Copper and its uses

Copper has been a building block of civilisation for thousands of years and its prominence will grow in the future.

Copper's unique combination of properties has made it central to the development of mankind. In antiquity, its malleability and flexibility allowed it to be hammered and shaped into tools, weapons and receptacles as well as attractive ornaments and jewellery. For thousands of years its durability, resistance to corrosion and attractive colour rendered it a key architectural material used in cladding, roofing or domes and spires. Since the end of the 19th century, its exceptional ability to conduct electricity and heat has made it a vital component of economic development.

Today copper forms the backbone of the modern world.

Its high conductivity ensures the efficient, reliable and safe generation, transmission and distribution of electricity. It powers our electronic devices, from mobile telephones and laptops to televisions and domestic appliances, ensuring that they are energy efficient. It provides reliable and economical electricity, heating and air conditioning in our homes and offices and is used in data transmission to meet society's demand for high-speed internet services and data storage. Furthermore, its use in industrial machinery promotes clean, economic development.

Copper's outstanding electric and thermal properties decrease load loss and keep the power grid working at full capacity as well as reducing the greenhouse gas emissions that cause climate change. Similarly, it is an irreplaceable component for the energy-efficient performance of the renewable energy systems, electric vehicles and equipment that will contribute to the quieter, less polluted cities of the future.

Copper also exists naturally in the environment and is essential for the health of animals and plants. It helps farmers produce more and grocers to keep food fresher for longer. Copper micronutrients promote bone growth and the operation of the immune and nervous systems in animals, as well as photosynthesis and transpiration in plants.

The construction sector, which uses copper in the wiring, plumbing, heating and cooling, lighting and roofing of buildings, accounts for 28% of total annual copper consumption. Rising urbanisation and industrialisation will continue to be a major stimulus for copper demand as the number of people living in cities is expected to grow to nearly 65% of the world population in 2040 compared to 56.2% in 2020.

As people move to cities, the middle class is projected to rise from two billion people today to five billion in 2030, and increased wealth will drive consumption of copper-rich consumer goods such as cars and electronic devices.

The trend to decarbonisation is expected to boost copper demand via the electrical network sector, which already accounts for 29% of total copper use, as renewable energy becomes the dominant source of global power generation over coming decades. Copper used by the transport sector will grow even faster, albeit from a smaller market share of 11%, as electric vehicles, which use four times as much copper as conventional ones, become part of everyday life.

On the back of these trends, total copper consumption, which includes primary production from copper mines as well as secondary production from "old" scrap recycled from end-of-life or obsolete copper products, is expected to grow by an average of 2% per year over the next two decades from 28.4 million tonnes in 2020 to 45.3 million tonnes in 2040.

Cu for copper

Copper is element No. 29 on the periodic table. Its element symbol Cu comes from the Latin word cuprum. The origin of this name is believed to come from aes cyprium, or metal of Cyprus, where there was extensive copper mining in the Roman era. It was later corrupted to cuprum.

67%

of copper produced since 1990 is estimated to still be in productive use

Infinitely recyclable

Copper forms part of a circular economy because it can be infinitely recycled without losing any of its chemical or physical properties in the process.

Typically the metal is in-use for some 40 years and roughly 40% of "end-of-life" copper is recycled. It is estimated that two thirds of the 550 million tonnes of copper produced since 1990 is still in productive use.

Copper scrap is divided into "new" (or 'direct use') and "old" scrap. The former is left-over metal discarded by the first users of copper, who fabricate "semis" (products such as wire, rod, tube, sheet, plate and castings), and by finished product manufacturers. It can be directly melted down and used in manufacturing and is not considered as new supply of refined copper.

"Old" scrap comes from worn out, end-of-life products such as wiring, motors, piping or circuit boards that need to be shredded to extract the copper, and requires reprocessing in smelters and/or refineries depending on its level of purity. This is considered a new source of supply. It is often described as the "swing producer" because scrap collection rates are more sensitive to commodity prices than mined production and it is the first source to stop production when copper prices fall below certain levels.

Every year, one-sixth of total refined copper is provided by "old" scrap and almost one third of global copper demand is met by recycled metal, including "new" scrap. Policy-led decisions to boost the circular economy, in particular in Europe, may lead to an increase in its share.

Copper kills bugs

Copper's antimicrobial properties have been known since antiquity.

As far back as 1,600 BC, the Chinese used copper coins as medication to treat heart and stomach pain. The Egyptians sterilised water in copper vessels. The Aztecs used copper compounds to treat burns, headaches and ear infections.

In 2008 the United States Environmental Health Protection Agency (EPA) officially recognised copper-bearing alloys, containing at least 65% copper, as anti-bacterial health materials. Today the EPA has pronounced over 400 copper surfaces as capable of killing germs.

A 2011 landmark study of intensive care rooms at three US hospitals found that copper reduced the presence of microbes by 83% and the chance of acquiring a hospital infection by 58%.

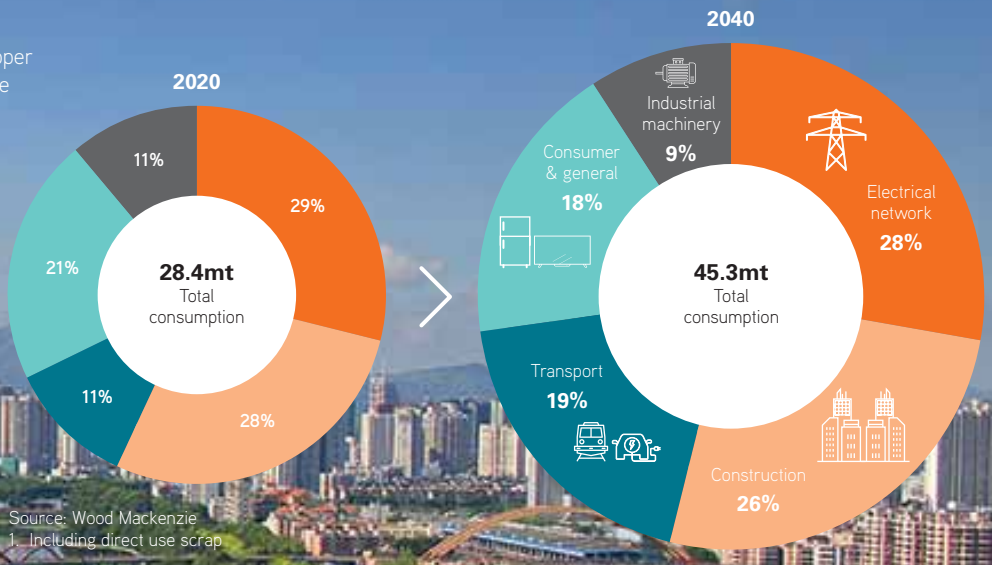
It has also been shown to be a match for the highly infectious COVID-19 virus. A 2020 study in the New England Journal of Medicine showed that the virus only survived for 4-8 hours on a copper surface, compared to 48-72 on plastic and stainless steel ones. Another study by the Faculty of Medicine at Bern University found that textiles with copper thread made by a Chilean startup, The Copper Company, eliminated 85% of COVID-19 bacteria in five minutes and 95% in two hours.

Known as a "contact killer", copper ions puncture the microbe's protective membrane and destroy the nucleus and its DNA, thus stopping the mutations that create drug-resistant super bugs.

Copper and its alloys are increasingly used in hospitals for touch surfaces such as doors, bed rails, IV poles, light switches and workstations, mostly to guard against hospital-acquired infections. There is also considerable potential for its use to prevent infection in nursing homes, schools, public transport and restaurants.

Copper's antimicrobial properties are retained when it is recycled.

Total copper consumption[1] by industry sector



Source: Wood Mackenzie
1. Including direct use scrap