MINING MODERNITY: ENERGY LIMITATIONS AND EFFICIENCY OPPORTUNITIES IN VIETNAM'S ALUMINUM INDUSTRY

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Overview

Vietnam has the world's fourth largest bauxite reserves. The development of a full aluminum supply chain, from bauxite to aluminum, is a highly energy-intensive process, and Vietnam has relatively few domestic energy resources. Yet, the government has expressed interest in supporting this industry, building two aluminum plants and one aluminum smelter. This research paper analyzes energy and technology use in Vietnam's existing aluminum industry, identifying the cost and energy saving potential of several retrofit technologies as well as speculating on the drivers of energy intensity in Vietnam's aluminum supply chain.

Methods

This paper uses interdisciplinary methods to analyse energy and technology use in Vietnam's aluminum industry. Using data from field research, a life cycle energy accounting approach is used to quantify energy intensity in each phase of aluminum production in Vietnam in comparison to global estimates. Global data came from the International Aluminium Institute's 2010 life cycle inventory (LCI) of the global aluminum industry. Potential retrofit technologies were identified for Vietnam's alumina plants through triangulating literature on the plants with Google Earth Landsat imagery of the plant sites. Cost and energy saving potential were also identified for each technology. This data was used for a simple cost analysis of the retrofit technologies as well as estimating the net present value of the technologies' capital costs and their electricity cost savings. Several scenarios are considered in the economic analysis, including subsidy reforms in Vietnam's energy sector. Finally, this research uses data from qualitative interviews with experts in Vietnam to identify the political and economic trends that also play a role in determining energy intensity in Vietnam's aluminum industry.

Results

The life cycle energy accounting results indicate that Vietnam's aluminum production overall is more energy intensive than the global average, driven by high energy intensity in the alumina production phase. In order to increase the energy efficiency of alumina production, the following technologies were identified and analyzed: two-step digester, high-rate thickener, five-step inter-state heat exchanger, fines destruction technology, and upgraded calcination. Analysis of net present value, including scenario analysis, indicates that some of these retrofit technologies are promising investments in the near term. This research also determined three qualitative trends that affect energy intensity in Vietnam's aluminum industry: tension between China and Vietnam that affects resource management; differences in national and provincial government policy priorities; and subsidies for electricity and fuel inputs that reduce the incentive to invest in energy efficient technologies.

Conclusions

The energy footprint of Vietnam's aluminum industry is an important consideration for decision-makers in Vietnam, given Vietnam's need for energy security. This research identifies retrofit technologies for alumina production and provides a range of cost estimates, as well as estimating energy intensity throughout the aluminum supply chain in Vietnam. Promoting efficient operation of Vietnam's aluminum industry will require deeper structural shifts, including reforming energy and electricity pricing and aligning government incentives at the provincial, national, and international level.

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