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## Powering the Future: Latin America's Geopolitical Role in the Global Energy Transition

<https://www.e-ir.info/2024/11/28/powering-the-future-latin-americas-geopolitical-role-in-the-global-energy-transition/>

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The evidence from recent years leaves no doubt: anthropogenic climate change is accelerating, with its impacts becoming increasingly severe, frequent, and hazardous. These include extreme weather events, rising global temperatures, sea level rise, biodiversity loss, threats to agricultural productivity and food security, health risks, water scarcity, and escalating economic losses. These interconnected challenges are not only harming ecosystems but also undermining societal stability and economic resilience. According to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC), without substantial and immediate mitigation efforts to reduce greenhouse gas emissions, these impacts will intensify, potentially reaching irreversible tipping points. The need for urgent global action to limit warming levels has never been more critical (IPCC 2022; 2023). August 2024 represents the fourteenth consecutive month in which global temperatures exceeded the pre-industrial baseline's monthly average (1850–1900) by at least 1.5 °C, reinforcing the warming trend's persistence (Rohde 2024).

The energy transition is pivotal for decarbonising the global economy and addressing the pressing challenges of climate change. Recent progress in renewable energy deployment has been encouraging. According to the International Energy Agency (IEA 2024c), wind and solar photovoltaic (PV) technologies are jointly projected to exceed hydropower in electricity generation by 2024. Furthermore, overall renewables are projected to surpass coal power generation by 2025, marking a pivotal shift in the global energy landscape. Notwithstanding these encouraging indications, ensuring the continuity and acceleration of the energy transition is imperative to safeguard a sustainable future. Continued efforts must be made to enhance the deployment of renewable technologies in order to reduce carbon emissions and ensure the establishment of reliable and resilient energy systems on a global scale.

However, the concept of energy transition is not limited to adopting renewable energy sources. Rather, it encompasses a multifaceted transformation involving cultural, societal, institutional, political, and technological shifts (Poque González 2020). In examining the technologies that drive this transition, which are termed 'low-carbon technologies', countries typically assume one or more distinct roles. These include supplying and processing essential inputs for production chains (critical minerals), manufacturing these technologies, or implementing them domestically. Certain nations, like the People's Republic of China, operate across these roles simultaneously, engaging in the extraction of critical minerals, manufacturing low-carbon technologies, and their domestic deployment (IEA 2022).

### The Latin American role

The adoption of low-carbon technologies across Latin America is indicative of significant regional heterogeneity. Notable progress has been made by countries such as Uruguay, Costa Rica, Brazil, and Chile in integrating renewable energy sources, particularly solar and wind power. In 2022, these technologies made a notable contribution to the power energy mix in these nations, with solar and wind accounting for 5.7% and 30.8%, respectively, in Uruguay and 0.16% and 11.34% in Costa Rica. In Brazil, the contribution of these technologies to the power energy mix was 11.85% and 11.51%, respectively, while in Chile, it was 23.97% and 12.98% (Castillo et al. 2023). In stark contrast, a significant proportion of Caribbean nations continue to rely heavily on fossil fuels as a source of energy. As of 2022, fossil fuel-based technologies constituted approximately 80% of the region's power

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generation mix when considering all Caribbean countries collectively (OLADE 2023).

The Seventh Sustainable Development Goal (SDG 7) of the United Nations (UN) aims to ensure access to affordable, reliable, sustainable, and modern energy for all. Nevertheless, attaining this objective presents considerable challenges in Latin America and the Caribbean, where notable social inequalities persist. Despite substantial improvements in electricity coverage—reaching 97.54% of the population by 2022 (Castillo et al. 2023)—access to clean and modern fuels and technologies remains unevenly distributed across socioeconomic and geographic sectors. Notably, energy poverty remains pronounced: the poorest quintile of the population has nine times less access to electricity than the wealthiest quintile, highlighting a persistent gap that disproportionately affects rural and marginalised communities (United Nations 2023).

In addition to structural inequalities, recent global crises, such as the COVID-19 pandemic and the war in Ukraine, have led to sharp increases in energy costs, exacerbating inflation throughout the region. This inflation has further burdened low-income households, with many struggling to afford energy services (United Nations 2023). In Brazil, the financial burden of energy costs is borne disproportionately by low-income households. A survey conducted by the Instituto Clima e Sociedade revealed that roughly one-quarter of the Brazilian population allocates approximately half of their income to expenses related to electricity and gas. This economic strain is particularly acute among lower-income families, who must dedicate a larger share of their earnings to energy-related needs. In 2021 (also in Brazil), nearly 40% of the poorest consumers reported deferring their electricity bill payments for at least one month due to rising energy prices (O Estado de S. Paulo 2022). Ensuring universal access to affordable and clean energy depends on resolving socioeconomic disparities within and between countries and mitigating external economic pressures exacerbating energy insecurity among vulnerable populations (United Nations 2023).

Concerning the Latin American role as a commodities provider, as articulated in Eduardo Galeano's seminal work, *Open Veins of Latin America: Five Centuries of the Pillage of a Continent* (1972), Latin America has historically assumed the role of supplying primary materials to fuel the development of the Global North. Given the region's abundant reserves of critical minerals needed for low-carbon technologies, the energy transition could reinforce this extractive role. In 2023, Chile led global copper production, with Peru ranking third. Additionally, Chile and Argentina were among the top five lithium producers, while Brazil held a similar position in global graphite production (IEA 2024b). However, the region largely lacks production capacity for low-carbon technology manufacturing, with Brazil and Mexico as partial exceptions (IEA 2024a).

## Socioenvironmental conflicts

Mining activities in Latin America are sometimes linked to socio-environmental conflicts and, in some instances, catastrophic socio-environmental disasters. Among the most notorious cases are the collapses of the Mariana and Brumadinho dams in Brazil, which occurred in 2015 and 2019, respectively. These tragedies, etched into collective memory, resulted in nearly 300 fatalities and caused extensive socio-environmental damage, severely disrupting local and regional ecosystems. Such events starkly illustrate the profound risks associated with mining operations (Rocha 2021). Similarly, on 6 August 2014, the Buenavista del Cobre mine in Cananea, Mexico, released 40,000 cubic meters of acidified copper sulfate into the Bacanuchi River, a tributary of the Sonora River, Mexico's second-largest basin. This spill precipitated a major ecological crisis, further emphasising the environmental vulnerabilities tied to large-scale mining activities (Gobierno de México 2013).

A substantial body of research—and databases (Temper, Bene, and Martinez-Alier 2015)—has documented the diverse socio-environmental conflicts associated with mining across Latin America. For example, the mining of copper and lithium in Chile has resulted in disputes over water resources with local communities (Akchurin 2023). Similarly, in the work entitled *This System is Killing Us: In Land Grabbing, the Green Economy and Ecological Conflict*, Dunlap (2024) draws attention to the human rights violations associated with copper-related disputes in Peru, thereby demonstrating the far-reaching impact of extractive industries on local communities and ecosystems across the continent.

Uribe-Sierra, Toscana-Aparicio, and Mora-Rojas (2023) posit that mining activities in Latin America, distinguished

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by a dearth of industrial processing and value-added production, have contributed to the concentration of wealth. This concentration of profits, however, has intensified territorial pressures, exacerbating socio-environmental conflicts. While the ongoing energy transition is of global urgency, given the imperative to decarbonise the world economy for long-term sustainability, there is a significant risk that if it continues to follow the current patterns of critical mineral exploitation in Latin America (and the Global South), it may perpetuate the unsustainable dynamics of inequality and environmental degradation in the region.

## Vulnerabilities in facing the crisis

The World Meteorological Organization (WMO) documents a range of significant climate anomalies in South America in 2024, thereby underscoring the intensifying impacts of climate change on the continent. During the winter months in the Southern Hemisphere, several regions recorded temperatures typically associated with the summer season. Areas in Bolivia, Paraguay, southern Brazil, Uruguay, and northern Argentina experienced temperatures exceeding 30 °C, some above 35 °C. In contrast, during the initial days of July, an unanticipated cold front impacted numerous regions across South America. In southern Peru, heavy snowfall significantly damaged infrastructure, leading to multiple residential structures and buildings collapsing. Additionally, temperatures as low as -6 °C were recorded in southern Brazil and Uruguay on 9 July, underscoring the region's susceptibility to unseasonable heat and extreme cold (WMO 2024). Moreover, the beginning of this year saw the devastation wrought by severe flooding in southern Brazil and, more recently, Hurricane Rafael in Cuba (European Union 2024; PAHO 2024). All these events served to illustrate the region's vulnerability to extreme weather occurrences.

The year 2024 has presented unprecedented scenes across Latin America, marked by extensive fire emergencies. In Argentina, wildfires ravaged 148,678 hectares across Córdoba and San Luis provinces during September and October of 2024 (Portal Oficial del Estado Argentino 2024). By 10 November, the TerraBrasilis platform had recorded 252,075 fire outbreaks in Brazil, with the Amazon biome suffering the greatest impact, accounting for at least 50% of the events (INPE 2024). These events underscore the intensifying pressures on vital ecosystems in the region, exacerbated by climate change and land-use changes.

These issues are not merely statistical; they concern ecosystems that are fundamental to maintaining the ecological balances essential for life on Earth. As the world's largest tropical forest, the Amazon plays a vital role in global climate regulation, with the capacity to sequester vast amounts of carbon dioxide and release oxygen. The consequences of such degradation or destruction extend far beyond the boundaries of Brazil, affecting the global and regional biophysical balances. Tropical forests such as the Amazon are vital for maintaining planetary health, thereby highlighting the global significance of their preservation (Revista Amazonia 2024).

## Final words

Industrial activities associated with the production of critical minerals embody a complex duality. While essential for decarbonising the global economy and enhancing national economies, they also have the potential to generate significant socio-environmental conflicts if sustainable practices are not upheld throughout production chains. This risk is particularly concerning in Latin America and the Caribbean, where the region's vulnerability to intensifying climate change-related events could exacerbate the adverse impacts of unsustainable resource extraction, leading to heightened pressures on both communities and ecosystems. Political definitions became critical.

In recent years, the region has seen significant fluctuations in governmental approaches to environmental stewardship. Leaders such as Gustavo Petro in Colombia and Luiz Inácio 'Lula' da Silva in Brazil have advocated for ambitious environmental agendas integrating ecological protection with economic development strategies. In contrast, other figures, including Javier Milei (Argentina) and, previously, Jair Bolsonaro (Brazil), have consistently downplayed the significance of climate change, prioritising short-term economic interests over environmental concerns. This divergence reflects a broader regional instability in commitment to sustainable policies, impacting the effectiveness of coordinated climate action. Nonetheless, the region's long-standing dependence on natural resources remains constant and is perpetuated across political spectrums, from neoliberal to progressive to centrist governments. This enduring dependency poses a significant challenge to advancing a more sustainable and

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diversified economic model.

It appears that both local and global economies require new models that go beyond mere energy form substitution. An economy heavily reliant on intensive energy and material consumption offers no true solution if it merely replaces fossil fuels with renewables. While renewable energy technologies do not emit pollutants during operation, their development demands extensive critical mineral resources, leading to environmental and social impacts—mainly—in peripheral regions. A sustainable transition, therefore, must also address consumption patterns and consider the broader implications of infrastructure demands on vulnerable ecosystems and communities worldwide. Reevaluating the biophysical limits of our planet and guiding the transition within the framework of planetary boundaries is urgent and imperative. Addressing this need is critical for ensuring that sustainable development pathways remain aligned with the Earth's ecological capacity, thereby preventing irreversible environmental degradation.

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