

Embargoed until Friday, October 20th, 2023, at 9:00 am (EST)

Columbia University Releases New Research on Accelerating Circular Economy Approaches in Mineral and Renewable Energy Value Chains

New York, October 20th, 2023 – The Columbia Center on Sustainable Investment (CCSI) has published a new report—*Circularity in Mineral and Renewable Energy Value Chains: Overview of Technology, Policy, and Finance Aspects*.

The report explores existing technology, policy, and finance conditions as well as reforms needed to enable global circularity in the mineral value chains of solar photovoltaic (PV) panels and wind turbines. It zeroes in on four key materials that are critical to solar and wind energy—aluminum, copper products, silicon, and steel—but many of its findings and conclusions are relevant and may be transferable to other energy transition value chains.

CCSI's key findings and recommendations in the report include:

- **Increased policy and financial support is necessary to lift technical and logistical barriers to circularity in the mineral value chains of solar and wind energy.** Existing policy frameworks analyzed are insufficient but already indicate the direction of travel and provide market signals.
- **Policy makers in both developing and developed countries should swiftly design and implement comprehensive and nationally appropriate policy packages** to accelerate the circular transformation of the economy and shift business practices beyond the current focus on waste management and recycling. To help achieve this, the report proposes a policy toolkit and roadmaps for its deployment.

Recommended policies include circularity-focused and industry-specific roadmaps, targets, standards, and digital labels; removal of legal barriers, extended producer responsibility (EPR) and producer ownership schemes; public financing for R&D, infrastructure, and data collection; trade measures—such as lifting export restrictions on metal scrap, which prevent cross-border circular flows—and information sharing, monitoring, compliance, and enforcement mechanisms.

- **Circularity creates business opportunities** for mining and metals companies, solar and wind manufacturers, and power utilities.

For example, copper mining waste piles created in 2022 amounted to 4,214 million metric tons. Residual copper recovered from these tailings could be worth between USD 74 billion and USD 297 billion at the current price for the primary metal.

By 2050, the aluminum content of solar PV waste could be worth USD 98 billion at current prices, and the steel content in wind turbine waste, USD 121 billion.

- **Circularity** is also **crucial in enabling them to achieve net-zero carbon emissions by 2050**, in line with the Paris Agreement on climate change. For instance, the emissions footprint of the production of recycled aluminum is 95% lower than that of primary aluminum.
- **Companies in mineral and renewable energy value chains should focus on exploring the diverse set of potential circular business models and pathways for transitioning**, including developing a shared understanding of the implications of circularity and gathering evidence documenting its value. On this basis, they should strategize and engage with policy makers, innovators, financiers, research institutions and downstream purchasers.

“The global transition to renewable energy systems will be mineral intensive and, under current linear economy conditions, will exacerbate mining’s footprint on the planet,” said report co-author **Perrine Toledano, Director of Research and Policy, CCSI**. “The primary extraction of minerals and metals will not keep up with the material needs of the energy transition and the growing population. Without engagement of the mining and metals and renewable energy sectors in the circular economy beyond recycling, pressure from these demands will build up against primary extraction and renewable energy value chains,” she added.

“To meet the demand for materials sustainably, responsible primary extraction needs to be combined with the adoption of circular economy approaches throughout the mineral and renewable energy value chains, ensuring that inherently durable materials never become waste,” noted report co-author **Martin Dietrich Brauch, Lead Researcher, CCSI**.

ICMM and the Enel Foundation supported the report and acted as knowledge partners to the CCSI research team throughout the research project.

Christian Spano, Director of Innovation, ICMM, said: “Responsible production of minerals and metals can drive social and economic development while supplying the durable materials that the world needs to support a global transition to a circular economy. Beyond the industry’s increasing focus on eliminating waste and restoring land to increase the sustainability of mining processes—collaboration and innovation across value chains to improve the recovery of critical materials will be vital to supplementing sustainable primary production to meet global demand for these materials.

“The findings from CCSI’s report will help the industry to catalyze innovation and action within their own organizations, as well as enhance collaboration with downstream customers and policy makers that can help to solve challenges impeding progress and accelerate a global circular economy at scale.”

Silvia Burgos, Senior Researcher, Enel Foundation, said: “The energy transition does not only refer to the change towards a system based on renewable energy sources, but also implies a paradigm shift throughout society and the circular transformation of the global economy. Commitment is needed from many sectors and actors, from mining and metals companies, utilities, and manufacturers, to policymakers, financial and research institutions. This report includes calls to action for these sectors to actively promote strategies that increase the circularity of critical materials necessary for the energy transition.”

Read the executive summary and the full report on CCSI's website:
<https://ccsi.columbia.edu/circular-economy-mining-energy>.