

SEG 2023 Conference: Resourcing the Green Transition

A Rapid Transition to an Electrical Economy Based on Energy from Solar and Wind is Not Resource Viable

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Transitioning to an energy infrastructure entirely reliant on renewable energy resources requires production of metals from new mineral deposits on an unprecedented scale. For example, to increase the number of U.S. wind turbines by 5%/y over current levels requires 115 kt/y of copper; expanding photovoltaic solar by 5%/y requires 600 kt/y more copper; producing 8 million battery electric vehicles per year requires 730 kt/y more copper. The Bingham Canyon copper mine in Utah produced 144 kt/y of copper in 2022. Thus, to support just these modest steps toward a green economy would require the U.S. put 10 new Bingham Canyon copper mines into production each year, and the number would increase as the wind and photovoltaic base grows. Globally, at least 100 Bingham Canyon mines per year are needed. This seems a practical impossibility considering that permitting and development of a new copper mine takes an average of 16 years. The projected annual global copper shortage will be about 10 million tonnes by 2030. In fact, by 2030 there will be a global shortage of cobalt, graphite, lithium, manganese, nickel, rare earths, and every other metal required for the green energy transition. These projections just consider the energy transition. They do not include the resources needed to bring the underdeveloped world up to developed-world levels of energy use. For equity and feasibility, we must consider zero-carbon strategies that take the pressure off resource supply.