

ENERGY AND MATERIALS NEEDS FOR A NET ZERO SCENARIO

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Extended Abstract

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Abstract Summary

Electrifying end uses and decarbonizing the power mix are central pillars of the energy transition, but they rely on technologies that are highly material intensive, particularly in critical metals such as copper, lithium and cobalt. Because mineral extraction is geographically concentrated and new supply takes decades to develop, material availability may constrain the transition.

This study combines the global energy model DEMO with the MONDELIUM module to link socio-economic drivers, energy demand, CO₂ emissions, material requirements and global temperature outcomes. Based on an adaptation of the IEA Net Zero Emissions Scenario, it develops a pathway to reach net zero emissions by 2050, consistent with limiting warming to around 1.6 °C.

Results show a profound transformation of the global energy system, with massive electrification and rapid expansion of solar and wind power. However, this transition leads to a sharp increase in material demand, particularly for copper, highlighting risks related to resource constraints, supply chain concentration and the need for a careful transition management.

Presenting Author Biography

François Cattier is a Project Manager at EDF R&D, responsible for issues related to the evolution of the international energy system. Before joining EDF, François Cattier was a Senior Energy Analyst at the International Energy Agency, where he co-authored six editions of the World Energy Outlook. François Cattier began his career at CNRS, contributing to the development of the global energy model POLES.