

The significant contribution by Continuous-Properzi to reduce the Carbon Footprint in the Copper Sector

Cu Green Wire and Properzi Cu Refining Technology

Copper (Cu), with its unique properties, is central for economic growth, quality of life and sustainability. However, the base-metal producing sector, as well as the downstream processes, is under growing public pressure with respect to energy and water requirements and needs to meet several challenges, including increased demand and lower ore grades, and increased demand of electrical energy which generally requires greater use of resources.

In this article we will emphasize and illustrate Continuous Properzi's significant contribution to reducing the CO₂ emission in the Copper Chain with recycled and green copper through the Properzi Refining Technology, detailed in the following paragraphs, and the production of the Cu Green Wire through Properzi's disruptive SAM (**S**elf **A**nnealing **M**icrorolling[®]) technology.



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Properzi Cu Refining Technology: savings up to 7'000 Kg CO₂-eq per ton of FRHC copper rod products processing 100% copper scrap



Copper Scrap at the Base of the Cu Refining Technology

The future challenges of the sector, in order to maintain its competitiveness, minimize carbon and water footprint, and achieve sustainable growth, include aspects related to exploitation and access of new resources, trade, research and innovation activities, and the reduction of energy and water requirements.

The decreasing ore grades result in environmental concerns such as large waste/metal ratio and higher use of resources with respect to the use of energy, explosives, and water.

The metal producing sector is, on the one hand, under growing public pressure, while on the other hand it needs to overcome several burdens such as, for example, increased demand for metals and the treatment of lower ore grades.

The most reputable publications on the Carbon footprint of Cu production from primary sources calculates values of CO₂ equivalent to produce 1 ton of Cu up to 8.5 t CO₂-eq/t Cu in certain geographical regions, according to the required metallurgical production process. This value is consistent with what was retrieved from the various literature sources.

Copper can be 100% recovered from the majority of its end-products and returned to the production process without loss of quality during recycling. The production of secondary Cu is based on the direct melt of “new scrap” (waste resulting from either metals discarded in semis fabrication or generated during the initial manufacturing process) and/or the recycling of “old scrap” (obsolete end-of-life products or structures). Old scrap is often contaminated to a certain degree, depending mainly on its origin and the efficiency of its collection systems. Scrap metal recycling involves a number of steps such as recovery, sorting, brokering, baling, shearing and smelting.

In the following paragraphs we will provide more information on the types of copper scrap that can be refined thanks to the Properzi Refining Know-How and the wide range of furnaces and performances we can achieve. Here we focus our attention only on the reduction of the CO₂-eq made possible with our technology in obtaining refined secondary Cu that is internationally identified as FRHC (**F**ire **R**efined **H**igh **C**onductivity).

The main processes used for obtaining secondary Cu are disassembly, sorting (according to different levels of purity), transportation, chopping, melting, and refining to remove the necessary quantities of impurities to reach the desired characteristics. The Properzi Refining Technology allows to melt and refine selected Cu scrap (old, new or a mix of them) with a production ranging from 0.2 to 0.3 t CO₂-eq/t Cu. According to the available literature the average values for the upstream processes, mainly for Cu scrap transportation/preparation, vary from 0.25 to 0.35 t CO₂-eq/t Cu. The data indicates that the variation depends on the quality of the source material, the metallurgical process used and the quality of copper scrap.



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Copper Bundles produced with Properzi Technology

According to our studies we obtained results similar to the ones published by Giurco and Petrie in their work titled “Strategies for reducing the carbon footprint of copper: New technologies, more recycling or demand management?” issued by Minerals Engineering. We calculated that the Carbon Footprint to obtain 1 t of Cu from an ore (0.45% Cu) can reach 7.65 t CO₂-eq; however, when Cu was obtained from a mix of 25% 1st quality scrap (> 99% Cu), 37.5% of 2nd quality scrap (> 96% Cu), and 37.5% of low quality scrap (> 94% Cu) the Carbon Footprint was estimated to be reduced to 0.65 t CO₂-eq.

According to this data the production of FRHC Cu products from secondary Cu, that can replace with almost identical characteristics Cu products starting from primary Cu, thanks to the Properzi refining technology, can reduce the Carbon Footprint **by as much as 7'000 Kg CO₂-eq per ton of FRHC copper rod products processing 100% copper scrap (old and/or new).**

Cu Green Wire: savings up to 50% of electrical energy per ton of 1.8 - 2.6 mm wire starting from 8 mm rod

In addition to the Refining Process, it is important to mention our revolutionary Self Annealing Microrolling® technology that facilitates a 50% energy savings. Even if the value of CO₂-eq per ton is much lower compared to the one indicated for the refining process, its amount is important considering the millions of tons of copper rod processed into wire.



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Properzi Microrolling @ Mill

The production of Cu wire from 8 mm ETP rod has occurred for almost 50 years through the traditional breakdown drawing machines equipped with an inline electric annealer.

During this period of time the breakdown drawing machines have been subjected to several improvements both in mechanics and automation.

However, the basic concept design still requires that the wire under process is cooled in each capstan before passing through the various dies so that the wire can then be subsequently heated and quenched by the annealing process in order to obtain soft wire.

The fundamental limitations, strictly from the environmental point of view of this consolidated process can be summarized by saying a high consumption of electric energy, in the range of **90÷110 kWh/t**, is necessary for the recrystallization of the Cu wire through the annealer.

With the aim of resolving the problems listed above, Continuus-Properzi has designed, patented, manufactured, and tested a revolutionary system based on the well proven Microrolling® mill as described here forth in the following paragraphs.

The concept design of Properzi's new Process is based on the use of the rolling power to increase the temperature of the wire while being rolled so that it exits at a temperature which is above the recrystallization temperature. The costly power usage for the re-heating in the annealer is totally avoided.

Furthermore, the electric power requested for the rolling operations at such temperature, needs considerably less power compared with the power needed by a breakdown drawing machine.

This Properzi SAM Cu Microrolling® system is a revolutionary piece of equipment and, among all the other advantages, is environmentally friendly with energy savings, compared to traditional rod-breakdown operations of up to 50% (in the range of 90÷110 kWh/t) while creating virtually no copper dust during the process. These two characteristics allow a savings of CO₂ and, considering the millions of tons of copper rod processed in the traditionally breakdown machine, the potential reduction of installed power plants of hundreds GigaWatt.

Conclusion

The Nature of our Company is to increase the efficiency of our equipment, to reduce the consumption of utilities and to reduce waste by inventing new technological solutions for recycling copper scrap. As explained above it is possible to convert 100% low quality copper scrap directly into high quality copper rod. We have spent tremendous effort in the realization of these goals and we continue to work to improve upon the significant results already reached. We summarized these results here below:

- Properzi Cu Refining Technology - savings up to 7'000 Kg CO_{2-eq} per ton of FRHC copper rod products processing 100% copper scrap
- Cu Green Wire - savings up to 50% of electrical energy per ton of 1.8 - 2.6 mm wire produced starting from 8 mm rod



*Cu Rod Produced with
SAM Microrolling® Technology*

The goal of the global community is to make the Copper Chain “greener” and Continuous-Properzi continues to make a significant contribution in this field.

For further details send an e-mail message to sales@properzi.it, or visit our website: www.properzi.com.

