Towards a sustainable and circular metals economy: the case of copper in China

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Propositions
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By **Di Dong**

1. In-use stocks and demand of copper are expected to increase substantially in China, and therefore the Chinese copper cycle cannot become completely circular by 2050 under current policies (Chapter 2).
2. A circular economy for copper in China can only be achieved when in-use stocks saturate and every circularity strategy is employed to the max. This is not expected to happen before the end of the century (Chapter 3).
3. Implementing the "Green Fence" policy will reduce the amount of available copper scrap, which limits the possibilities to meet copper demand with secondary supply (Chapter 3).
4. The energy transition by shifting from fossil fuels to renewable energy can significantly reduce the environmental impacts of copper production, but it also increases copper demand (Chapter 4).
5. Increasing secondary copper production, which is the most environmentally friendly option towards a sustainable and circular economy, requires actions across the full product lifecycle, including waste prevention and end-of life strategies as well as early-stage product design (Chapter 5).
6. Whereas the characteristic properties and cost of materials are the main important decision points in product designs, the consideration of a material's environmental attributes is only recently becoming more common (Babbitt et al., 2021).
7. Rebound effects may occur by shifting from a linear to a circular economy and could diminish environmental benefits, and even change the preference order of End of Life (EoL) practices (Siderius et al., 2021)
8. Considering supply risk, environmental implications, and vulnerability to supply restriction, geopolitical concentration of primary production, available suitable substitutes, and political stability are main contributors to criticality of metals, and could also affect their sustainable development (Graedel et al., 2015).
9. Resource efficiency strategies are not only essential for the move towards a circular economy, but also can contribute to economic growth, job creation and climate change strategies (Hertwich et al., 2019).
10. The tensions in the Sustainable Development Goals can be resolved if economic growth and human development can be decoupled significantly from material use, waste, and emissions (Schandl et al., 2018; OECD, 2019).
11. "*Sustainability is a cultural phenomenon*": the only way to achieve a sustainable development is to create cultural change "deliberately by designed interventions" (Ehrenfeld, 2008).