary boundaries and the needs of future generations. Unless these tensions are explicitly addressed, CE may become yet another mechanism for legitimizing and perpetuating the expansion of the extractive frontier in the Global South.

# 1. Introduction

The projected exacerbating demand of minerals and metals for the energy transition, digitization, aerospace and the military sector, has led to a global rush, geopolitical tensions and wars over those resources. Rising national economic protectionism, supported by subsidy programs, strategic stockpiling and export restrictions as well as the (re-)negotiation of bilateral and regional trade and investment agreements pushed by the Global North seek to secure access to strategic natural resources. At the same time, they pose severe risks and negative impacts on mining affected communities and ecosystems, while impeding industrialisation and value addition in minerals supply chains in Global South countries. Nonetheless, the economies of many resource rich countries are often highly dependent on the exports of minerals and try to attract investments through tax exemptions and low royalties and are in a competition leading to a race to the bottom of human rights, Indigenous People's Rights and environmental standards.

A strategy that has gained momentum within the last years especially among resource-intensive economies from the Global North, in order to secure their access to minerals and to reduce dependencies from resource-rich countries is the promotion of Circular Economy (CE) approaches. Promoting CE is also considered a strategy to support their sustainability agendas, such as the achievement of the Sustainable Development Goals (SDGs) or the implementation of the Paris Agreement. The Economic Commission for Latin America and the Caribbean (CEPAL) sees CE as a model contributing to nature conservation and the reduction of greenhouse gas (GHG) emissions and as an essential element in achieving climate goals (CEPAL, 2022). In international dialogues, such as the UN Secretary General's Panel on Critical Energy Transition Minerals, CE approaches are highlighted as an important means to reduce pressure on the environment and on mining affected communities.

Although there is not a single definition of CE, the main intention of most approaches is to extend the life-cycle of products through measures such as reuse, remanufacturing and recycling and consequently minimize waste. On closer examination, the concept remains rooted in a business-as-usual approach based on a "sustainable" growth and market efficiency paradigm that fails to acknowledge planetary boundaries and falls short in providing ground for the systemic change needed to tackle the multiple ecological crises and social inequality the world faces.

It follows a rather isolated, national or regional path conceived from the perspective of the Global North with a focus on technical solutions, efficiency and recycling rather than strategies to reduce absolute primary raw materials use.

The extraction of minerals fueling a CE, such as lithium, has huge environmental and social impacts in the territories they are extracted from. However, the debate on CE tends to be disconnected from the resource base this economy needs and lacks a territorial perspective in its implementation strategies. CE is often only associated with finished products at the end of their useful life and with recycling. However, this leads to the disregard of the initial impact of extraction and product manufacturing, as if products were de-territorialised, without origin and without environmental and social costs. In other words, neither the water and land used, the biodiversity put under threat and the pollution left behind in the territories as a consequence of extraction is reflected in the finished products, nor cultural implications for affected communities of mining in a context where more than 50 percent of the transition minerals resource base is located on or near the lands of Indigenous and peasant peoples.

Moreover, current CE approaches and implementation policies lack a comprehensive, global, and territorial view. Impact assessments on what environmental, social and economic consequences these might have on global supply chains and especially for Global South economies are basically absent. Considering that

in 2020 around 95% of the knowledge and research on CE has been produced in so-called developed countries where highest material footprints[1] are registered, that's hardly surprising (Kirchherr 2021).

Although CE is often declared as being crucial for achieving the Sustainable Development Goals and creating new jobs and prosperity, research on the impact of CE on global economies and supply chains in which power asymmetries create injustices through dispossession, contamination and exploitation - especially in the Global South - is scarce and political measures to address those issues within this framework are basically absent as most of the CE frameworks are based on consumption-driven economies, but many circular activities, particularly in the Global South, are based on production-driven economies based on export and raw material extraction and consequently need different approaches.

This document outlines the main concerns, and position of Fundación Ambiente y Recursos Naturales (Environment and Natural Resources Foundation, FARN) from a global and socio-environmental justice perspective regarding the international debates and implementation strategies of a CE for transition minerals and its potential and limits for socio-ecological transitions in Argentina, Latin America and the Global South.

In the first part, it identifies gaps and limits of the approach for the reduction of minerals consumption and extraction based on the assumptions of most CE definitions and implementation strategies by Global North countries, such as decoupling[2] of materials use from economic growth and the expected reduction of materials use through resource efficiency and higher recycling rates without questioning consumption patterns.

In the second part, the document identifies potential negative impacts for the environment, societies and the economies of Latin America, especially as long as the Global North implements a CE without considering its historical responsibility for generating the triple planetary crisis and without taking into account the historical patterns of dependency of the Global South. The latter being a supplier of raw materials and ecological creditor, while the Global North - in this sense the ecological debtor- consolidates accumulation processes and its position as a supplier of capital goods and technologies associated with CE and accumulation of capital. This dynamic is closely linked to Global South´s external fiscal debt and the Global North often promotes a deepening of extractivism in the South as a way to guarantee its repayment. CE is far from questioning or addressing this unequal relationship.

In order to understand and address the limitations of current CE approaches for a socio-environmental transition in Latin America, the document aims to shed light on structural questions: who promotes the concept of CE? Who implements it and how? Who benefits economically and who doesn't? Who pays the price environmentally and how do the current CE approaches support socio-environmental transitions in Global South countries? This might help to better understand why the CE, as it is implemented today, is not leading to a structural change in the global economy and bears the risk of perpetuating global inequalities and injustices instead of addressing them. Besides that, with this document, FARN intends to contribute to create conditions for an economy that integrates human rights and ecosystems, that overcomes global inequalities and benefits people and the planet.

1. *Material footprint* is the total amount of fossil fuels, biomass, metals and minerals a country/region consumes, including those embodied in imports.

2. "Resource decoupling means reducing the use of (primary) natural resources per unit of economic activity" (UNEP 2011:4)

## 2. What is a Circular Economy?

CE is an economic term that unfolds from the theory of sustainable development. The concept has been influenced by many different scholars and has its roots amongst others in Industrial Ecology and Industrial Ecosystems. Although it was initially seen as a way to reduce costs in industrial and business development (e.g. more efficiency, effective designs) starting in the 1960s and 1970s, the CE took on new significance due to emerging global problems related to excessive resource consumption and pollution (D'Amato & Kohonen 2021). Today it is presented as an economic, environmentally responsible model oriented to protect natural resources and enhance their value within a continuous cycle (Garabiza *et al.* 2021). Since the late 1970s its practical applications in modern economic systems and industrial processes have gained momentum and have further developed since then (Arroyo Morocho 2018:79).

To date there is no single accepted definition of a "circular economy". Instead, there is a broad range of interpretations and definitions, from more technical and conservative interpretations, such as efficiency, recycling and waste management to more inclusive and radical ones, focused on consumption patterns. What they have in common is that they are defined in opposition to the prevailing global linear economy in terms of the physical flows of materials and energy and that they are related to "[...]limiting resource inputs and waste and emission outputs in production and consumption systems, with the intent to retain material and energy and value for as long as possible." (D'Amato 2020:236).

As the world is facing a triple planetary crisis (climate change, pollution and biodiversity loss) and as resource extraction and processing are responsible for about 50 percent of GHG emissions, and 90 percent of biodiversity loss (UNEP, 2019), CE is promoted as an alternative to the current resource-intensive linear economy model based on extraction-production- consumption-disposal or take-make-waste. It aims to conserve materials and products in use for as long as possible through reuse, refurbishment, repairing and recovery of waste, extracting the maximum utility and recycling them at the end of their useful life. Currently, the concept is largely driven by the practitioner community, as for example by the Ellen MacArthur foundation and promoted and implemented on political level in several countries, e.g. China, the United States of America (US) and the European Union (EU) and in multinational fora, such as G7 or G20 (D'Amato & Kohonen 2021).

The European Parliament (2023) states for example that: "In practice, it [a Circular Economy] implies reducing waste to a minimum. When a product reaches the end of its life, its materials are kept within the economy wherever possible thanks to recycling. These can be productively used again and again, thereby creating further value. [...]". The US Environmental Protection Agency (2026) defines CE in a similar way, and highlights that:" A "circular economy approach" [...] demonstrates continuity in our emphasis on reducing negative life-cycle impacts of materials, reducing the use of harmful materials, and decoupling use of materials from economic growth and meeting society's needs." Comparative studies on CE Policies in China and Europe (Mc Dowell *et al.* 2017; Zhang *et al.* 2025) show that there is a common conceptual basis especially concerning resource efficiency. While China enforces CE policies rather centered around "cleaner production" due to pollution and environmental concerns through rapid growth and industrialisation in the last decades. The EU focuses more on sustainable product policies, such as ecodesign, extended producer responsibility for better waste management and more efficient recycling (Zhang *et al.* 2025).

The assumption of decoupling of materials use from economic growth and the expected reduction of materials use through resource efficiency is prevalent in most CE definitions and is mirrored in the before mentioned concrete CE strategies of Global North countries, as the main focus is put on efficiency and

recycling instead of the waste hierarchy principle, which puts waste prevention and reduction at the first place. Moreover, it is assumed that circular activities, such as refurbishment, repairing or recycling, will lead to job opportunities, re-industrialisation and economic growth. To date there is still lack of research on macroeconomic impacts of a global CE and impacts on global value chains and possible negative impacts on Global South economies.

# 3. Limitations of the current Circular Economy approach for reduction of transition minerals extraction

While changing global production and consumption patterns is more than ever needed and measures aimed at addressing them are very important and welcome, CE approaches alone will not be enough to tackle the global overconsumption of minerals. Moreover, they may even perpetuate current inequalities and reproduce the same extractivist logic that currently prevails. Considering the historical responsibility of Global North countries for generating the triple planetary crisis as well as adverse impacts of mining and the discharge of waste on the environment, local communities and indigenous peoples are not sufficiently taken into account by policy makers. The EU, for example, stated in 2024 a material footprint of 14,8 tons per capita with huge differences between the Member States. Spain counts with a material footprint of 9,8 tons per capita, whereas Finland exceeds 42,2 tons per capita (EEA 2025a). That is almost seven times higher than what is considered "sustainable" by the International Resource Panel (6-8 tons per capita, UNEP 2021) and considerably higher than the global average of 12,2 tons per capita and the consumption of LAC countries of 12.4 tons per person per year, with the Caribbean having the lowest consumption rate in the region (4,8 tons per person per year). According to the EEA (2025b) the EU transgressed alone in 2023 the planetary boundaries for minerals and metals use 1,8 times.

Despite several CE implementation strategies and roadmaps, concrete measures with binding targets to reduce its material consumption are missing. Two significant limitations of the CE approach to address reduction of transition minerals are its focus on material efficiency and recycling, and physical limitations of recycling and rebound effects.

## 3.1. Focus on material efficiency and recycling

A common criticism to CE from the perspective of ecological economics is that, in the case of transition minerals, the discussion risks being reduced to a predominantly technical solution of material efficiency and on recycling, without questioning the levels and impacts of extraction, consumption, and resource demand in a more structural way (Forcinito *et al.* 2024). Manuel Albaladejo, Representative of the United Nations Industrial Development Organization (UNIDO) for Uruguay, Argentina, Chile and Paraguay warns that: "Recycling can reinforce a linear model, as it feeds on waste.(...) While we continue to mass consume and generate millions of tons of trash, waste management and recycling can, and will, play a role. The oversimplification in the circular economy approach comes from the fact that many think that waste management and recycling are the solution, when they could in fact reinforce the problem. (...) It is not about how we deal with the trash we generate and the impact it has, but rather about the fundamental societal changes needed to prevent trash."(UNIDO, 2019).

The shortcomings of the main focus on efficiency and recycling are also reflected in the CE approach for so-called critical minerals of the European Union. The EU Critical Raw Materials Regulation, a legislation to secure EU's access to minerals critical for the energy transition, digitization, defense and aerospace sector, shows quite emblematically how the current CE measures of the EU fall short in addressing structural inequalities and overconsumption. Although it recognises its need to moderate its demand of critical minerals, no benchmarks or specific binding targets to reduce its material consumption have been set. Instead of incentivising sufficiency or substitution measures, the legislation only foresees the EU to undertake "(...) efforts to incentivise technological progress and resource efficiency in order to moderate the expected increase in Union consumption of critical raw material" (Critical Raw Materials Regulation 2024, Art.1.2). Besides that, the legislation foresees that until 2030 25% of minerals defined as 'strategic' and that are used within the EU come from recycled minerals. While recycling metals is important to use minerals as long as possible and may reduce primary extraction per unit, if total production keeps on growing, overall extraction and emissions will also increase and exacerbate degradation of ecosystems and human rights violations connected to minerals value chains. As long as the CE approach is based on an economic growth and a sustainable development paradigm with the belief of decoupling economic growth from resource use - although there is until now no evidence of successful absolute decoupling of economic growth from environmental impacts and resource consumption - CE bears the risk to perpetuate current inequalities and extractivist logics (D'Amato *et al.* 2021, Ghisinelli *et al.* 2016, Vadén *et al.* 2020). Besides that, recycling metals is very energy and emissions intensive, often needing hazardous chemicals to recover the materials. But not only the strategies of the EU also a large part of the literature on CE seem to focus more on recycling than on other solutions and neglect the waste hierarchy, which sets priorities for waste management starting with prevention - refuse, rethink and reduce material use - then repair, refurb and lastly recycling and disposal (Kirchherr *et al.* 2017).

## 3.2. Physical limitations of recycling and rebound effects

Physical limitations of recycling are often neglected. Circularity in the strict sense does not exist, given the second law of thermodynamics: the law of entropy, which states that in every material and energy process there are irreversible losses, particularly of energy, and thus makes the reduction of their consumption essential (Forcinito *et al.* 2024). Moreover, the functionality and design of consumer products complicate recycling due to their ever more complex structures producing low grade and complex recyclates.

In addition, CE doesn't address possible rebound effects sufficiently. More efficiency and lower production costs and impacts may produce a rebound effect, ultimately increasing production and consumption levels. This could translate to reducing or cancelling out the net environmental benefits of the total environmental burden (Forcinito *et al.* 2024; D'Amato & Korhonen, 2021). In this sense, CE should be thought of as a tool or strategy to reduce the pace and scale of primary extraction, but it should necessarily be complemented by policies aimed at reducing primary minerals demand and changing consumption and production patterns.

## RECYCLING OF LITHIUM-ION-BATTERIES IS ONLY PART OF THE SOLUTION

Lithium demand has already tripled since 2020, and according to the International Energy Agency (IEA) is expected to see another tripling over the next decade with the EV sector being responsible for 90% of this additional demand (IEA 2025). The projected growing demand of lithium batteries is caused not only by the car industry, but also the military sector for drones and missiles, and communications and digitizations for portable electronic devices and AI-infrastructure.[3] This raises questions about the future supply of those large amounts of minerals and the impact their extraction has on fragile ecosystems such as the High Andean Wetlands or the Amazon, and on the livelihoods of Indigenous and local communities impacted by mining who are currently paying the price for the global energy and minerals demand. Instead of questioning those projections and consequently implementing policies that lead to absolute reduction of primary raw materials consumption and mitigate the destruction of unique ecosystems and violations of human rights and Indigenous Peoples' rights, the prevalent answer to rising minerals demand globally is ramping up investment in mining and important though insufficient increasing recycling capacities.

Currently, a new industry is developing around the recovery of economically valuable minerals from end-of-life lithium-ion batteries (LIB). The global battery recycling market is projected to grow approximately seven-fold over the next decade depending on e.g. minerals prices and political incentives (Statista 2025). The EU, for instance, has set specific targets for lithium recovery from spent batteries, aiming for 50% by 2027 and 80% by 2031. Currently, China is the global leader in battery recycling capacity followed by the US and Europe, but recycling of lithium and access to data is quite limited. There are estimations that only around 5% of LIBs are recycled worldwide as the recycling industry is relatively new and lithium batteries have a more complex chemistry as for example lead batteries (GAIA 2025). The low recycling rates of LIBs cause serious concerns about improper disposal that can lead to soil and water contamination due to the release of hazardous materials. Damaged or short-circuited batteries can even cause fires and explosions and cause severe safety risks (Morris 2025).

There are different ways of recycling LIBs depending on the chemistry. The most prevalent method is so called pyrometallurgy or smelting which means that high temperatures from 1400 to 1700° are needed to recover the metals. This requires a lot of energy and bears direct environmental and health risks as it produces toxic dust, ash, air emissions and gases. This process is often combined with hydrometallurgy, which needs huge quantities of toxic acids and solvents, in order to effectively recover the minerals and produces toxic wastewater. Direct recycling promises less environmental harm and higher recovery rates but is still mainly in a research and development stage (ibid. 2025). Currently, the lithium itself is often not even recycled. The pyrometallurgical process aims mainly at recycling the nickel, cobalt, and

3. Data center electricity consumption is estimated to more than double by 2030 compared to 2024. AI is the most important driver of this growth. To meet this energy demand and ensure reliability, as AI data center facilities cannot afford even brief power interruptions, operators rely on battery energy storage systems BESS), which are largely based on lithium-ion technology (IEA 2025, energyx.com 2025). Consequently, AI is and will be a key growth driver alongside electric vehicles for lithium demand and will fundamentally reshape the outlook for battery supply chain markets.

copper, and not the lithium as the value of recovered materials is often lower than the cost of recycling. Designing and standardizing batteries the way that metals can be recovered in a less harmful and more efficient way and policies and legislations around this are needed (Morris 2025, negawatt 2023).

But the increase and efficiency of recycling rates of LIBs can't be the main solution due to the environmental harm outlined above and the environmental and social impact of mining in the first place. Consumption patterns have to change. One important step to shift mobility politics leading to less mineral use. For this to occur, car dependency has to be lowered, car sizes and thus EV batteries sizes in the Global North must decrease. Riofrancos *et al.* (2023) showed in different scenarios that in the US alone lithium demand could be reduced by up to 92% in 2050 by following these steps, in comparison to the most lithium-intensive scenarios. But instead, in the US the size of EV batteries has grown threefold since the first commercial EV was released (ibid. 2023). In Europe, reducing battery size by making smaller electric vehicles could reduce mineral demand for lithium, nickel, manganese and cobalt between 19 and 23% (Transport and Environment 2023).

## 4. Circular Economy for whom? Who dominates the narrative, who fuels a CE, who bears the environmental burden and who benefits economically?

To date, CE research, knowledge production, and policymaking have been mainly driven and implemented by countries in the Global North. This is reflected in international policy fora, such as UNEA-6, where the EU for instance brought in a resolution[4] on "Stepping up efforts for enhancing the circular economy transition" in 2024. It is also evident in the policies and strategies developed and implemented by the EU, China, the US and Japan.

The dominance of the Global North is also reflected in CE research: around 95% of CE research in 2020 has been produced in so-called developed countries which have some of the world's highest material footprints[5] (Kirchherr 2021). Although interest and research in CE is growing in the Global South, many countries adopt CE policy models from the Global North. As those don't consider or address historical and structural inequalities sufficiently, they bear the risk of being ineffective due to discrepancies in technology access, economic constraints, and regulatory capacity, and may even inadvertently harm workers, the environment and industries in developing countries, exacerbating existing inequalities (Calderón Márquez *et al.* 2025).

The UNEA-6 resolution mentioned above was rejected. Although this has certainly different political reasons, it can also be read as an indication of resistance from other regions to a concept dominated

4. https://resolutions.unep.org/resolutions/uploads/eums_concept_note_on_ce_final.pdf

5. Material footprint is considered the total amount of fossil fuels, biomass, metals and minerals it consumes, including embodied in imports.

by the EU and other Global North countries and being imposed on other regions. Especially as long as there are no signs of will to change profound production and consumption patterns within planetary boundaries. This is connected to the questions to which this chapter intends to contribute. Who actually benefits from current CE policies, who fuels it with resources, who bears the environmental burden, and which economic opportunities and downsides for Latin America and the Caribbean (LAC) region can be expected? This might help to understand certain resistances against the concept and why alternatives and more inclusive approaches are needed to tackle global inequality and the triple planetary crisis.

## 4.1. Unequal minerals consumption and roles in shaping the global economy

Global North countries including China are to date the main drivers for exacerbating transition minerals demand. In 2024, Lithium demand rose by nearly 30%, while demand for nickel, cobalt, graphite and rare earths increased by 6-8% (IEA 2025). At the same time the raw materials, especially minerals and biomass, fueling the global circular and linear economies are mainly provided by Global South countries with considerably lower material footprints. The LAC region has an estimated materials footprint of 12,8 t per capita with significant differences between countries. According to CEPAL (2023), in 2018 around 40% of materials extracted in LAC were exported to meet global material demand. This is placing excessive pressure on the ecosystems and people in the most biodiverse region on the planet. It also threatens the cultural diverse of a region that is home to numerous indigenous peoples who inhabit and safeguard these territories.

The historic role of the region in shaping the global economy by providing its natural resources led to an unequal ecological and economic exchange and made it a “major sink for global environmental impacts” (CEPAL *et al.* 2023:9). This role has led to a clear and indisputable trend towards overexploitation, socio-environmental conflicts, human rights violations, pollution, inequality, scarce productive linkages, extractive and enclave economies, a combination of legal and illegal economies and, in general, a reduced fiscal space due to pressing external debt. All of this hinders greater investment in social policies and economic diversification.

Belloni & Peinado (2013) even speak of a new role for peripheral countries as exporters of “artificial sustainability”. This happens through the supply of materials and energy that enable more “green” and “sustainable” production patterns in Global North countries, at the expense of greater unsustainability of production patterns in the periphery, in this case extraction of minerals or inappropriate management of hazardous waste, and which is often disconnected from the consumption patterns of its local populations (Forcinito *et al.* 2024). In order to maximize the exportable balances necessary to import and pay off external debts or even to import that “green” technology, such as LIBs or EVs, the consumption of fresh water by these extractive activities can even be prioritized over the consumption of their own communities, as it is the case for lithium extraction in High Andean Wetlands (Forcinito *et al.* 2024).

## 4.2. De- territorialized goods that circulate in the economy

The LAC region accounts for about 40% of global copper production, led by Chile (27%), Peru (10%) and Mexico (3%). The region also supplies around 35% of the world’s lithium: Chile (26%) and Argentina (6%). Bolivia, Mexico, Brazil and Peru also have significant lithium resources. In addition, there are deposits of bauxite, graphite, nickel, tin, manganese and rare earth elements (IEA 2023). At the same time, 73% of

existing and planned critical minerals mines in the LAC region are on or near Indigenous or small-farmer land. For lithium projects in the region it is even estimated to be 87% (Owen *et al.* 2022).

The extraction of minerals fueling the Circular Economy, such as lithium, has huge environmental and social impacts in the territories they are extracted from. However, the debate on CE tends to be disconnected from the resource base this economy needs and lacks a territorial perspective in its implementation strategies. CE is often only associated with finished products at the end of their useful life and with recycling. However, this leads to the disregard of the initial impact of extraction and product manufacturing, as if products were de-territorialised, without origin and without environmental and social costs.

For instance, in the Hombre Muerto Salt Flat situated in the Argentinian Province of Catamarca more than 10 lithium mining projects are operating at various stages without a cumulative and comprehensive environmental impact assessment. This poses a clear risk of environmental damage to the wetlands where the projects are already operating. The Fenix Lithium project -currently operated by the mining company Rio Tinto- has already led to the drying up of around 5 km of the Trapiche river, an important freshwater source for local indigenous communities, their livestock and surrounding ecosystems. In the Salinas Grandes and Laguna de Guayatayoc basin which is shared between the provinces of Jujuy and Salta, violations of collective rights –including Indigenous Peoples' right to consultation and to free, prior and informed consent (FPIC)- and of environmental law due to lithium and borate mining projects have lead the communities to legal actions before provincial, national, and international bodies. These have included the Supreme Court of Argentina and the Inter-American Commission on Human Rights, demanding a hydrogeological baseline, coordinated basin management, and culturally appropriate respect for their right to FPIC in order to avoid irreversible damage on the environment that sustains their lives (FARN 2025a, FARN 2025b).

Despite the impact of mining on people and ecosystems outlined in the examples above, a territorial view is overlooked in debates on circularity of transition minerals or batteries, although those minerals are the resource base for a CE discussed within transition frameworks.

## 4.3. Outsourcing of hazardous waste in the name of CE

The current CE approaches are leaving the question of what to do with toxic waste that can no longer be reused, recycled or used in any (circular) economic way open. They also fail to assert what impact it has on the areas where the waste is ultimately dumped.

The burden of waste management in many CE initiatives is often unequally distributed between North and South and between rural and urban areas and is characterized by the dynamics of outsourcing of hazardous practices for the disposal of waste to third countries (Pansera *et al.* 2024). One example is the export of e-waste as well as reusable electronic and electric equipment from the EU to third countries, mainly to Southeast Asia and West Africa. It is estimated that between 30 and 66 % of those products exported to Ghana are not eligible to be repaired, refurbed or reused, but instead directly landfilled (Denter 2025).The Free Trade Agreement (FTA) between Ecuador and China also shows unequal waste exchange led by power asymmetries. The FTA specifies that China can introduce waste and scrap from batteries and electric accumulators, scrap metal, toxic liquids, among others to Ecuador. The Zero Waste Alliance Ecuador (2024) warns that CE can be used as a pretext for cross-border trade in waste. The latter being labelled as raw material that can be used for recycling. "South American countries are already

facing a serious health crisis and are unable to manage their urban, toxic and hazardous waste, which generates serious environmental liabilities and severely affects nature, ecosystems and communities located in areas of direct influence. This represents extremely high management costs for the state and very serious environmental liabilities. (...)Worse still, it makes no sense for Ecuador to be importing other waste to be supposedly used as raw material, when it is burying 96 per cent of its own waste." (bilaterals.org, 2024)

Until now the LAC region lacked strong regulatory frameworks for the proper management of used and end-of-life electronic products or lithium-ion batteries and should therefore prevent and regulate hazardous waste imports. The first aspect leads to challenges for developing sound end-of-life management solutions. While such policy gaps must be closed in the near future, there is also a need to develop a regional approach aimed at improving capacities, facilitating transboundary movement of batteries and promoting investments for more efficiently used lithium-ion battery collection, recycling, and reuse. This regional approach is particularly important for countries that will continue to lack sufficient end-of-life battery volumes to justify investments in their own end-of-life management capacities" (López *et al.* 2024).

## 4.4. Economic growth and job opportunities

It is often assumed that the shift to a CE will lead to job creation, re-industrialisation, value creation and economic growth. CEPAL (2023:11) states that "The circular economy can help LAC increase value addition and diversify its economic structure, and shape a better balance between exports and imports." At the same time, McCarthy *et al.* (2018) highlight that CE will lead to structural shifts, such as the decline and rise of certain sectors in certain regions, as well as reallocation of capital and labour. They warn that the possible magnitude and overall economic impacts are not clear and sufficiently studied. It is assumed that early adopting countries could profit and realise additional benefits by becoming exporters of CE expertise and technologies. The EU estimates that around 700,000 additional jobs will be created within the EU between 2015 and 2030 due to "(...) -through additional labour demand from recycling plants, repair services and rebounds in consumer demand from savings generated through collaborative actions" (EEA 2025c). But how can be ensured that allocation of capital and the rise in labour will happen in Global South countries and not only in early adopting countries in the Global North?

Although some economic activities are expected to grow and emerge, such as some manufacturing industries, secondary material production, repair and remanufacturing, waste management and recycling activities or the services sector as consumers might substitute services for goods, other sectors, such as primary production, may decline. CE initiatives led by developed economies may inadvertently harm workers and industries in developing countries due to high dependence on the extractive sector and primary production (Mc Carthy *et al.* 2018, Loughborough 2024). While Chapter 3 outlined limitations of current CE approaches to actually reduce transition minerals consumption and consequently primary extraction, and processing, there exist concerns that decreased activity in extractive sectors, which are the basis for many Global South economies, could negatively affect those economies and workers employed in those sectors. While slower production cycles, and less consumption of natural resources especially in Global North countries are more than ever needed, they have to be addressed with a holistic approach that leads to the wellbeing of societies and global wealth distribution. Several authors (e.g. Forcinito *et al.* 2024; Geistdoerfer *et al.* 2017; Kirchherr 2017, Murray et al 2015 ) criticize that current CE approaches neglect those questions and prevalent power asymmetries in the global economy. While CE might bring prosperity and labour to some countries, there are severe concerns about distributional

effects on regional and sectoral level. “In this view of the circular economy, there is a win-win proposition that is not being realised” (Mc Carthy *et al.* 2018:12).

## 4.5. Value creation in CE through raw materials and trade policies

While Latin American countries supply a substantial share of the world’s minerals demand, most of the processing, refining, and downstream manufacturing operations which add value to the raw material are undertaken in other regions. China is currently the dominant producer of refined mineral components and the most important export destination for minerals from Brasil, Peru, Panama and Chile (Hernandez-Roy *et al.* 2024). The guidance developed by the UN Secretary-General’s Initiative on Critical Energy Transition Minerals for an energy transition based on equity and justice (2024) highlights the importance that countries and local communities providing those minerals fully benefit economically, including through local value addition and economic diversification while safeguarding their rights and the environment. To achieve this, industrial policies, responsible and fair trade, investment, finance, and fair taxation are stressed out to be crucial (UNSG 2024). But to date those aspects and sustained public and private investment in the research, technology, and infrastructure necessary to create a value-added ecosystem that benefits people and protects the environment are lacking or insufficient.

There are examples of value creation and industrialization opportunities in the CE sector, as for example in the field of e-waste management. Schroeder *et al.* (2020:31) highlight the possible opportunity of advanced e-waste recycling and urban mining as an emerging economic activity “that can ensure both the supply of secondary resources and, under proper conditions, a source of decent work for waste pickers”, but only if current limitations in the sector, such as lacking robust legislations, are addressed.

Brazil already has relatively strong legal frameworks related to e-waste management which supports developing this industry and it is the largest generator of such waste, producing 1.5 million tons per year. In Argentina this kind of framework is still missing and is currently impeding further value addition in the sector. Plants carrying out the separation of hazardous waste, such as electrical and electronic equipment waste are still scarce. Currently, they are focusing merely on dismantling the products and exporting the valuable fractions, such as circuit boards, containing precious metals like gold, lithium and cobalt to the EU, US and China. The extraction of the precious metals itself is currently not done in the country although this could increase the valorization of the waste recovery at national level. The authors conclude that this would require investment in new facilities for safe recovery of e-waste, harmonization of national and regional regulations around hazardous waste and allow the consolidation of e-waste in large enough quantities to supply the necessary input for recovery facilities (Schroeder *et al.* 2020).

While CE policies and initiatives largely take place domestically within national boundaries or at a regional level, in a globalized world with international value chains, developments in international trade agreements and tendencies of national protectionism of third countries have to be considered as they might have an impact on the economic opportunities of a CE in the LAC region. The EU-Mercosur Trade Agreement is a clear example. While the EU Commission considers the agreement as instrumental for securing its critical raw materials supply, it foresees the fundamental prohibition of any taxes and duties on exports, if not negotiated differently. In the minerals sector only Brazil’s government under Lula has negotiated a list of exceptions for themselves individually. This raises the question if the Trade Agreement can incentivize local industries and value addition in the transition minerals secto, as the EU Commission claims (European Commission 2025c). On the contrary, as export taxes are an important instrument for ensuring the domestic availability of raw materials in case of shortages or price inflation, there is the risk for a limited scope for industrial and raw materials policies of the Mercosur countries (Fritz 2025).

In the CE area, export tariffs on electronic waste could have been an important tool to secure supply of raw materials, such as cobalt, nickel or other transition minerals scarce in the region, and to develop transition minerals industries, such as batteries production. An opportunity that has been missed by the Mercosur countries.

Considering at the same time the Europe-first approach of current EU raw materials and CE policies, such as the Critical Raw Materials Regulation which foresees ramping up the strategic minerals processing capacities of the EU to 40% of its annual consumption until 2030, and its recycling capacities of those minerals to 25% without contemplating binding targets of reduction of consumption and at the Commission's Resource EU plan which foresees export restrictions of rare earth waste, such as permanent magnets, targeted measures for aluminium and potentially copper and battery scrap that can be recycled, reinforces the doubts about the opportunities of current international raw materials and CE policies for the Global South. To the contrary, they bear the risk of deepening global inequalities and cementing the role of Latin American countries as raw materials suppliers for the global (circular) economy.

## ECOLOGICAL ECONOMICS AS AN ALTERNATIVE AND PROACTIVE APPROACH TO THE CIRCULAR ECONOMY

In contrast to a Circular Economy rooted efficiency and sustaining economic growth by reincorporating materials through recycling, efficiency, and reuse, Ecological Economics goes much further. In addition to proposing an approach to well-being which is decoupled from individual material consumption, it proposes reducing the economic metabolism (which is rather a sufficiency approach than only efficiency) - or in different words making the circle smaller not only more efficient, as Ecological Economics is based on the recognition that it is impossible to produce any good or service without materials or energy and understands the economy as an open subsystem embedded within the biosphere and subject to biophysical limits. This implies recognizing that the energy transition and our economies in general cannot be sustained on the basis of an indefinite expansion in the use of materials and energy. From this perspective, the central challenge is not only to improve efficiency or resource reuse, but to reduce the socio-economic metabolism and to address the ecological-distributive conflicts associated with extraction and the intensive use of energy and materials. Socio-economic metabolism refers to the volume and dynamics of the flows of energy and materials that pass through the economic system—from extraction, transport, and processing, through consumption, to final disposal—allowing for an analysis of the biophysical pressure that the economy exerts on ecosystems and the impossibility of sustaining its indefinite expansion. This entails promoting sufficiency-oriented strategies, changes in production and consumption patterns, and energy transitions that minimize pressure on ecosystems and territories.

Furthermore, Ecological Economics incorporates the concept of ecological debt, which highlights historically differentiated contributions to the socio-ecological crisis and the externalization of environmental costs toward territories in the Global South. This process has enabled material accumulation and high-consumption patterns in the Global North. This approach challenges the centrality of monetary debt borne by countries in the South, pointing

out that financial debt has frequently been associated with extractive dynamics that generate significant socio-environmental impacts and deepen ecological debt. In this sense, both debts express interrelated dimensions of the same historical relationship of resource appropriation and impact transfer. Recognizing ecological debt thus opens the possibility of questioning the legitimacy of financial debt and rethinking the dominant patterns of production and consumption that underpin the current economic system and the ecosocial crisis.

In the context of the energy transition, these dynamics are particularly evident in the growing demand for critical minerals used in transport electrification, energy storage, and the deployment of energy infrastructure. The expansion of material metabolism associated with these technologies demonstrates that the transition is not free from new extractive pressures and territorial conflicts, especially in regions that supply raw materials. Rather than proposing compensatory solutions or marginal adjustment mechanisms, Ecological Economics seeks to address the structural causes of the crisis and to promote transformations that reduce material pressure and the inequalities embedded in the transition.

**More information:** Forcinito, K.; G. Peinado & P. Varela (2024): La crisis ecosocial bajo la perspectiva de la economía ecológica. Published on behalf of: Fundación Ambiente y Recursos Naturales.

## 5. Conclusions

The implementation of a CE must be guided by and assessed against a key question: does it contribute to a fair global socio-ecological transition based on socio-environmental justice, inclusion, and citizen participation? From FARN's perspective, a profound change is needed in Argentina, Latin America and globally in order to achieve a socio-ecological transition. For this, concepts and instruments that address current structural asymmetries and respect planetary boundaries are needed.

By focusing on technological solutions, infrastructure, and capital goods, CE practices fall short in addressing those necessities. Many CE practices tend to rely on technologies developed and controlled by the Global North, thereby configuring new forms of technological and economic dependency for countries in the Global South. Moreover, they neglect measures for the absolute reduction of raw materials demand. In contrast, reuse and waste recovery practices with strong territorial and community roots that effectively contribute to reducing economic metabolism and strengthening local autonomy already exist. Such experiences are more closely aligned with the ecological economics paradigm, as they prioritize sufficiency, reduced material flows, and socio-environmental justice over gains in productive efficiency.

CE can provide positive incentives implemented with a comprehensive, global, equitable, and territorial perspective. To date, however, the concept is largely based on a paradigm of economic growth and sustainable development, without questioning the current model of consumption and production. As a result, it fails to address global inequalities. In order to avoid deepening historical patterns of dependence, whereas the Global South remains a supplier of raw materials while the Global North consolidates its position as a supplier of capital goods and technologies associated with CE, the concept of CE would have to be expanded beyond the management of materials. It should also be understood as a possible

strategy for the structural transformation of North–South economic relations, including the reduction of primary raw materials consumption especially in Global North countries while respecting planetary boundaries and the needs of future generations. Unless these tensions are explicitly addressed, the CE approach may become yet another mechanism for legitimizing and perpetuating the expansion of the extractive frontier in the Global South.

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