

Energy Transition in South America: Insights from an Integrated Long-Term Optimization Framework

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Extended Abstract

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Abstract Summary

Deep decarbonization demands a rapid expansion of low-carbon technologies like renewables, electrification, hydrogen, and carbon capture, which also drives up demand for critical minerals and metals. South America plays a pivotal role in this transition, particularly as a supplier of lithium, copper, and nickel. The "Lithium Triangle" composed of Argentina, Bolivia, and Chile sits at the heart of debates over lithium supply, bringing together vast brine resources, national industrial ambitions, and tensions over resource sovereignty, as highlighted in the 2023 IEA article by Bernal, Husar, and Bracht. Yet the region faces more than just opportunities because mining expansion risks intensifying water stress, competing with agricultural and community needs, and sparking social and geopolitical conflict. Meanwhile, South American countries are pursuing diverse development trajectories and decarbonization strategies, making regionally granular analysis essential. This work describes our efforts to strengthen South America's representation in TIAM-FR, a global long-term energy optimization model. We're integrating the regional structure and database from the legacy TIMES-ALyC model (circa 2014, documented in Postic, 2015) into TIAM-FR. The goal is to create a framework capable of analysing how energy transitions and mineral extraction dynamics interact across South America within a coherent global context

Presenting Author Biography

Thomas Nguyen is an engineering graduate from ENSIE and holds a Master's degree in Prospective Modelling for Economy, Environment and Energy from AgroParisTech. He is currently pursuing a Specialized Master's in Energy Systems Optimization at Mines Paris – PSL, where he also works on prospective energy modelling. His research focuses on energy economics, environmental assessment, and long-term techno-economic modelling, with particular experience in TIMES-based scenario analysis for decarbonization pathways in South America.