International Copper Association
Copper Alliance

Power of Zero

See full report via QR code or
copperalliance.org/resource/copper-pathway-to-net-zero

COPPER– THE PATHWAY TO NET ZERO

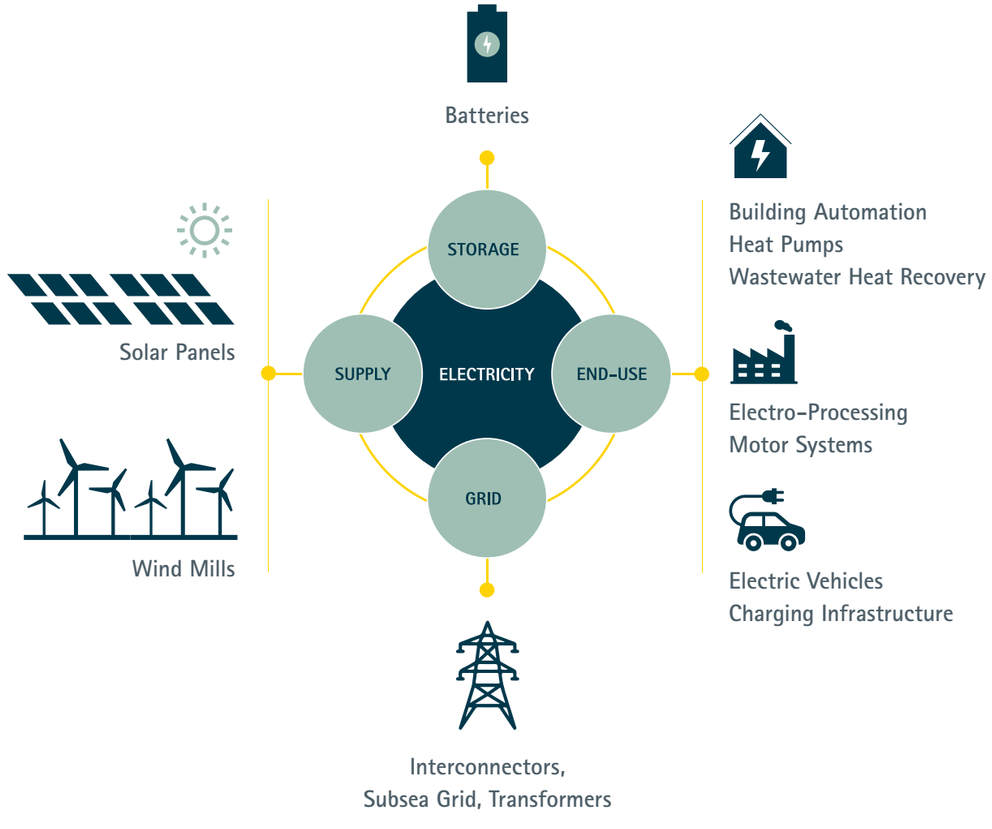
March 2023

SUMMARY

Copper is essential for the clean energy transition

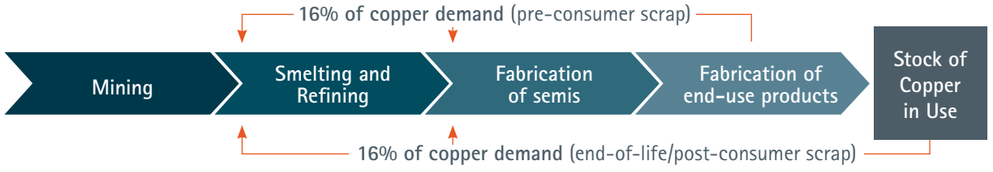
Copper's superior electrical conductivity makes it ideal for a vast array of decarbonizing technologies. When taken together, these technologies have the potential to abate approximately two thirds of global greenhouse gas (GHG) emissions by 2050.

As a result of the energy transition, population growth and economic development, the **annual global demand for refined copper is expected to reach 50 million tonnes by 2050**, a doubling compared to 2020.



Copper is highly recyclable. Recycling of copper scrap from end-of-life products can fulfill 16 percent of copper demand (*Fraunhofer Copper stocks and flows, 2018*) [*1*]. Another 16 percent of copper demand can be fulfilled through the recycling of fabrication scrap.

Although the end-of-life recycling rate needs to grow to meet increasing demand and conserve existing resources, recycled copper alone will not meet growing demand. For this reason, copper produced from mineral ores will still be required, along with recycled copper scrap, to fufill the growing needs.



Industry global flow of copper

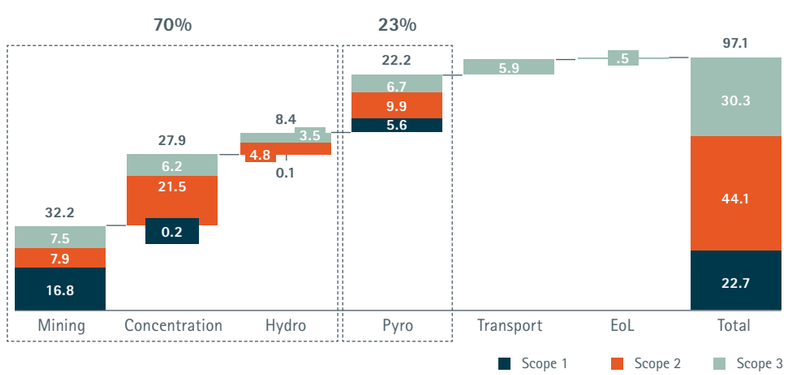
1 Fraunhofer Copper stocks and flows, 2018, see https://copperalliance.org/policy-focus/society-economy/circular-economy/stocks-flows/

GHG emissions of copper production today

The largest portion—46 percent—of the 97 million tonnes of GHG emitted by copper producers come from Scope 2 emissions, indirect emissions associated with the purchase of electricity, steam, heat and cooling. Scope 3 emissions—other indirect emissions outside of Scope 2—represent 31 percent of GHG emissions generated by copper production. Scope 1 emissions—direct emissions from owned or controlled sources—represent 23 percent of GHG emissions by the industry. Scope 3 emissions were computed from data on six categories identified as material to copper production: purchased goods and services, fuel- and energy-related activities, upstream transport, downstream transport, waste generated in operations and end-of-life treatment of sold products. It excludes an analysis of "use of sold products" due to a current lack of reliable data.

These emissions represent **0.2% of the global GHG emissions**

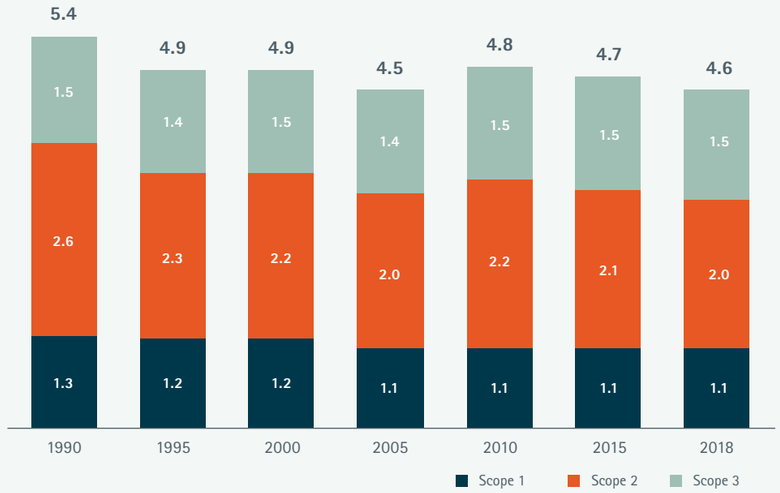
Global Scope 1, 2 and 3 Copper CO_2e Emissions, 2018, *Million Tonnes*



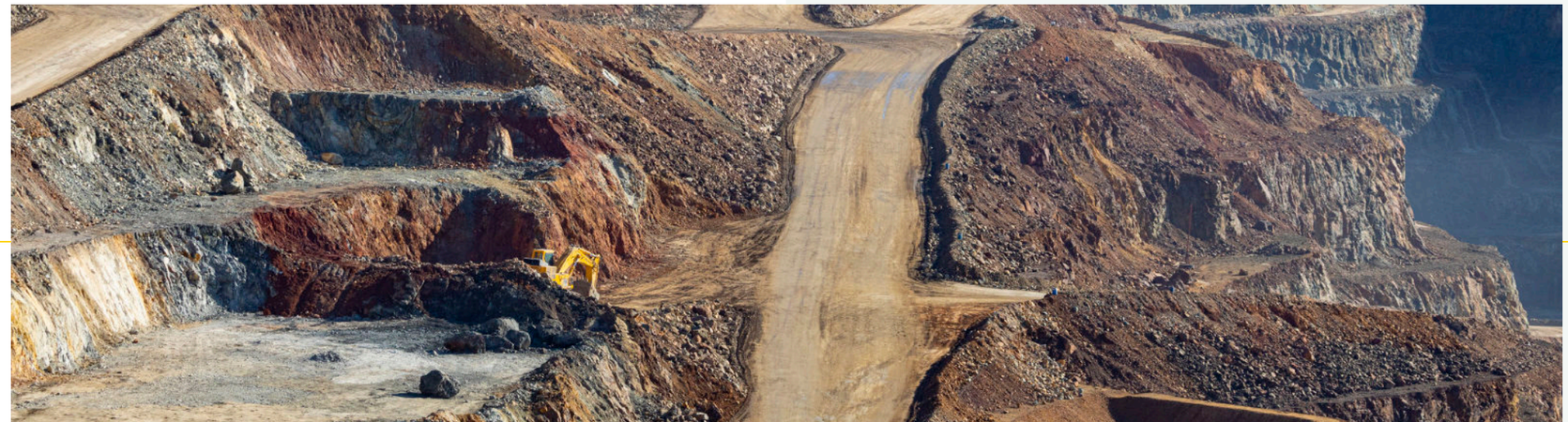
Global Scope 1, Scope 2 and Scope 3 CO2e Emissions of Copper In 2018 (*Source: Quantis*)

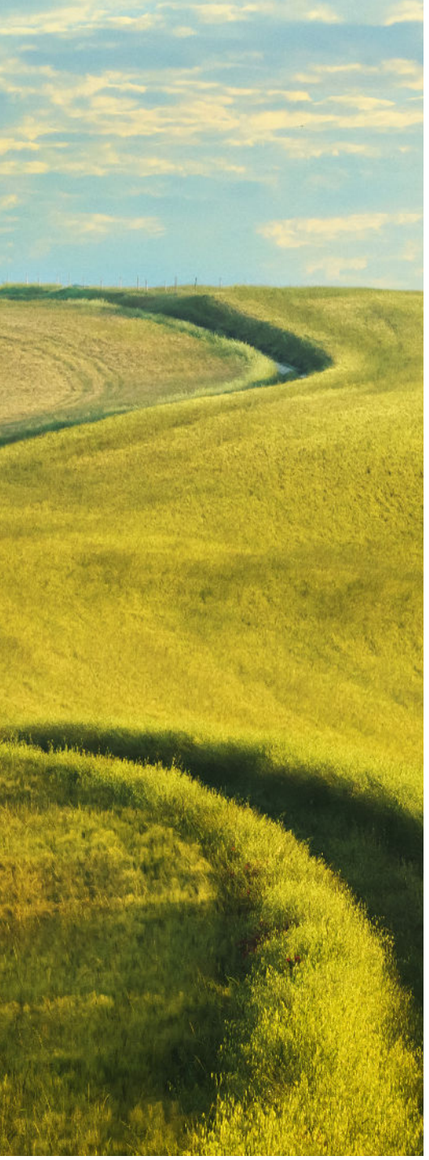
Copper producers have already made important efforts to reduce their GHG emissions. In 2018 the GHG average emission intensity of refined copper production was 4.6 tonnes of CO_2e per tonne of copper. This compares with 5.4 tonnes of CO_2e in 1990, a reduction of 13.4 percent over the 28 year period. This reduction stemmed from an increase in copper production from secondary sources, changes in the electricity mix and ongoing measures by copper producers to improve the energy and emission efficiency of production.

Average GHG Emission Intensity of Refined Copper *t CO_2e/t Cu*



GHG emissions – past performance





Copper—The Pathway to Net Zero

The International Copper Association (ICA) and its members have performed an in-depth, robust analysis, based on a comprehensive set of data, facts and sound hypotheses, to determine how quickly GHG emissions from copper production can be abated with market-ready and developing technologies, at what cost and under what conditions. The below outlines the main findings of *Copper—The Pathway to Net Zero*, which can be found at copperpathwaytozero.org.

Abating Scope 1 & 2 emissions

Four main abatement levers exist for reducing Scope 1 and 2 emissions.

	Examples
Decarbonized Electricity	- Decarbonized electricity supply or on-site generation
Alternative Fuels	- Hydrotreated vegetable oil - E-fuels - Hydrogen
Equipment Electrification	- Battery-driven haulage trucks - Electric drills - In-pit crushing and conveying
Efficiency Gains	- Higher efficiency grinding media for mills - Higher efficiency in smelting, leaching…

The above technologies facilitate the reduction of copper production's Scope 1 and 2 emissions in line with the trajectory described below.

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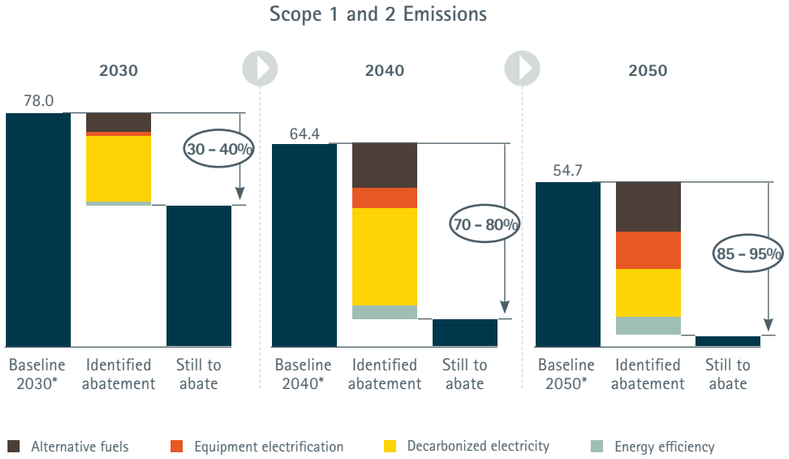
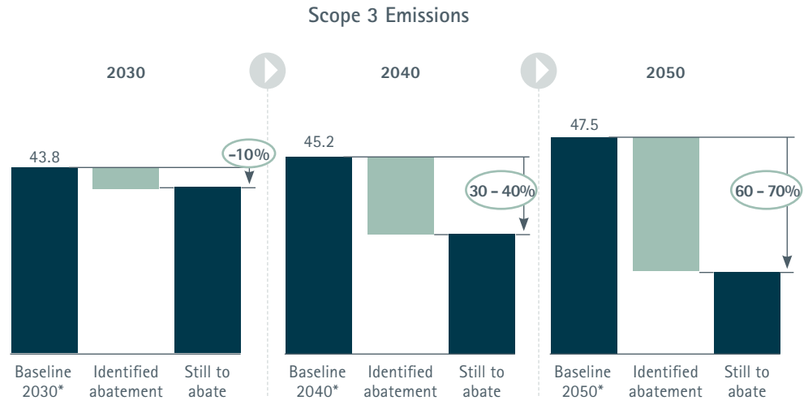


* = 'no-action' scenario
Potential for Scope 1 and 2 Emission Abatement by 2030, 2040 and 2050 compared to a No-Action Scenario
(*Source: MineLens Asset Decarbonization Tool; Team Analysis*)



* = 'no-action' scenario
Scope 3 Emissions Abatement Potential by 2030, 2040 and 2050 in a No-Action Scenario
(*Source: MineLens Asset Decarbonization Tool; Team Analysis*)

Abating Scope 3 emissions

Addressing the reduction of Scope 3 emissions is more challenging, as the interdependence between actors in the value chain requires a partnership approach to maximize potential abatements, which are not under the sole control of copper producers. The availability of up-to-date, quality data on emissions presents an additional challenge.

Based on a preliminary assessment, the following main levers were identified to abate Scope 3 emissions:

1. Decarbonized electrification
2. Near shoring
3. Alternative production technologies or fuels
4. Efficiency gains
5. Increased circularity

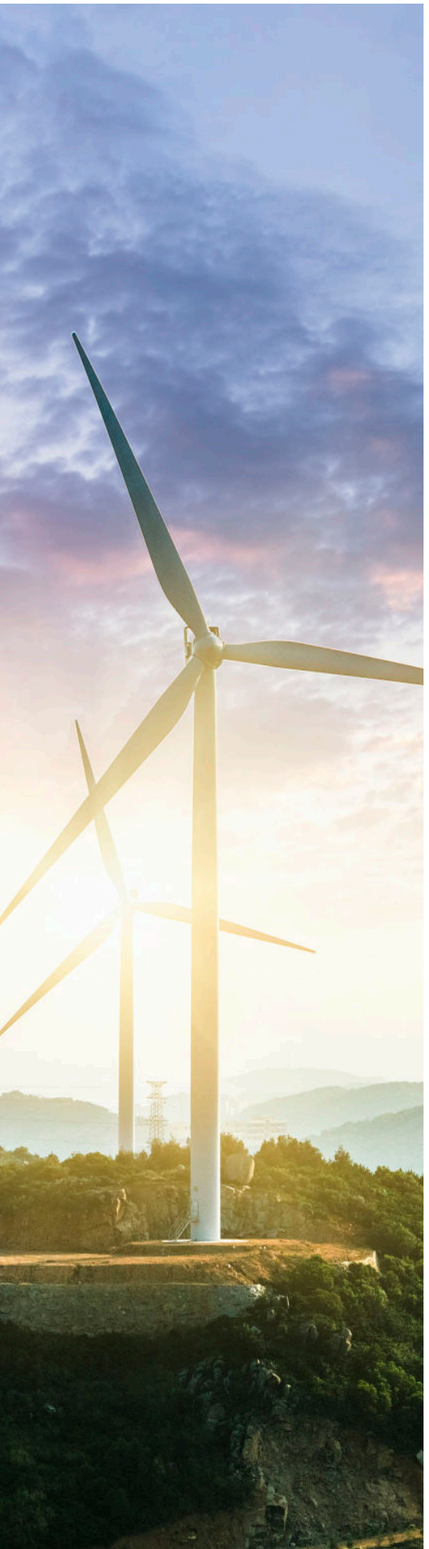
Combining these levers could allow copper producers to reduce Scope 3 emissions as described in the trajectory above.

ICA members' commitment to decarbonize copper production

Based on the analysis, the members of the International Copper Association (ICA) commit to

- A goal of reaching net zero Scope 1 and 2 greenhouse gas emissions by 2050
- Actively engaging with their value chain partners to bring Scope 3 emissions as close as possible to net zero by 2050.

This is a collective ambition. The intermediate trajectories of individual ICA members companies are likely to vary given differences in the scope of activities and operating conditions. Additionally, this ambition is based on current knowledge and, therefore, may evolve.



Framework conditions for the ICA decarbonization goal

Key enabling conditions will be required for ICA members to decarbonize their copper production.

Access to technology and energy

1. **Decarbonization technologies must be available from manufacturers at sufficient scale.** As an example, by 2050, open pit copper mines will require 16,000 zero-emission haulage trucks, twice the number currently in use in these mines today.

2. **An electricity-intensive process, copper production requires access to clean electricity** that is cost effective, available at scale and supplied through adequate infrastructure.

Copper industry operating conditions

1. **The end-of-life collection rates of copper-containing products must increase.** Refined copper production from secondary sources requires less energy than that needed from primary sources. It does not require the mining and concentration of copper ore, processes that account for about 60 percent of the total GHG emissions of refined copper production.

   Consequently, increasing the input rate of recycled scrap in the production process lowers its carbon emission intensity while meeting the growing demand for copper. To achieve this, product designs that facilitate recycling and incentives for end-of-life collection are needed, together with improved separation techniques for the treatment of multi-metal scrap streams.

2. **Flexible investment funds should be available to copper producers.** Given the critical contribution of copper to the energy transition and the ambitious plans of ICA members to decarbonize production, copper producers should be granted access to investment funds integrating environmental, social and governance (ESG) criteria to support innovative research and development and these substantial capital expenditures.

3. **Copper production sites need highly skilled staff.** Addressing the decarbonization challenge requires skills, such as data mining, carbon footprint measurement and monitoring, energy storage, and electrification infrastructure, that are new to the sector. Support from local educational institutions will be indispensable. The growth in copper production will also create new employment opportunities.

Effective and efficient regulatory framework

The copper sector requires a regulatory framework that facilitates and sustains decarbonization while ensuring the industry can meet the growing demand for production.

1. **Transparent carbon pricing** should become common practice—preferably coordinated worldwide—to encourage investment to support decarbonization and create a level-playing field in the integration of externalities into product costing.

2. Access to public funds should prioritize support for the development of **innovative decarbonization solutions**.

3. **A faster permitting process** for new mining assets and expansions is critical to enable the copper industry to meet growing demand.

4. **Facilitation** of accelerated installation of on-site electricity generation capacity, a key emission abatement lever, should be promoted.

5. **A stable regulatory environment** is necessary, given the substantial capital expenditures for capacity expansion and for process decarbonization. In this context, fair and stable royalties as well as long-term mining licenses will be required. Lawmakers should also consider introducing protection mechanisms against external shocks such as extreme energy price volatility.

6. **Consistent chemical and product regulations** must allow an optimized and responsible contribution of copper and its byproducts, such as iron silicates, to the transition toward carbon neutrality.

The copper sector requires a **regulatory framework that facilitates and sustains** decarbonization while ensuring the industry can meet the growing demand for production.

The Way Forward

Measuring Progress

- Apply comprehensive guidance for calculating the carbon footprint of copper production.
- Establish a regular and transparent monitoring mechanism by the end of 2024.

Decarbonization and Responsible Production

- Reduce GHG emissions in compliance with responsible production practices, for example, through commitment to The Copper Mark®.
- Continue to promote ethical standards across the industry.

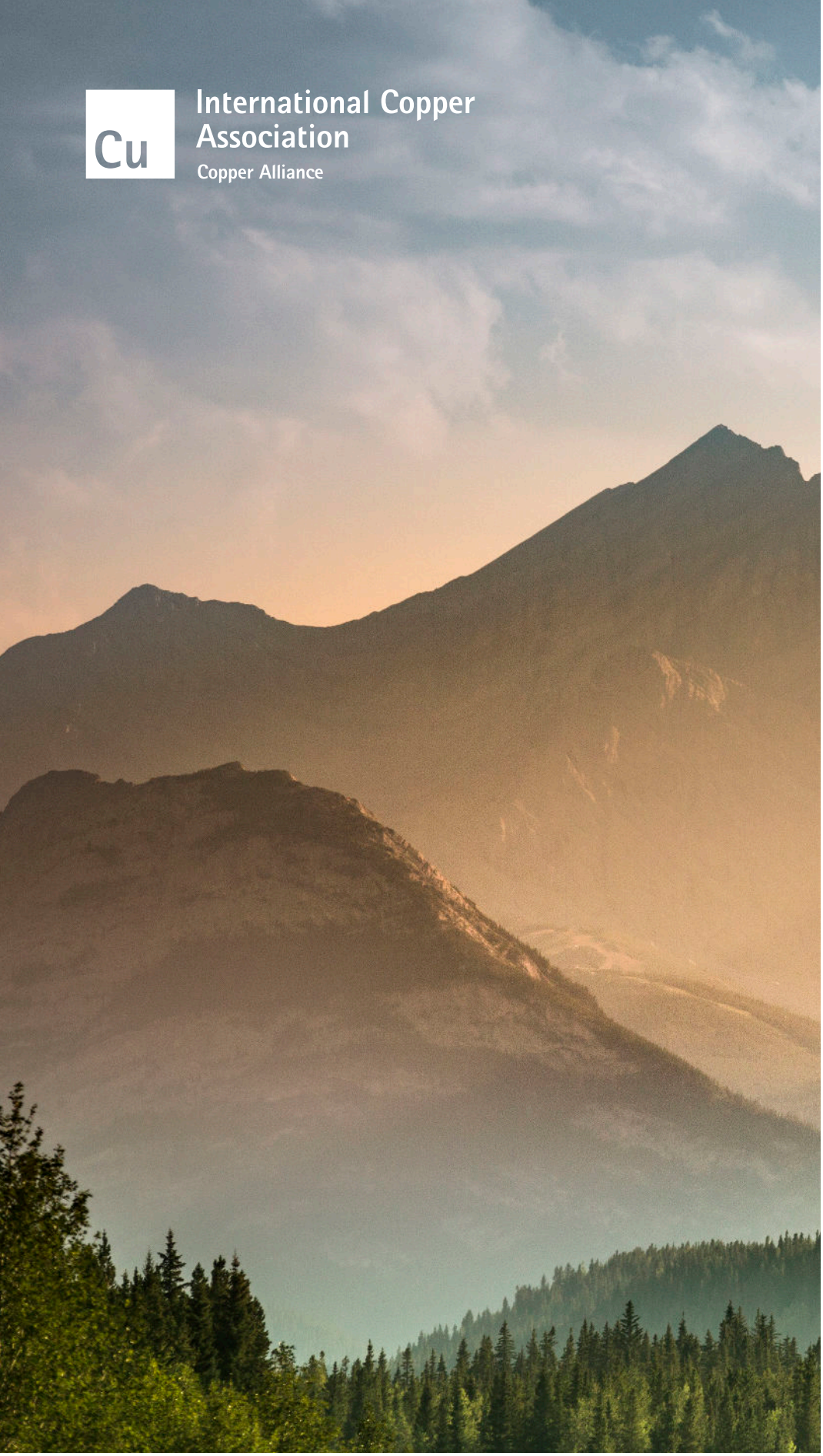
Updating the Pathway to Net Zero

- Review and update the Pathway every five years, or more frequently as needed, to track and analyze relevant changes across the global industry.

Developing Partnerships

- ICA members invite policymakers, academic institutions and civil society organizations to pursue innovative partnerships to work to reduce GHG emissions to net zero by 2050, with the aim of establishing impactful and sustainable partnerships.

ICA members look forward to **actively engaging with suppliers, customers, communities and policymakers** to achieve the decarbonization of copper production by 2050 and to provide a key raw material, in increasing quantities, to enable the decarbonization of many sectors of the economy.



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