

The best copper mine is copper scrap

With new Properzi combo lines now available for ingot and rod production, Giulio Properzi talks with Aurora Tedaldi di Tavasca about recent progress

During the last ten years a great part of my attention and study of new development in the electric copper production process has been dedicated to fire refining of copper scrap and FRHC (Fire Refined High Conductivity) rod. Up until ten years ago, reverberatory tilting furnaces for melting and refining copper had been unchanged during the prior 50 years” - Giulio Properzi

A top-loading reverberatory refining furnace was patented by Giulio Properzi in 2012. This was the first step to finding a new, more efficient way to refine copper scrap. Especially for big furnaces (150-250 plus tons), this new (top-loading) configuration is really a step forward in terms of efficiency and energy savings. These patented top-loading furnaces are currently operating in several countries throughout the world with an additional furnace in the installation/commissioning phase. Thus begins Giulio Properzi’s chat about his personal commitment and dedication to FRHC copper over the last 10 years:

“Copper is a semi-precious metal that today is quoted around US\$ 10,000 per tonne on the LME market. It is not mined in many places of the world, and today the copper content in the minerals is decreasing: currently in the range of only 0.5 - 2%. The total annual mined production in 2019 was approximately 20.5 million tonnes.

If we consider an average copper content of 1%, approximately 2 billion tons of minerals have to be excavated, transported, crushed, roasted, melted, re-melted and electrically refined in order to attain 2019 levels. A very energy intensive process that also includes the destruction of many millions of acres.

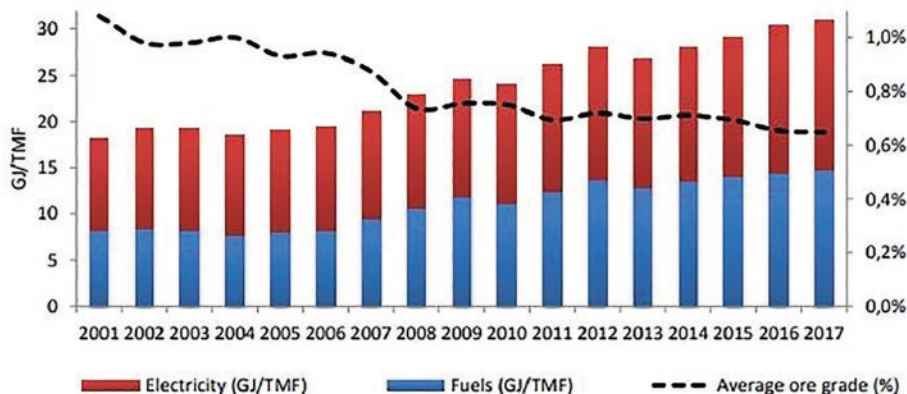
Table 1 from the Chilean Copper Commission shows how much fuel and how much electricity is needed to produce one ton of copper during the period 2001 to 2017, with an initial copper content of 1% in 2001 that decreased to 0.6% in 2017. One GJ is ~ 278 kWh! That is about 4,000 kWh per ton in fuel and the same in electricity.

Today, approximately 8 million tonnes per year of copper scrap is collected from new manufacturing processes or from dismantling of existing installations. A portion of these 8 million tons have a Cu content in the range of 90-99% and therefore it can be fire refined and used again in electrical applications, tubes and other products.”

Revitalised scrap processing

It is history that continuous cast rod - the revolution that changed the entire electrical applications industry of the 1960s and 1970s - was born by melting copper scrap, since cathodes were not yet traded at the time. Ilario Properzi’s first line, installed in Carrollton (Southwire) and then moved to Nassau (Western Electric Company), was fed by scrap summarily refined in a Reverberatory Furnace.

Table 1. Unit energy consumption and ore grade in Chilean Copper Mining, 2001 - 2017



Source: COCHILCO.



Chuquicamata Copper Mine in Chile saw its last open pit blast in September 2018 after 103 years. Photo: web

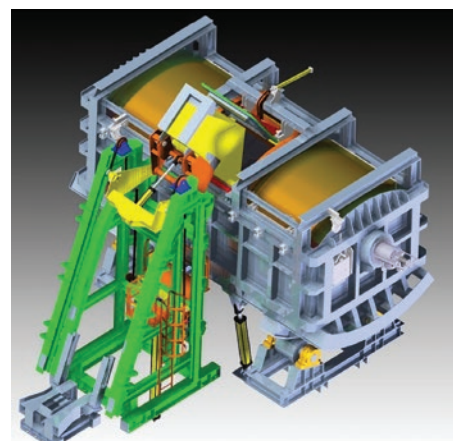
“The control of the refining process, practically without scientific instrumentation, created many problems and some myths like 2H versus 3H rolling stands but, as soon as the cathodes were available, all the producers began using cathodes and quickly forgetting the scrap.

Today refining chemistry is well advanced and standard laboratories can check and control the process in real time. Therefore, my next step was the development of a continuous scrap refining system instead of the ‘traditional’ batch system with a tilting Reverberatory furnace. This was not only a continuous system with all of the associated advantages but it was based on a melting tower (Shaft) that is extremely easy to charge and very energy efficient. The molten copper flows to a couple of small static furnaces where it is continuously refined using an updated mix of additives. We call it the Vert-Ref system.

For a mix of selected scrap with Cu content > 97%, this system can provide a very pure final composition between 99.90 and 99.95% Cu. It can be truly continuous and provide a production rate of 15-20 tph. This can equate to approximately 90,000-120,000 tpy of rod, but it is also useful for small production of ingots below 10,000 tpy. So, our possible Vert-Ref configurations can offer a range of choices for companies that want to profit from the gap between the price of cathode (LME plus) and the price of scrap (LME minus). The interest in such plants is steadily increasing and we are able to tailor the equipment to meet everyone’s unique demand.



Conveyor belt feeding copper scrap to a 250-ton top-loading reverberatory furnace. Photo: Properzi



Properzi Reverberatory loaded with a skip hoist machine. Photo: Properzi

It is my belief that over the last ten years we have also created a very strong team of experts who have practical, hands-on experience in refining technology. By combining new hardware with our knowhow, we are able to fulfil any request for a complete plant, big or small, to make billets, ingots, or rod from 100% copper scrap”.

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