

BACKGROUNDER: COPPER'S ROLE IN SUSTAINABLE DEVELOPMENT

Often viewpoints on extractive industries like copper are narrow. The general public may get stuck on unattractive imagery such as an open-pit mine or a vapor-emitting stack. However, copper is more than what these images show. While the production of copper is definitely part of the story, it represents only one chapter in a much larger book. The additional chapters show unequivocally how copper is making a positive impact on sustainable development. Through the programs of the International Copper Association and its Copper Alliance partners, the copper industry is making a positive impact on areas of critical societal concern, such as energy efficiency/security, climate-change mitigation, public health, food supply, green building, and more.

ENERGY EFFICIENCY/SECURITY

Copper is the best nonprecious conductor of heat and electricity, so the things that contain it tend to operate more efficiently. Seventy percent of copper goes into end-use products that benefit from copper's high electrical and thermal conductivity.

The most efficient unit of energy is the one that is never produced at all. A growing global population is dependent on energy. Many of the things that provide the world's citizens with a higher quality of life are powered by electricity. In many parts of the world—in particular, the non-OECD (Organization for Economic Cooperation and Development) countries—existing infrastructures are insufficient to meet the growing demand for energy. A growing middle class is powering a massive increase in energy consumption. According to the Brookings Institute, the middle class should grow from two billion people to five billion people by 2030. Most of that growth will be in warm and humid climates. If this emerging middle class purchases air conditioners, refrigerators or both, existing power sources will not be able to handle the increased loads.

Through market transformations based on mandatory Minimum Energy Performance Standards (MEPS), the developing world can move toward efficient appliances and industrial equipment, creating virtual capacity and reducing the need for new power generation. It is estimated that if all the world's geographies would adopt MEPS and associated policies in only six product categories—motors, distribution transformers, refrigerators, air conditioners, information technology, and lighting—\$350 billion in economic activity would be created through reduced energy costs. In addition, these new products would lower worldwide electricity consumption by 10 percent. An effort is underway to make these goals a reality through Energy Efficient Appliances Global Partnership Programme. As a leading partner in this initiative ICA is committed to energy efficiency.

CLIMATE-CHANGE MITIGATION

Copper's outstanding electrical and thermal conductivity help the products it's in operate more efficiently. More efficient products emit less CO₂. Copper needs to be mined, processed and refined to make it suitable for end-use. Those processes contribute to greenhouse gas production. On average, 3.5 tons of CO₂ are emitted to produce one tonne of copper cathode (99.9 percent pure copper). However, because of its inherently high efficiency, in conductive applications (which account for 70 percent of copper usage today), we reduce between 100 and 7,500 tons of CO₂ emissions in those end-use applications—a mitigation factor of up to 2,000-to-one!

Energy efficiency offers one of the most effective paths toward climate-change mitigation. Leading climatologists worldwide are already predicting a rise in average surface temperatures by 2 to 5° C by 2050. Whether that number is closer to 2 or closer to 5 will make a tremendous difference to future generations.

The market transformations being undertaken by the Energy Efficient Appliances Global Partnership Programme will make a profound impact on climate change. The move toward efficient appliances and industrial equipment will not only reduce global electricity consumption and create billions of dollars in economic development, but these actions will lower CO₂ emissions by 1.25 gigatonnes, which is equivalent to removing a half *billion* cars from the road.

RECYCLING

Today's global economy requires efficient use of raw materials, as well as material conservation through its re-use and recycling. On average, copper products contain 35 percent recycled content, which significantly reduces copper's carbon footprint. Unlike other commodities, such as energy or food, copper is not consumed. Since copper does not lose its intrinsic properties during recycling, it can be used again and again with the same expectations for performance.

Recycling copper is a highly eco-efficient way of reintroducing a valuable material back into the economy. Nine million tonnes of copper are recycled every year. The copper recycling requires up to 85 percent less energy than primary production. Around the world, this saves 40 million tonnes of CO₂ annually, the equivalent of taking 16 million cars off the road.

It is estimated that since 1900 two-thirds of the 550 million tonnes of copper produced are still in productive. Approximately 70 percent is used for electrical applications and 30 percent for nonelectrical applications. Each tonne of copper used in electrical applications can deliver lifetime savings of 100 to 7,500 tonnes of CO₂ emissions and save its users between \$25,000 and \$2.5 million in reduced energy costs.

For recycling to be effective, innovation is needed. Endeavors supporting recycling can be implemented in new product design to facilitate end-of-life recovery and the industrial recycling processes to increase overall yields. In addition, regulatory policies must continue to encourage recovery and recycling, both at the industry level and by individual citizens.

PUBLIC HEALTH

Hospital-acquired infections (HAIs) are a global epidemic, claiming about 1,000 lives *each day*. That's more than HIV and breast cancer—combined. In the United States, HAIs are the fourth leading cause of death. A vast majority (80 percent) of HAIs are spread through touch surfaces in healthcare facilities. To help combat this problem, healthcare facilities the world over have adopted rigorous cleaning and hand-washing policies.

Copper is naturally antimicrobial. Laboratory tests prove that copper and copper-alloy touch surfaces kill 99.9 percent of deadly bacteria such as MRSA and e coli in less than two hours. As evidence of copper's antimicrobial properties, the U.S. Environmental Protection Agency (EPA) has registered more than 300 copper alloys as having public health benefits. No other solid material has ever been recognized in this way.

Clinical trials funded by the U.S. Government show that it is possible to lower infection rates through the use of Antimicrobial Copper® touch surfaces in hospitals. In these trials, the six most-frequently-touched surfaces in some intensive care unit (ICU) rooms in three hospitals were replaced with copper alloys. All other cleaning and hand-washing protocols remained unchanged. In the rooms with copper-alloy touch surfaces, a reduction in infection rates of nearly 60 percent was measured versus the control (noncopper) rooms.

FOOD SUPPLY

Protein is an important dietary requirement. Fish are an excellent source of protein. The UN Food and Agriculture Organization (FAO) estimates that 75 percent of the world's fisheries are fully exploited. Aquaculture—the farming of fish—is critical to meeting the demand for fish. The fish-farming industry is facing serious challenges, and many of its problems can be attributed to materials selection.

Synthetic nets are prone to the buildup of organic material. This buildup prevents the free flow of water, blocking much needed oxygen for the fish. Fish farmers try to prevent this problem with antibiotics for the fish or frequent net cleaning. Neither solution promotes a healthy growth cycle. In addition, traditional enclosures can be damaged by predators—sea lions or sharks can cause catastrophic losses for the fish farmer. The useful life of these nets is also quite short (usually a very few months) and end-of-life disposal becomes an environmental issue due to the buildup of organic matter.



Copper's inherent antimicrobial property translates to marine environments. Net pens made of copper alloys do not allow the build-up of organic matter, so the fish are farmed in healthier environments, eliminating the need for antibiotics. Healthier fish grow faster and grow larger, creating better economics for the fish farmer by reducing harvest cycle times and the amount of investment needed to feed the fish. Predators cannot penetrate the strong copper-alloy material. Additionally, at the end of its useful life—measured in years instead of mere months—the fish net is 100 percent recyclable.

ELECTRICAL SAFETY

An estimated 90 percent of homes globally have unsafe electrical installations, and nearly 70 percent of building fires are caused by the overheating of electrical wires. Overloads, short circuits and faulty insulations cause billions in property damage or losses each year.

Copper wiring makes homes safer. Copper's unique properties make it the most secure, efficient and durable material for residential and commercial electrical installations. Copper is highly resistant to deformation and corrosion. It can be found in many devices, including circuit breakers, fuses, grounding rods, rails, switches and sockets. Copper is easy to install, is a better conduit for electricity and lasts longer than any other material, making sure your home is as safe as possible for as long as possible.

Copper wiring is known for withstanding an overload better than other materials because of its significantly higher melting point. Additionally, copper requires less maintenance and its connections are much less likely to loosen and corrode over time. It effectively resists moisture- and humidity-driven corrosion that can destroy other wiring systems, reducing the risk of power outages, system failures and fires. The unique combination of strength and ductility allows copper electrical wiring to be bent further, twisted tighter and pulled harder, all without stretching, creeping, nicking or breaking.

RENEWABLE ENERGY

Rapid population growth and increasing standards of living are driving societies to develop alternative energy sources that are renewable, efficient and economical while reducing CO₂ emissions. According to a 2011 Intergovernmental Panel on Climate Change (IPCC) special report, close to 80 percent of the world's energy supply could be met by renewables by 2050. Renewable energy policies are the main drivers behind renewable energy growth around the world. More than 95 countries now have some type of policy to support renewable power generation.

Whether they are powered by sun, wind or water, efficient and renewable energy systems rely on copper for optimum performance. The use of copper helps reduce CO₂ emissions and lowers the amount of energy needed to produce electricity. In many renewable energy systems 12-times more copper is used than in traditional systems to ensure efficiency. Renewable sources provide nearly one-quarter of the world's power, and copper plays an important role in making it as efficient as possible, with minimal impact on the environment.

GREEN BUILDING

Building homes and offices with materials using less electricity and water is becoming more of a requirement than an option. Sustainable construction, also known as green building, is concerned with the economic, social and environmental impact of creating a usable structure. The site the building occupies, the water and energy that building occupants use, materials used for construction and wastes generated, and any gases or particulates emitted to the atmosphere and inside the building are all measures of how sustainable a building is. The growth of sustainable construction is not limited to one geographic region. Around the world, sustainable construction is accelerating as it becomes viewed as a long-term business opportunity. It requires



designers and contractors to use building practices that will not cause long-term damage to the environment. Sustainable buildings are designed to be energy efficient, healthy for the people who live or work in them, and reduce pollution and waste.

Due to its intrinsic properties, copper is widely used in the building and construction sector. Copper contributes to sustainable construction through architectural designs, building wire systems, renewable energies conversion and better use of energy-efficient systems. Copper is one of the top material choices for structural reinforcements, roofing, plumbing, heating equipment and many other applications.

Copper is one of the few materials that can be recycled and re-used without any loss in performance, making it a logical choice in an era of global sustainability.

UNIVERSAL ENERGY ACCESS

The United Nations Human Settlements Programme estimates that more than one-billion people live in areas known as slums, shanty towns or favelas without access to safe electricity. This number is growing at a rate of about five percent per year due to increasing urbanization. The lack of modern, safe, reliable electricity poses safety hazards, from increasing the number of fires to injuries and even death. Energy is wasted due to inefficiencies in supply and use, making electricity unaffordable and resulting in living conditions that are not only unsafe but demoralizing and degrading.

Most of the technical solutions to advance universal energy access involve copper as an enabler of electricity, energy efficiency and renewable energy technologies, from replacing overloaded distribution transformers with energy efficient transformers using copper winding wire to wiring public street lights.

In Paraisópolis, Brazil, the second largest favela in São Paulo, we partnered with AES Electropaulo, a local utility, on a pilot project that initially provided 4,000 safe connections to local citizens and businesses. The program has since surpassed 500,000 connections, and access to secure, dependable energy has changed the lives of the local population.

Copper helps enable reliable, safe and affordable energy access to millions of people who are unable to get electricity through traditional means. Modern, copper-based, access to energy offers a range of societal benefits, including safer living conditions, economic development and energy security.

AIR QUALITY

The wet and humid environments in air conditioning units are perfect places for mold to grow. Harmful mold spores can be spread through fans into homes and cause serious health problems. Contaminated air may cause infections, allergic responses or other toxic effects. Mold build-up in noncopper units degrades performance and prevents the unit from working correctly, costing the user more money. Also, bacterial growth on air-handling exchanger coils is associated with lowered heat transfer efficiencies and increased corrosion as well as potential odor issues.

The inherent antimicrobial properties of copper and its alloys offer an alternative approach to control the growth and distribution of bacteria and allergens through HVAC systems. Uncoated copper surfaces are capable of killing bacteria, viruses and fungi in very short periods of time. Toxic bacteria die within 90 minutes at room temperatures and within a few hours as the temperature decreases. Copper HVAC components prevent the growth of bacteria and mold, resulting in longer coil life and higher operating efficiencies. In air conditioners, copper-coiled units are virtually mold-free—even after years of use—maintaining efficiency and improving air quality.

