

Can Copper Recycling and Substitution Displace Mining?



▲ Scrap copper, one source of recycled copper

Image credit: www.scrapmetalsydney.com

Recovering and recycling copper helps meet global demand, conserves natural resources, and reduces environmental and social externalities.

40 MILLION METRIC TONS

OF CO₂ EMISSIONS
AVOIDED EACH YEAR BY
COPPER RECYCLING



At a first look, recycling appears to be a viable option to displace mining.

Copper is virtually 100% recyclable; as an element, it does not decay. Copper does not lose physical, chemical, or performance properties with recycling processes, so recycled copper is no different from copper smelted from ore. Recovering and recycling copper for reuse helps meet global demand, conserves natural resources, and improves sustainability by reducing environmental and social externalities. The process of recycling copper, called secondary production, also uses up to 85% less energy than primary production (mining). Overall, the current level of copper recycling saves an estimated 100 MW of electrical energy and 40 million metric tons of CO₂ worldwide each year.²³

Currently, recycling provides approximately 30% of the global copper supply. Copper prices are high. The global recycling market is large, brisk and efficient, and there is a strong global awareness that recycling copper provides income. However, it appears that there is no vast stock of copper easily available and simply waiting to be recycled. Copper has a long useful life in most products. In fact, most of the copper mined since 1900 is still in use.²⁴ With no vast copper resources available for recycling, the potential for fully replacing mining with recycling simply cannot be realized.

Mining today continues to provide the majority of the copper supply. The ever-increasing demand for copper has already reached 24 million tons/year and continues to rise, but this demand is also highly sensitive to economic downturns, particularly in the housing market. Additional copper recycling will be necessary to keep up with the growing demand, but this will not relieve the full demand for copper from mining.²⁵ As it is clear that recycling will not supply enough copper to meet growing global demands, the only option left available for displacing mining is substitution. For many applications, copper is a difficult material to replace because it performs so well as a power and heat conductor. Carbon-based conductor replacement materials are on the technological horizon, but they are simply not yet present in quantity.²⁶

30% OF THE GLOBAL COPPER SUPPLY IS PROVIDED BY RECYCLING



Overall, it is clear that continued mining is required to meet growing copper demand and to ensure that more people living in poverty can avail themselves of modern power, drinking water and electronic goods.

Fiber optics cable technology, used in many telecommunications applications, provides an example of a superior substitute for copper in one industry. Fiber optic cable is far faster and more efficient at conducting communications signals than copper, and it has significantly reduced what would have been the demand for copper without fiber optic development. Optic fiber is unquestionably a superior substitution for copper in long-haul communications, and markets have powered this substitution.

Another example of substitution is in aircraft wiring. In this case, aluminum wire is more efficient than copper in the conductivity to weight ratio. However, when weight is not a factor, copper remains the better option. Aluminum has a greater expansion coefficient, which has caused a greater frequency of house fires in aluminum wired houses than in copper wired houses.²⁷

Other substitutes such as Pex and aluminum wiring remain more costly, with less overall performance value and therefore less sustainability than copper. Substitution could provide a significant and less costly source of copper; however, supply would still be insufficient.

Overall, it is clear that continued mining is required to meet growing copper demand and to ensure that more people living in poverty can avail themselves of modern power, drinking water and electronic goods.²⁸ Much of the current copper consumption provides new services such as rural electrification, residential construction, and industrial applications, particularly in China and India.