Can clean electrification empower the industrial sector in South America?

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What if the clean electricity that powers most of South America's grids could also enhance industrial competitiveness? The region's industry is at a crossroads due to low-cost imports, volatile fuel prices, and pressure to decarbonize. Electrifying heavy industry, from steel and cement to aluminum and mining, is an economic opportunity, not just climate commitment. Running on the world's greenest grids, from Brazil and Uruguay to Colombia, and driven by ambitious plans in Chile, clean industrial electrification can cut costs, empower re-industrialization, and create jobs.

The basis for an Industrial transformation powered by electricity.

The region's industrial sector has faced stiff competition from overseas low-cost manufacturers, which has affected domestic production leading to closures and job losses. Also, industry has traditionally relied on a mix of natural gas and petroleum derivatives to power processing and logistics, which adds volatility associated with their global markets. Furthermore, it has an overreliance on raw material exports, making it vulnerable to global price swings and bypassing higher value-added domestic production.

Electrification of industry has the potential to reduce manufacturing costs and promote re-industrialization. Electrification of the sector should be driven primarily by economics, but it could also address global supply chain pressures, fossil fuel price volatility, resource efficiency, and the necessity to meet energy transition goals and low-carbon economy commitments. Through initiatives such as Brazil's Energy Transformation Plan, Chile's Long-Term Energy Planning (PELP), Uruguay's, Energy Transition Program, Colombia's indicative National Energy Plan (PEN 2050), several countries in the region are laying the groundwork to spearhead a green industrialization.

Advantages of powering industry with renewable energy

A primary benefit of industrial electrification in the region is the synergy between the renewable-energy based character of the power grid and the intrinsic efficiency of electricity to deliver usable work. The region already has one of the highest shares of renewables globally. In 2025, Latin America and the Caribbean generated 65% of its electricity from renewable sources (IEA, 2026). The use of renewables is expected to reach 90% in South America by 2050 (IRENA, 2025).

For example, Brazil has one of the most renewable power grids in the world, with roughly 90% to 92% of its electricity generated from renewable sources, predominantly hydroelectricity, complemented by a rapidly expanding capacity in wind and solar power. In Uruguay, already 100% of the electricity is provided by wind and solar complemented by hydro, while in Chile, there is a rapid transformation of the power grid, expected to eliminate reliance on fossil fuels by 2050. In Colombia close to 80% of its electricity came from low-carbon sources, with hydropower alone supplying more than 70% in 2025.

As electricity is already mostly provided by renewables, shifting basic industrial systems—such as boilers, furnaces, pumps and assembly lines—from fossil fuels to electric power directly passes energy efficiency gains to the end users. This grants manufacturers a distinct advantage in the global market, where consumers are increasingly demanding competitive and sustainably produced goods.

At a macroeconomic level, widespread industrial and transport electrification increases efficiency and drives down costs of services and products. A recent report (Vergara et al, 2025) estimates that complete electrification of the economy of Chile would result in annual savings of the order of $13 billion by 2050.

Readiness of electrical industrial processes.

Are electric industrial processes ready for adoption? Mayor advances have recently been made in the development and commercialization of electrical industrial processes (see for example WEC, 2025). Our analysis (Vergara et al, 2025) indicates that Direct Iron Reduction in the manufacture of steel is one option that is already competitive when low-cost electricity, hydrogen and high-quality iron ores are available as is the case of Chile. Other processes are also well positioned to enter the market if electricity is available at low user prices (see Table 1).

Table 1. State of readiness of electrification technology in heavy industry

Sector	Electrical Option	Readiness level	Relative competitiveness
Steel	Direct reduction of iron	First commercial units in operation (Stegra, 2026)	High
Cement	Electrochemical decarbonation	Advanced pilot (Volaity S., et al, 2024)	Moderate
Aluminum	Electricity decarbonization, hydrogen anodes.	Commercially available (Dardor D., et al, 2024)	High
Pulp and paper	Plasma calcination	Laboratory and pilot plant testing	Moderate

		(Dylong, 2024)	
Iron mining	Electric mining equipment (excavators, grinders), electric mining fleet	Various stages of development (Glushenko A, 2026)	Moderate
Glass making	All electric furnaces	Some commercial-size units in operation.	Moderate to high

Likewise, the electrification of mining operations has the potential to reduce production costs and further improve the economics of the industrial sector. For example, fully electric operations for iron and bauxite mining are either being implemented or being considered. As rolling stock in mining operations has an oversized contribution to production costs, the electrification of this type of heavy equipment is also a priority.

Job Creation

Electrification serves as a catalyst for reindustrialization. Countries could develop domestic manufacturing capabilities and create jobs for the equipment needed for the energy transition. It positions their economies to better-face stiff competition in the global markets, as in Brazil, where industry already accounts for 25% of GDP and over 11 million jobs.

The transition to electrical processes for industry as well as the production of electric devices like boilers, furnaces, heaters, mining equipment, as well as battery-electric vehicles, electric buses, smart grid components, and advanced battery storage systems requires a workforce trained in engineering, advanced manufacturing, electric equipment maintenance and operation, and grid management, fundamentally expanding and upskilling the labor force. This would also promote education and vocational systems while expanding in-house R&D activities.

Health, Environmental, and Public Welfare Benefits

The electrification of industry brings additional benefits that are not traditionally monetized in public accounts. Displacement of combustion engines, fossil-fuel boilers, furnaces and other thermal devices would eliminate airborne criteria pollutants linked to respiratory and cardiovascular diseases, that place a burden on the public healthcare system. In the Chile study, it was estimated that full displacement of fossil fuels in the economy would result in annual avoided health costs of $15.4 billion by 2050. Similarly, the electrification of industry using renewables would avoid carbon emissions. The avoided social costs of these emissions constitute an important welfare benefit.

Grid Modernization

The integration of new demand for electricity alongside new central generators and decentralized renewable generation—requires significant investments in grid expansion, flexibility, high-voltage transmission networks, and energy storage. To fully realize the benefits of industrial electrification, the transmission and distribution grids need to expand and modernize.

Rather than basing this expansion on the existing technologies, it could rely on novel practices like: a) reconductoring which enables increase in electricity transmission while avoiding the laying out of new rights of way (see for example Chojkiewickz et al, 2024); b) low frequency transmission (LFAC), which reduces losses while avoiding inversion; and c) multi point HDVC which uses a single HDVC line that is accessible to multiple points of entry by different generators.

Upgrading the grid involves deploying smart solutions, including supervisory and data acquisition systems, AI-driven predictive maintenance, and cybersecurity measures. These efforts will make the power system more resilient, flexible, and decentralized.

Furthermore, the rise of industrial and fleet electrification enables greater consumer participation in demand management. With the right regulatory framework, industrial facilities can act as active agents in the energy market, adjusting their electricity consumption based on grid conditions and pricing, which helps stabilize the overall system and reduces pressure during peak demand periods.

Global Leadership and Geopolitical Positioning

By taking early action to electrify manufacturing, countries avoid the risk of being left behind with obsolete combustion-engine manufacturing capacities. Instead, it can capture market share in a rapidly growing Latin American market. With abundant energy endowments necessary for the energy transition, strong institutions and policy frameworks, Brazil, Chile, Colombia, and Uruguay possess all the necessary conditions to build an independent, domestic supply chain for green technologies, attractive to the global market.

Conclusion

The electrification of the industrial sector represents an opportunity to leverage the region’s endowment in renewable energy and its ample mineral resources. It would contribute to strengthening global competitiveness and can generate substantial economic output.

For heavy industry, the shift to electric processes powered by renewable energy can dramatically improve competitiveness, promote job creation, and cut emissions while maintaining industrial output. Achieving this transition will require coordinated action among technology developers, industry leaders, policymakers, and energy providers. If

pursued ambitiously, electrification can help transform some of the region's most carbonintensive industries into engines of a sustainable economy.

Although the transition will require continuous investment in grid modernization, energy storage, and targeted public policies, the long-term benefits far outweigh the upfront costs. Ultimately, the electrification of industry allows countries such as Brazil, Chile, Colombia, and Uruguay, to transition into a modernized, renewables-based electrified economy, setting a blueprint for industrial development and climate action.

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