European
Copper Institute
Copper Alliance

COPPER– THE PATHWAY TO NET ZERO

Regional Focus: Europe

Power of Zero

March 2023

Contents

EXECUTIVE SUMMARY

Copper is essential for a vast array of decarbonising technologies. When taken together, these technologies have the potential to account for the abatement of approximately two thirds of global greenhouse gas emissions by 2050. The production of copper accounts for around 0.2 percent of worldwide greenhouse gas emissions (97 Mt in 2018, of which 10.3 Mt were generated in the EU). The copper industry is actively working to reduce these emissions. The members of the International Copper Association (ICA), the leading advocate for the copper industry worldwide, commit to a goal of reaching net zero Scope 1 and 2 greenhouse gas emissions by 2050 and to actively engaging with their value chain partners to bring Scope 3 emissions as close as possible to net zero by 2050.

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.

ICA members active in the EU fully subscribe to this commitment. Furthermore, ICA members have set intermediate decarbonisation ambitions at global level for the years 2030 and 2040, for Scope 1, 2 and 3 emissions, which are outlined in *Copper—The Pathway to Net Zero*. This collective engagement is the result of an in-depth, robust analysis performed by ICA and its members, based on a comprehensive set of facts and sound hypotheses.

This document provides a regional focus on Europe. Based on the analysis carried out for *Copper—The Pathway to Net Zero*, it outlines the current GHG emissions of EU copper production and sets out the intermediate decarbonisation ambitions of ICA members in the EU for the years 2030 and 2040. It also provides an estimate of the investments needed to reach net zero GHG emissions for scope 1 and 2 by 2050.

This decarbonisation pathway must be accomplished in the context of a significant increase in expected copper demand—an increase of 35 percent in Europe over the period from 2020 to 2050—driven by critical decarbonisation technologies such as wind turbines, photovoltaic panels, heat pumps, electric vehicles and energy efficient equipment.

This *Regional Focus: Europe* demonstrates the commitment of ICA members in Europe to act on climate change. Copper producers in the EU have already taken action to reduce their carbon footprint. In the coming 27 years, decarbonised electricity, alternative fuels, equipment electrification and energy efficiency have been identified as the key levers for reducing Scope 1 and 2 GHG emissions. ICA members commit to deploying these and additional decarbonising measures in a responsible and sustainable manner, noting the increasing acceptance of The Copper Mark®, the world's leading third-party assurance framework for copper production.

ICA members are working on a mechanism to ensure transparent and regular reporting of their progress in decarbonising copper production, through a coherent and aligned methodology for measuring carbon footprint.

In addition, *Copper—The Pathway to Net Zero* and the *Regional Focus: Europe* will be regularly updated to integrate changes in technology and external variables, e.g. decarbonisation of the power grid.

Success in decarbonisation depends not only on the efforts of copper producers and the value chain but also on the fulfilment of critical enabling conditions:

1. Decarbonised electricity needs to be available in sufficient quantities and at competitive prices.

2. Decarbonisation technologies such as battery electric mining vehicles and green hydrogen need to be available at scale.

3. Collection rates of copper-containing products at their end of life must be improved to increase the contribution of recycling to decarbonisation.

4. Public and private financing must be available to support innovation and the deployment of decarbonisation technologies.

5. There must be a global level playing field on carbon pricing.

6. EU and national regulatory frameworks must incentivise investments. This requires a coherent and fit-for-purpose regulatory framework that provides legal clarity and predictability, together with a more ambitious industrial policy to support strategic raw material value chains that are essential for achieving the EU's objective to become a carbon neutral continent by 2050.

The European Copper Institute, the European branch of ICA, together with ICA members looks forward to actively engaging with suppliers, customers, communities and policymakers in Europe in order to achieve the decarbonisation of copper production by 2050.

INTRODUCTION

Copper is a strategic raw material for the clean energy transition. Given its widespread use in decarbonisation technologies, global copper demand is expected to increase in the run up to 2050. It is therefore important to ensure the availability of low-carbon, sustainable copper to meet this need.

This report (further "*Regional Focus: Europe*") complements *Copper—The Pathway to Net Zero*, the roadmap for decarbonising global copper production developed by the International Copper Association (ICA) and its members. The *Regional Focus: Europe* outlines ICA members' commitment to decarbonising the production of copper in Europe and presents strategies for bringing the carbon footprint of copper mining, smelting, refining and recycling in the EU as close as possible to net zero by 2050. It is not intended to prescribe how to decarbonise specific copper production sites, as individual producers know best which decarbonisation measures to implement across their assets. Rather, it analyses available decarbonisation options to propose a general trajectory toward net zero emissions for the copper production industry in Europe.

The *Regional Focus: Europe* concludes that by 2050 it should be possible to bring the scope 1 and 2 GHG emissions from copper production in the EU to net zero and to significantly abate scope 3 GHG emissions, provided that certain enabling conditions are fulfilled, for instance securing access to a sufficient amount of fossil-free, competitively priced electricity.

The methodology behind *Regional Focus: Europe*

ICA and its members developed *"Copper—The Pathway to Net Zero"* through a pragmatic analytical approach that leverages the know-how of copper producing companies and the public data sets of industry experts like MineSpans. ICA members in Europe represent the vast majority of refined copper production in the EU and, together with ICA members active in other parts of the world, are uniquely positioned to collect and analyse data related to carbon emissions.

Developing a roadmap for the copper industry to reduce carbon emissions over the next 30 years poses a critical challenge.
It requires rigorous data collection, in-depth analysis and modelling to chart potential pathways for a clean energy transition across the sector. Any forecast of the industry's capacity to reduce carbon emissions—and strategies for achieving targets—must address issues related to production, changes in technology and global trends.

ICA first assessed the current greenhouse gas (GHG) emissions of the copper industry with the support of environmental sustainability consultancy Quantis. Analysts collected emissions data from ICA members for each major step of the production process using 2018 as the baseline, as the COVID pandemic and lockdowns that followed likely skewed the figures from the subsequent years. They incorporated data on local electricity grid emission factors published by the International Energy Agency (IEA) and the model of global copper stocks and flows built by the Fraunhofer Institute to assess the 2018 carbon footprint of the copper industry.
They also gathered data on Scope 3 GHG emissions from purchased goods and services, fuel- and energy related activities, transport upstream and downstream in the value chain, operational waste and end-of-life treatment of sold products, six categories that represent the bulk of Scope 3 emissions for copper producers.

This carbon footprint assessment was then developed into an emissions profile for 14 types of production processes, which include various stages and technologies ("archetypes"—see Annex 1 of *Copper—The Pathway to Net Zero*) and cover copper mining, refining, smelting and copper recycling. In Europe, the production stage "mining" for example, includes open pit mining, underground mining with room and pillar technology and underground mining with long hole stoping.

Options were assessed to reduce GHG emissions from copper production within four abatement categories: decarbonised electricity, alternative fuels, equipment electrification and energy efficiency gains. No offsets were considered in this assessment.

The analysis considered emission abatement options for each archetype, their potential to lower emissions and their total cost of ownership (TCO) to establish the Unconstrained Marginal Abatement Cost Curve (MACC). Drawing on the Unconstrained MACC, a Constrained MACC was constructed for Europe that considered the emission intensity of the electricity grid, the availability and long term TCO of each abatement option. This analysis established a pathway to reduce Scope 1 and 2 GHG emissions for each archetype in Europe by identifying:

- The most effective emission abatement options
- The recommended timeline and sequences for implementing these options, with two intermediate milestones for 2030 and 2040 and a third target by 2050
- The financial investment required to reach these ambitions

The analysis estimated Scope 1 and 2 GHG emissions abatement potential through a bottom-up analysis drawing on information about copper production assets, reported mine development projects and country-by-country forecasts on the evolution of grid emission factors. By contrast, it provided a top-down analysis of Scope 3 GHG emissions that identified emission abatement options for each of the Scope 3 categories examined.

This detailed analysis served as the basis for the decarbonisation pathway for the copper industry in Europe. However, when it comes to the GHG emissions-reduction trajectories of individual ICA members, it is expected that these will vary because of the significant differences that exist e.g. in the projected decarbonisation of the electricity grids in different regions. The trajectory set out in this document is therefore indicative for the industry as a whole, while individual members remain responsible for setting their own intermediate GHG emissions reduction targets toward net zero.

SECTION 1 – THE COPPER INDUSTRY IN EUROPE

COPPER IS A CRUCIAL RAW MATERIAL FOR THE ENERGY TRANSITION

The transition relies to a large extent on renewable power generation (e.g. wind, solar photovoltaic) and the electrification of energy end use (e.g. heat pumps, electric vehicles), all of which use substantial amounts of copper (see Annex 2 of *Copper—The Pathway to Net Zero*). Copper also enables a more energy efficient electricity system, triggering carbon emission savings at a negative cost in the short term and reducing the need for renewable energy generation capacity in the longer term. For a more comprehensive overview of why society needs copper and where it is used, see The World Copper Factbook 2021[1].

Copper's superior electrical conductivity makes it an essential material for the clean energy transition.

BUILDINGS & INDUSTRY
- Electrical Installations
- Appliances
- Solar Heating
- Air Conditioning
- Heating
- Water & Gas
- Motors

ELECTRICITY SYSTEM
- Renewable Generation
- Transmission & Distribution System
- Submarine & Underground Cable
- Grid Storage

TRANSPORT
- Railways (Catenary)
- Automotive Harness
- Automotive Batteries
- Electric Car Motors

MISCELLANEOUS
- Telecommunications
- Electronic Appliances
- Farming & Agriculture
- Aquaculture
- Marine Applications
- Architecture
- Interior Design

Figure 1 — Overview of Copper Uses

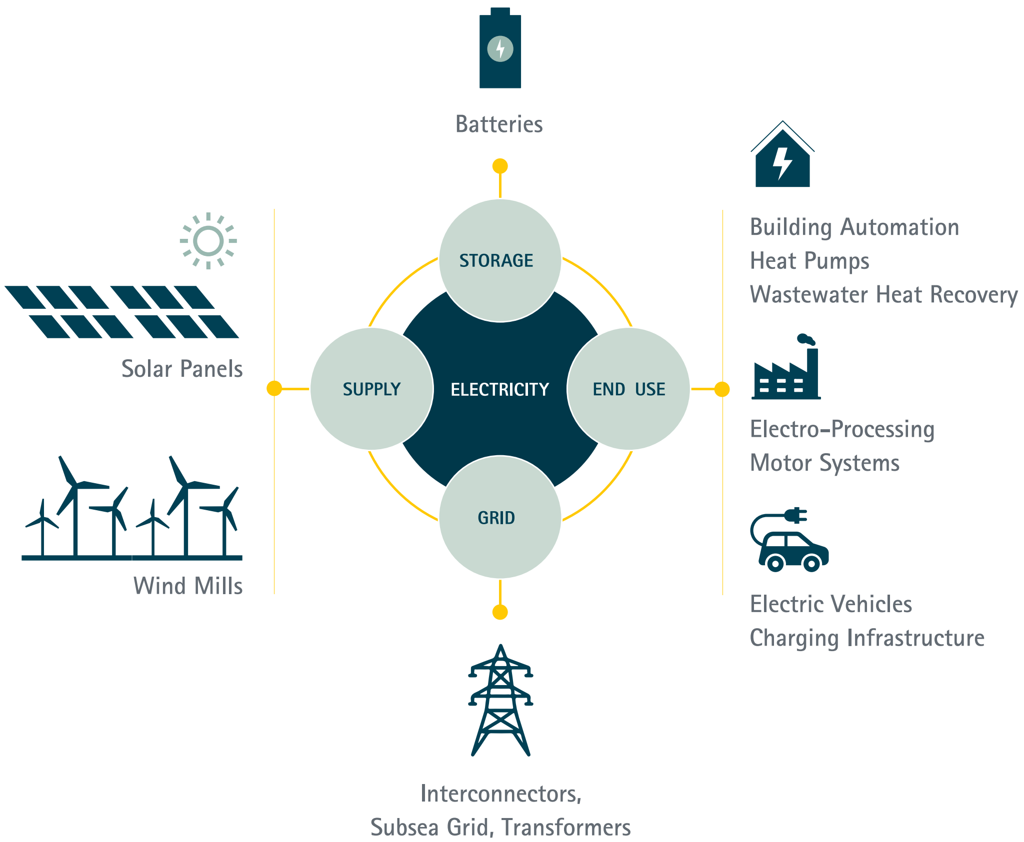


Figure 2 — Copper in the Energy Transition

COPPER DEMAND AND USAGE ACROSS REGIONS

Growth in copper demand differs greatly across regions. For the past 25 years, growth can be mainly observed in the Asian market, where demand has expanded eight-fold over the past four decades, largely driven by industrial expansion in China (source: ICSG World Copper Factbook). Although copper usage in Europe has increased in real terms, the EU share in global copper use has shrunk radically from 57% in 1960 to 15% in 2020 given the accelerated increase in global copper usage in other jurisdictions (see Figure 3).

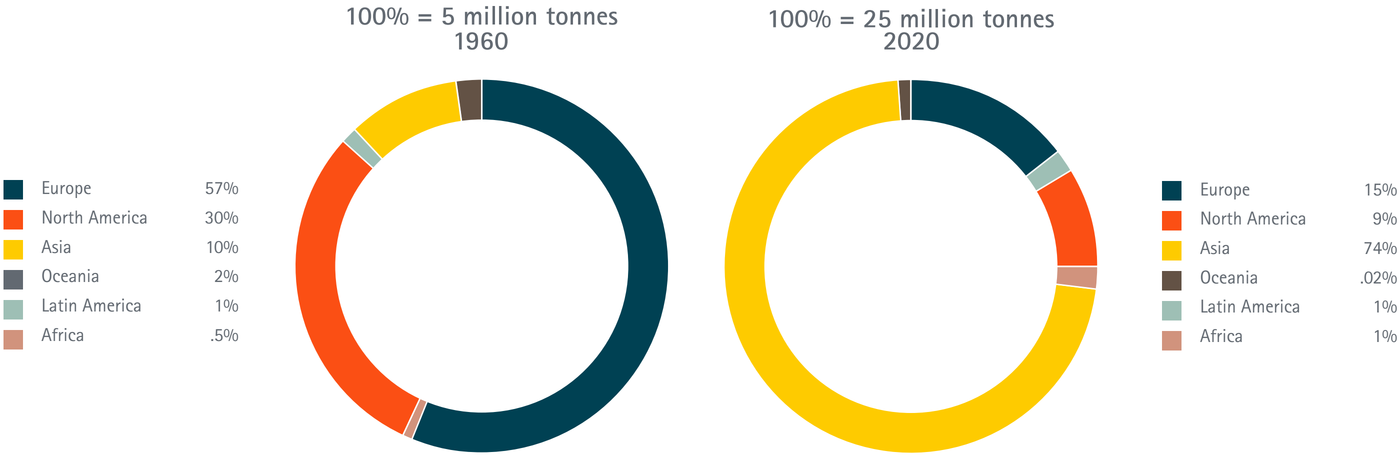
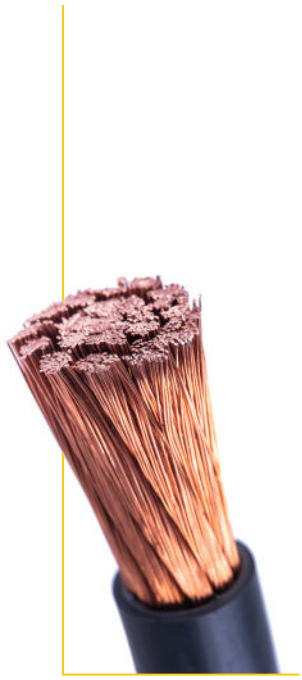


Figure 3 — Refined Copper Usage by Region, 1960 versus 2020 (Source: ICSG)

The annual global refined copper demand is expected to double by 2050 compared to 2020.

As a result of the energy transition, population growth and economic development, the annual global refined copper demand is expected to double by 2050 compared to 2020 (see Figure 4). If measures are taken to restrict global temperature rise to 1.5°C, demand for refined copper by 2050 could even increase to 57 million tonnes.



Base Case Refined Copper Demand by End Use, 2020 – 2050, Mt

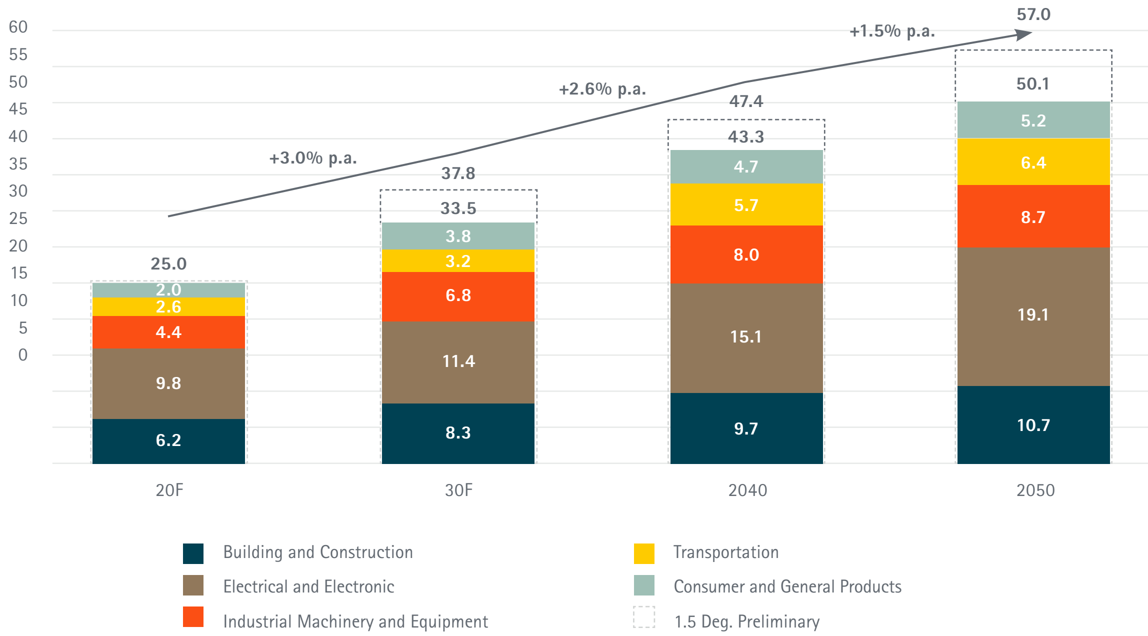


Figure 4 – The Expected Rise in Annual Global Refined Copper Demand between 2020 and 2050 (Source: MineSpans Copper Demand Model Q3 2021)

Copper demand in Europe is also expected to grow in the next three decades, although at a lower rate than the global market. According to the 2022 study by KULeuven commissioned by Eurométaux [2], the demand for refined copper in Europe is expected to grow by 1 percent annually over the period from 2020 to 2050, under a scenario of keeping the production of decarbonisation technologies in Europe (solar panels, wind turbines, electric vehicles, ...) at current or increasing levels.

COPPER PRODUCTION IN EUROPE

The copper industry in Europe includes copper mines, smelters, refiners, recycling facilities and fabricators of semi-finished products from copper and copper alloys, such as tubes, wire rods and bars. Copper is an important contributor to the European economy and the copper industry employs approximately 50.000 people in Europe. Many more individuals are employed indirectly.

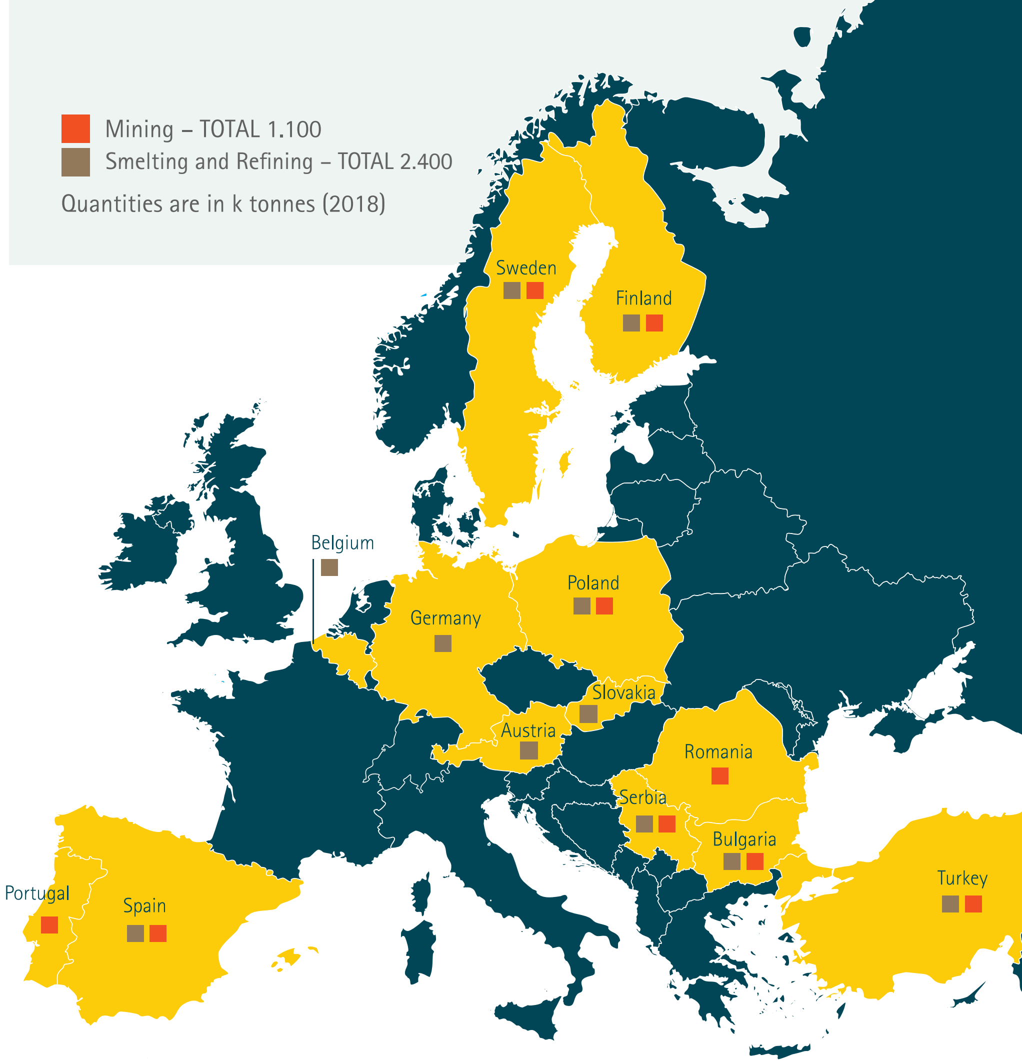


Figure 5 – Copper Mining, Smelting and Refining Production in Europe (Source: ICSG)

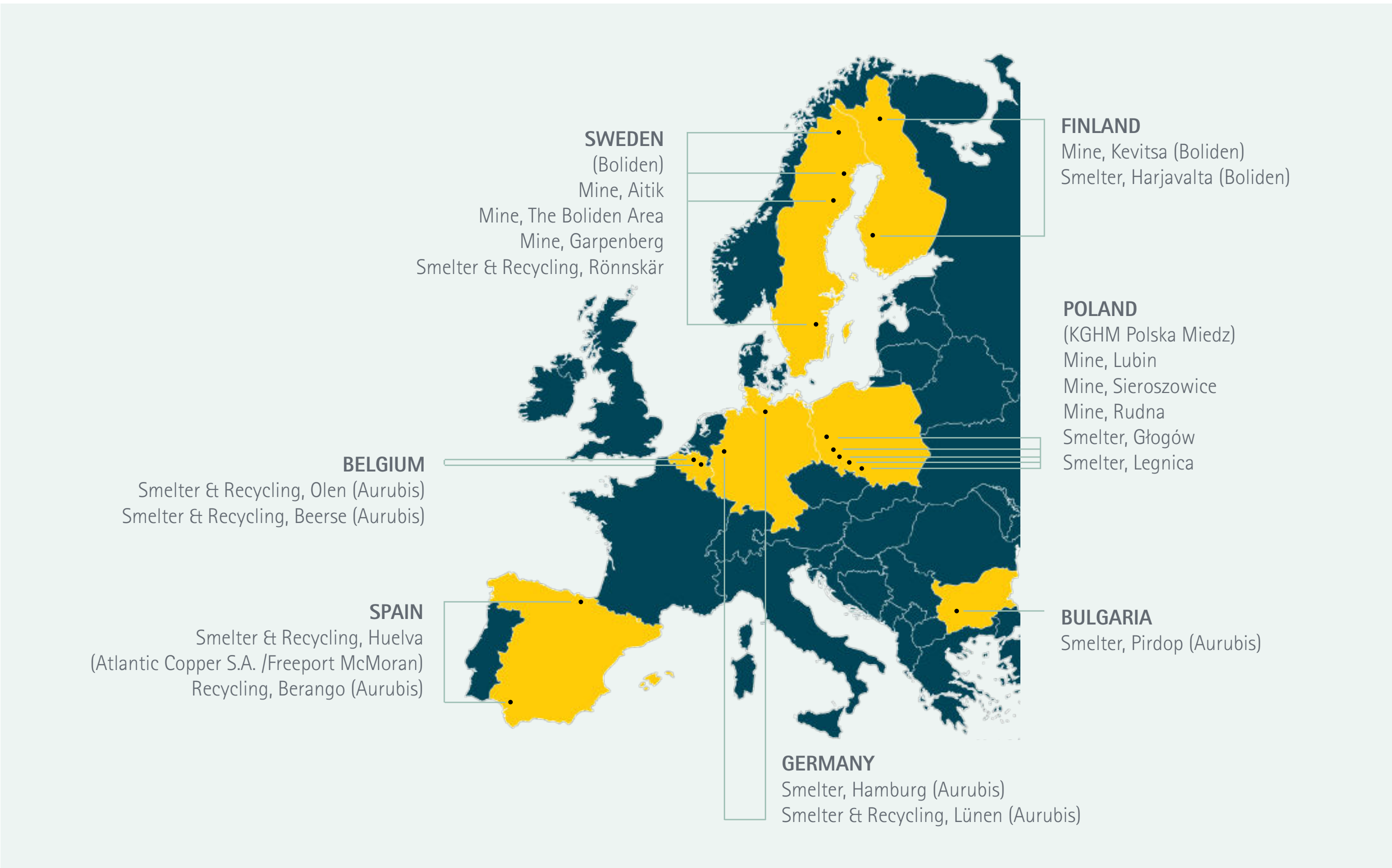


Figure 6 – ICA Members' Copper Mining, Smelting, Refining and Recycling Sites in Europe (Source: ICA)

THE PRODUCTION PROCESS

Production from primary sources starts with the extraction of copper-bearing ores from open-pit or underground mines. The ores typically contain between 0.25 and 1 percent of pure copper, which are then enriched into copper concentrates with a content of pure copper above 25 percent. Subsequently, two different production routes exist (pyrometallurgical and hydrometallurgical), depending on the characteristics of the raw material—sulfide or oxide ores.

Production from secondary sources is fed by copper scrap that originates either from semi-finished or finished products manufacturing waste ("new scrap"), or from copper-containing products reaching the end of their life ("old scrap"). After initial treatment, which usually includes sorting and shredding, the copper scrap enters the pyrometallurgical production process at different stages. In the EU, the copper industry has developed advanced technologies and made considerable investments to be able to process a wide range of copper scrap, including complex, low-grade residues and electronic scrap characterised by variable copper content and a broad concentration range of other metals.

The three production routes to refined copper are shown in Figure 7 and more details on copper production processes can be found in Annex 3 of *Copper—The Pathway to Net Zero*.

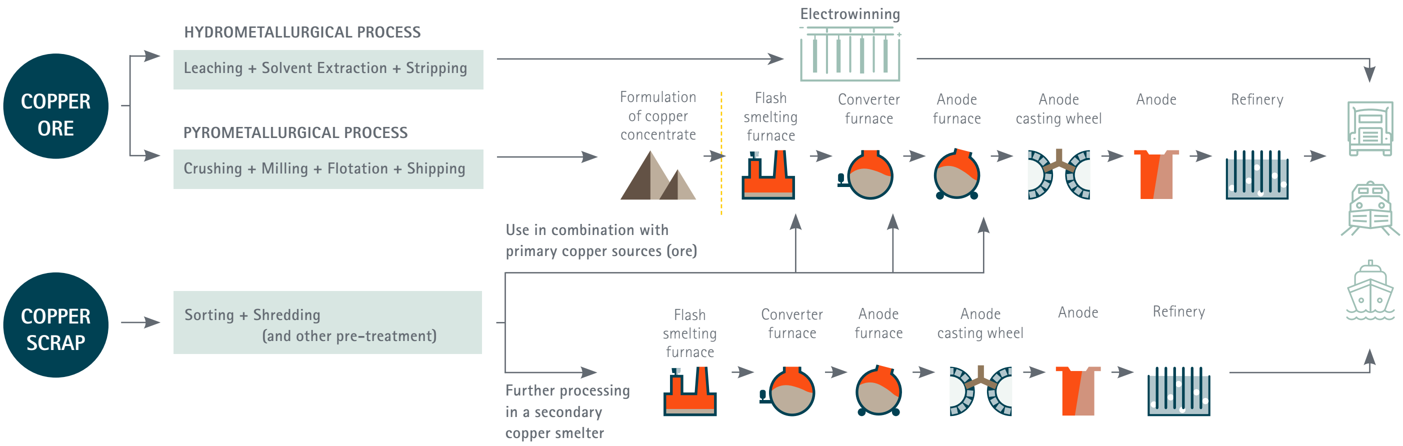
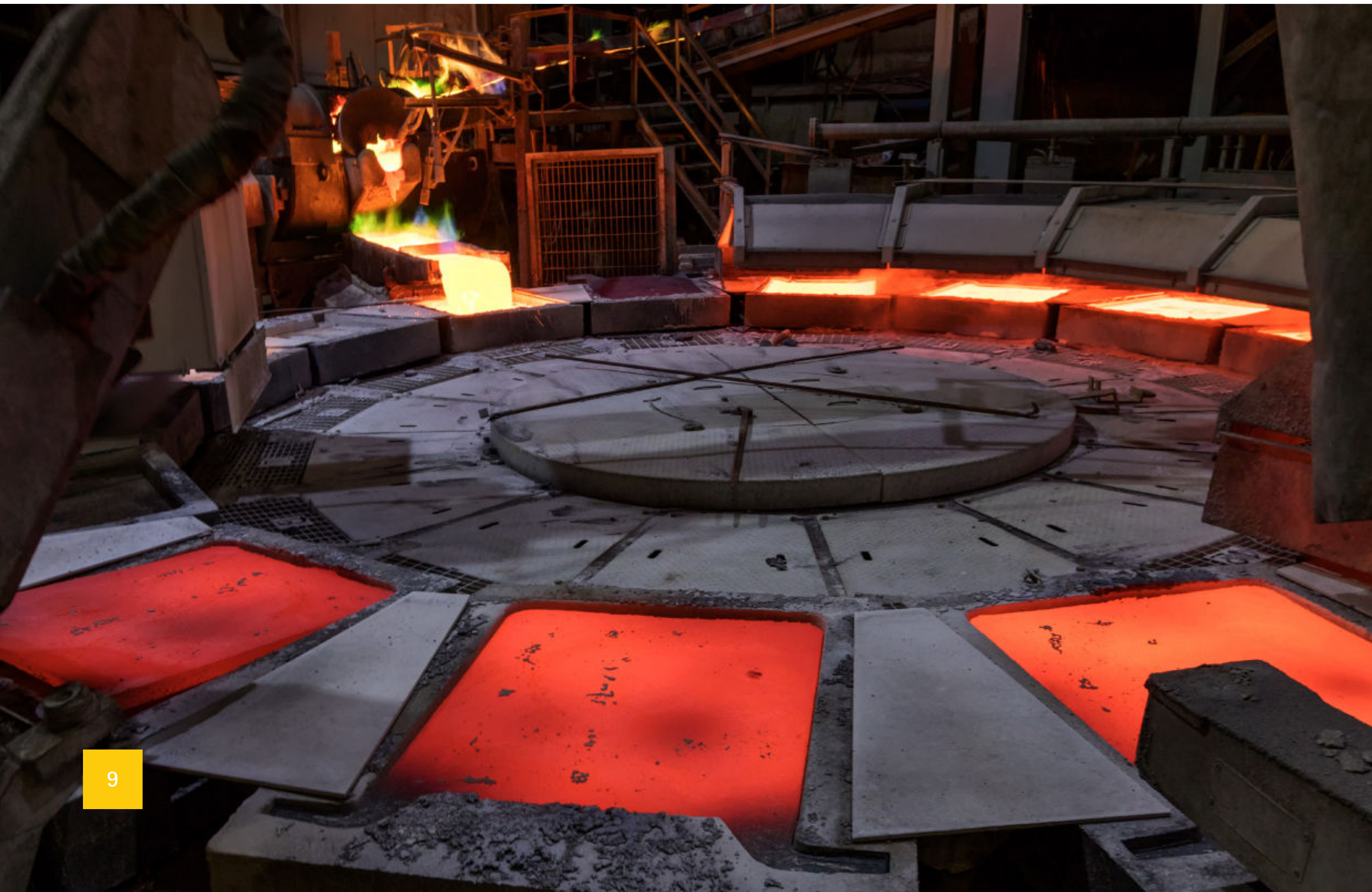


Figure 7 — The Three Production Processes of Refined Copper



CONTRIBUTION TO RESOURCE EFFICIENCY AND TO THE DECARBONISATION OF OTHER SECTORS

It is worth underlying that copper contributes to resource efficiency as an important 'carrier metal': its production enables the extraction of a range of important metallic by-products that are critical for society —including gold, silver, cobalt, molybdenum, platinum group metals, tin, nickel, lead, selenium, tellurium.

Copper production also generates more complex by-products, such as sulfuric acid and secondary mineral aggregates (iron silicates), and enables the recovery of excess heat from production processes for use as steam or hot water in the generation of electricity or in district heating. Heat for district heating reduces carbon emissions from conventional sources such as natural gas and hence helps the decarbonisation of other sectors. Iron silicate is an industrially produced mineral that can substitute virgin natural resources in a large variety of applications such as cement, concrete and road construction. It can help contribute to the decarbonisation of these sectors, while also contributing to saving natural resources and reducing other environmental emissions, together with energy and land use.

In the EU, the GHG emissions associated with by- and co-generated products were estimated to amount to 5.8 million tonnes of CO_2e in 2018. These are assumed as avoided emissions in other sectors, as these products, representing an important share of their respective markets, are provided by the copper industry.

COPPER RECYCLING

Copper is a highly recyclable material that can be recycled infinitely without loss of properties. 27 percent of copper demand in the EU can be fulfilled through the recycling of copper scrap from end-of-life products (Fraunhofer Copper stocks and flows, 2018)[3]. Another 28 percent of copper demand can be fulfilled through the recycling of fabrication scrap. This is illustrated in Figure 8. Adding up both numbers shows a total recycling input rate of 55 percent. Important to note here is the challenge to increase the end-of-life recycling input rate.

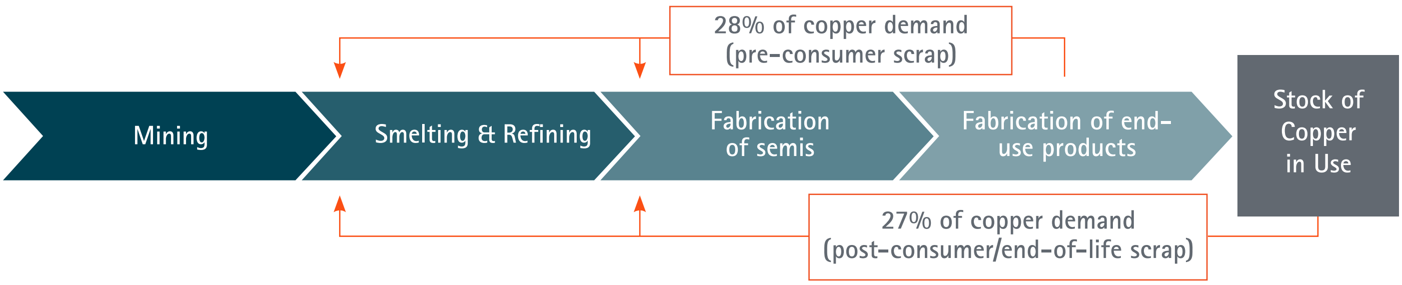


Figure 8 – Industry Flow of Copper in the EU-28

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. The first re-use of extracted copper can be decades later—a long average lifetime is beneficial for reducing the environmental impact of production but has a negative effect on copper availability from secondary sources. The World Bank Group calculated that even a 100 percent end-of-life recycling rate would only reduce the demand for copper from primary sources by 26 percent by 2050 [4]. Moreover, no process is 100 percent efficient, and losses in collection, separation and re-processing of copper scrap will always exist. For this reason, copper produced from mineral ores will still be required, along with recycled copper scrap, to fulfil the growing needs. For more information about the estimated evolution of the global end-of-life recycling input rate, see Annex 5 of *Copper—The Pathway to Net Zero.*

SECTION 2 – DECARBONISING COPPER PRODUCTION IN EUROPE

GHG EMISSIONS OF EU COPPER PRODUCTION TODAY

Copper producers in the EU have already made important efforts to reduce their GHG emissions, notably through shifting to flash smelting furnaces, installing renewable energy generation on site and implementing energy efficiency measures in the mining and processing of copper. This resulted in a decrease of total emissions[1] by 6.3 percent over the period 1990-2018, while production volumes increased by 40 percent [5], which corresponds to a reduction of approximately one third in the carbon intensity of refined copper.

In 2018, copper production in the EU 28 emitted an estimated 10.3 million tonnes of CO_2e. 35 percent of these 10.3 million tonnes of GHG emitted by copper producers in the EU 28 were Scope 2 emissions, indirect emissions associated with the purchase of electricity, steam, heat and cooling. A significant portion – 51 percent – were Scope 3 emissions, other indirect emissions outside of Scope 2[2]. Scope 1 emissions—direct emissions from owned or controlled sources—represented 14 percent of GHG emissions by the industry.

[1]This estimate does not include the emissions associated with imported copper concentrates.
[2]This analysis considers Scope 3 emissions from data on six categories 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.

Picture courtesy of Boliden

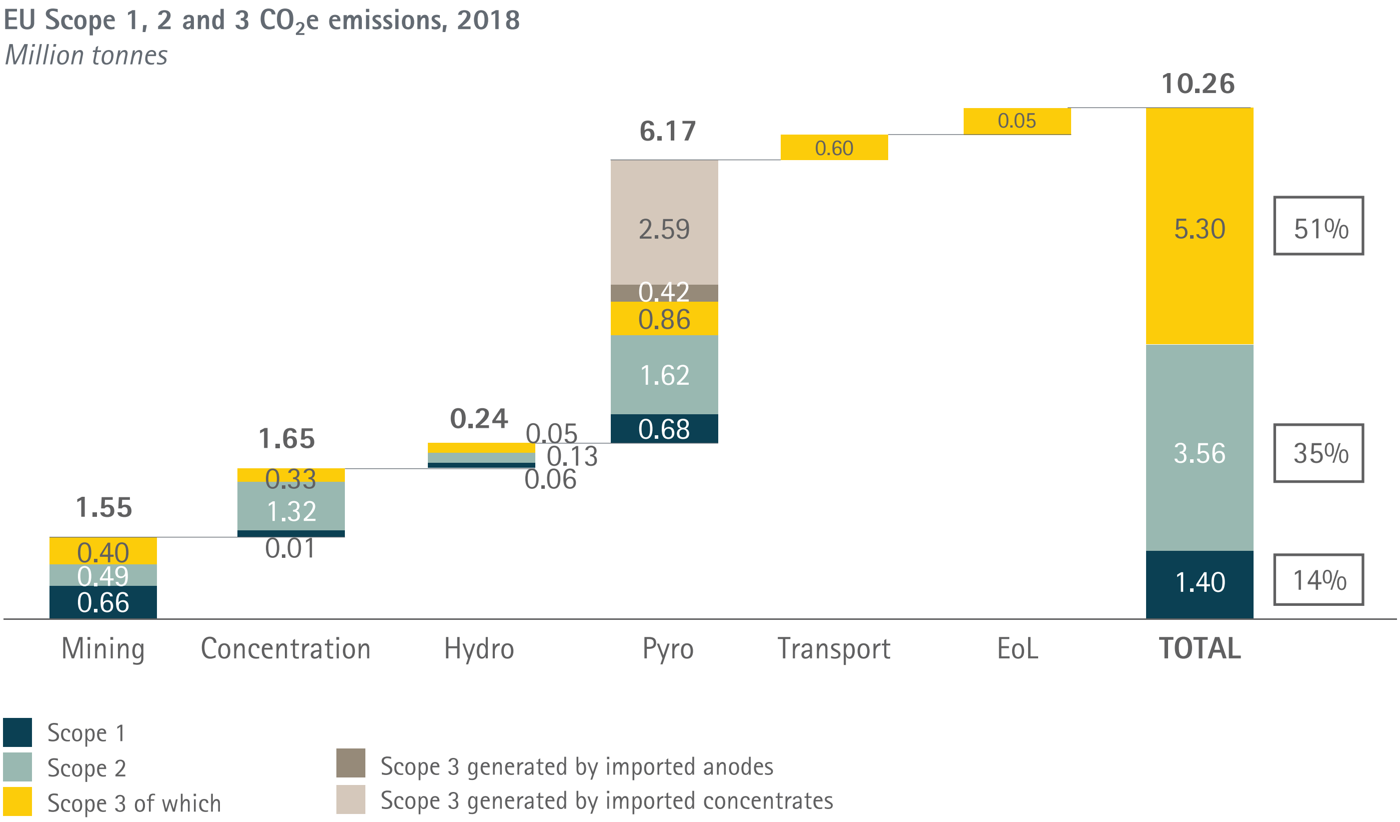


Figure 9 — Scope 1, Scope 2 and Scope 3 CO_2e Emissions of EU Copper Production in 2018 (Source: Quantis, ICA Analysis)

Of these 10.3 million tonnes of GHG emissions, 34 percent were generated by EU mining sites, 25 percent by the production of imported concentrates, 35 percent by the smelting and refining stages of production (pyrometallurgy) and the remaining 6 percent occurred in upstream and downstream transport and in the end-of-life treatment of sold products.

The high share of Scope 3 emissions is explained by the reliance of copper production in Europe on the import of copper concentrates, as the European mining activities are not sufficient to meet the demand for copper on the continent. This dependency on imports is illustrated in Figure 10.

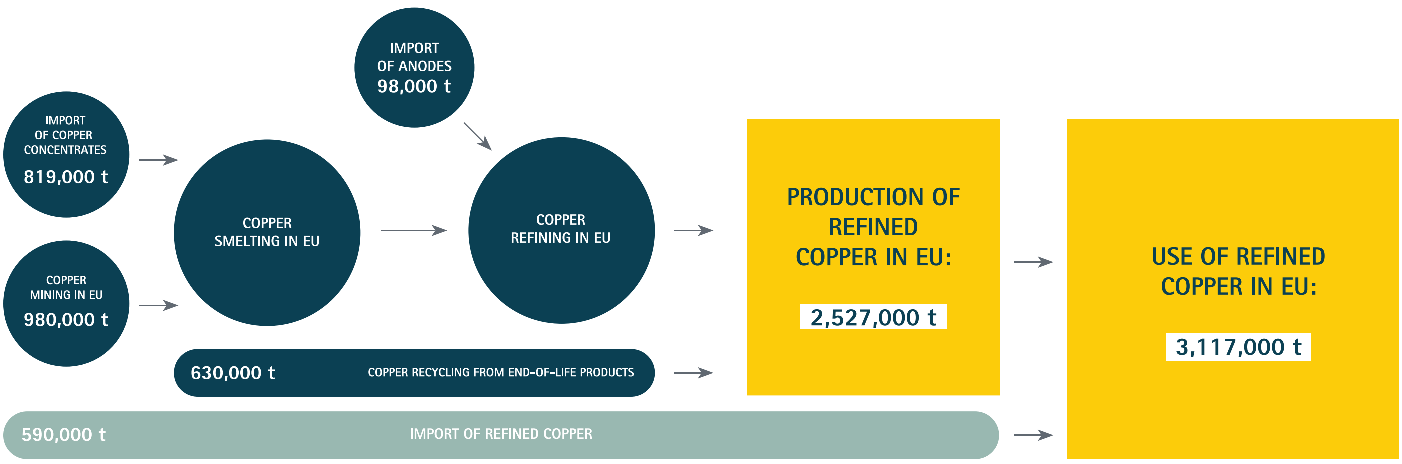


Figure 10 — Copper Flows in EU in 2018 (Source: Fraunhofer Institute, ICSG, ICA Analysis)

Scopes 1, 2 and 3 have been defined at the EU copper production level, meaning the range of processes from mining, smelting, refining to recycling. Since some copper producers focus on mining and the production of concentrates—and others on smelting and refining only—the classification by these companies of their GHG emissions as Scopes 1, 2 and 3 will differ from the definition used here.

BASELINE FOR COMPUTING THE ABATEMENT POTENTIAL

The production of refined copper in Europe is expected to grow by about 1 percent annually, which corresponds to a 35 percent increase between 2018 and 2050, under the hypothesis of a constant EU production to demand ratio. This is expected to lead to an annual production of refined copper of 3.4 million tonnes by 2050 in the EU, with 0.9 to 1 million tonnes of the total originating from end-of-life copper scrap. The share of scrap is forecast to increase in Europe over the period from 2018 to 2050, as shown in the 2022 study by KULeuven [2], since the lower carbon footprint of recycled copper helps accelerate the decarbonisation of copper production. This hypothesis of a 60 percent increase of the volume of end-of-life scrap recycled by 2050 has been included in the computation of the baseline.

Over this period, two major factors will affect the CO_2e intensity of copper production: 1) the decline of the mill-head grade of copper ore will continue to drive up emissions (for further explanation of the evolution of the mill-head grade of copper ore, refer to Section 2 of *Copper—The Pathway to Net Zero*) and 2) the shift towards fossil-free energy will lower the CO_2e intensity of the electricity consumed by copper producers. The carbon intensity of electricity grids around the world is expected to decrease from 200 to 600 kg CO_2e/MWh today to less than 100 kg CO_2e/MWh by 2050.

Scope 1, 2 and 3 emissions, 2018-50 - No-action scenario

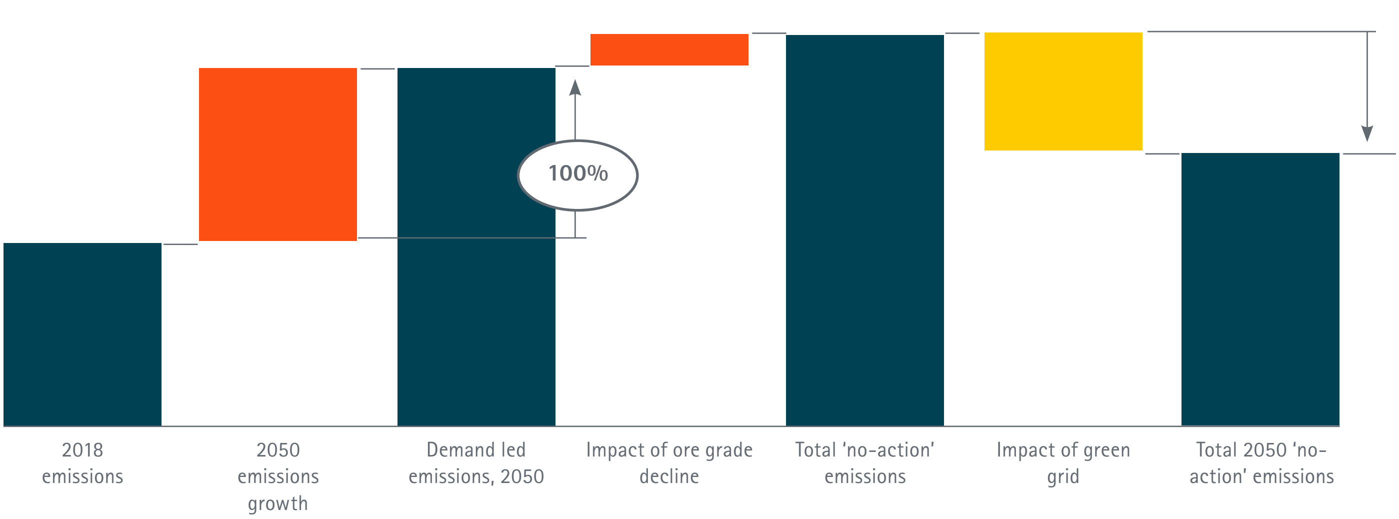


Figure 11 — Modeling Emissions: 2018-2050

The estimated baseline for European refined copper production in a no-action scenario (no decarbonisation initiatives taken by copper producers) is 10.3 million tonnes of CO_2e emissions per annum throughout 2050. Total emissions are indeed expected to stay stable as emission growth triggered by production increases is compensated for by the continued decarbonisation of the power grid.

GHG Emissions - Baseline

Million tonnes CO_2e

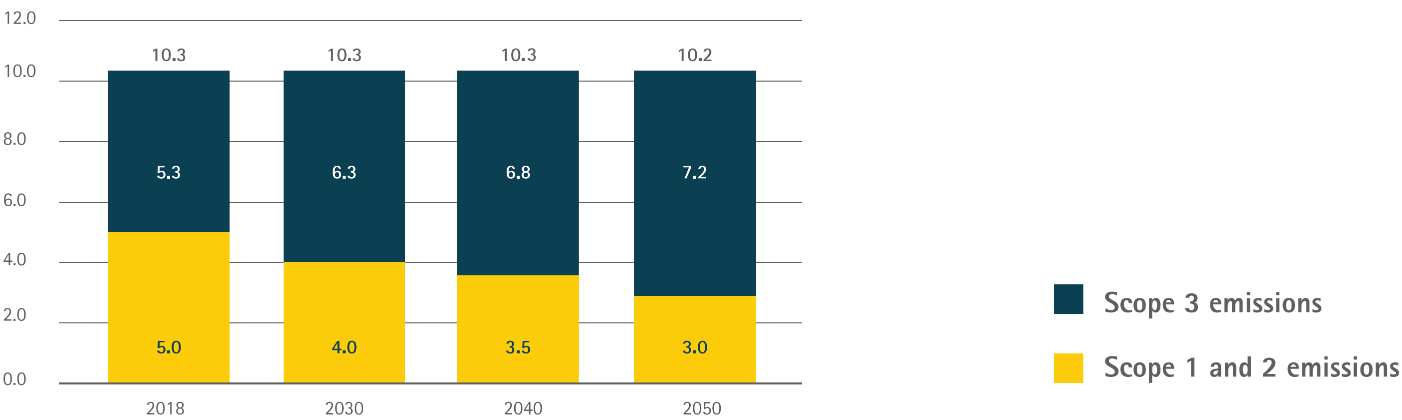


Figure 12 — Baseline: GHG Emissions from EU Copper Production in a No-Action Scenario

ABATING SCOPE 1 AND 2 EMISSIONS

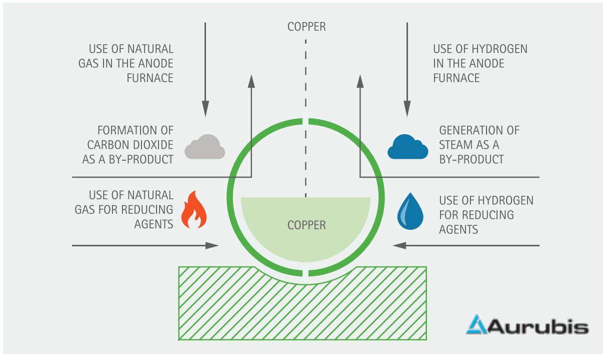
A significant percentage of Scope 1 and 2 emissions from European copper production can be reduced by using four types of market-ready and developing technologies:

1. Decarbonised electricity.
This includes the switch from standard to carbon-free purchased electricity through Power Purchase Agreements (PPAs) as well as the installation of wind and solar energy farms at copper production sites. Such measures would allow copper producers to reduce the CO_2e intensity of used electricity faster than if they purchased it from the grid without a specific purchase agreement.

As an example, KGHM Polska Miedz inaugurated a PV programme in 2020 by connecting a pilot solar farm to the Legnica smelter in Poland, supplying 3 GWh of electricity and cutting 2400 tonnes of CO_2e emissions annually. As the first step toward supplementing its own projects with external renewable sources, the company also entered a corporate PPA in 2022 to purchase the total output (5.2 MW) of a new solar power plant in the Wielkopolskie Province.

2. Alternative fuels.
This includes the transition from diesel to biofuel for trucks, excavators and drills as well as the shift to green hydrogen for haulage trucks. In smelting furnaces, green hydrogen could replace natural gas; other natural gas systems could switch to biogas, ammonia or other alternative fuels; biochar could replace coke.

For example, in 2021 Aurubis carried out a first pilot project to test the use of hydrogen as a reducing agent in the anode furnace.

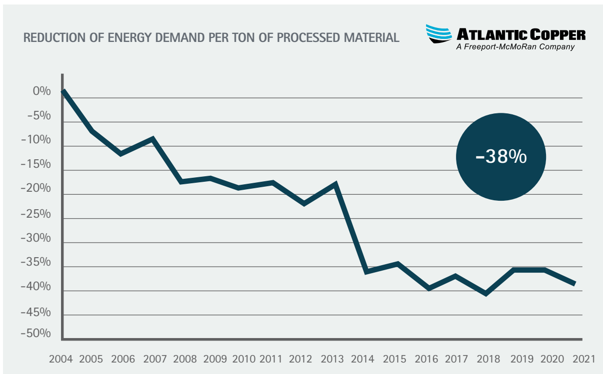


3. Equipment electrification.
Examples include the introduction of battery or pantograph electric trucks to replace diesel trucks for haulage at mine sites and electric furnaces to replace natural gas furnaces at smelters. Such equipment should of course be supplied by decarbonised electricity.

For example, Boliden has piloted and expanded pantograph electric haulage trucks at the two open-pit mines of Aitik (Sweden) and Kevitsa (Finland). At these sites, 14 and 13 mining trucks respectively will be converted from diesel to electric, reducing the GHG emissions from transportation over the mines' life spans by 15% for Aitik and 9% for Kevitsa.

4. Energy efficiency.
Examples include the improvement of milling efficiency using high-chromium grinding media and the installation of in-pit crushing and conveying systems to avoid truck haulage, when applicable.

By recuperating the heat from process gases to dry copper concentrates before they are fed into the smelter, and by improving efficiency of most of the burners along the foundry, Atlantic Copper managed to significantly reduce its energy consumption per tonne of copper produced.



The relative importance of these four abatement levers over time is illustrated in Figure 13 (See next page).

In the run up to 2030, the expansion of fossil free electricity is expected to offer the biggest abatement opportunity in Western Europe. In Eastern Europe, abatement potential is expected to be limited by the unavailability of large-scale energy storage, making it difficult to abate Scope 2 emissions via renewable electricity. For the EU as a whole, the greatest abatement potential is in decarbonised electricity and the switch from fossil fuels to alternative fuels such as biogas in smelting sites and hydrotreated vegetable oil in mining equipment and vehicles. Overall, by 2030, **an estimated 30 to 40 percent of emissions can be reduced compared to the baseline.**

From 2030 to 2040, the switch to alternative fuels in mining and smelting is expected to offer the biggest abatement lever in Western Europe, while renewable electricity is forecast to remain important and be the most cost-effective abatement lever. In Eastern Europe, decarbonised electricity has the biggest abatement potential and is cost-effective due to low renewable cost. By 2040, **an estimated 85 to 95 percent of emissions can be abated compared to the baseline scenario.**

From 2040 to 2050, fossil-free electricity and alternative fuels are predicted to remain the most prevalent abatement opportunities in Western Europe, while decarbonised electricity is expected to retain the largest abatement potential in Eastern Europe. Electrification of mining equipment and efficiency gains also present important opportunities in both regions. With the increasing availability of low emission vehicles, the importance of alternative fuels is forecast to reduce, but it is anticipated to remain the largest abatement lever in Western Europe given the large smelting and refining capacity in this region. In this category hydrogen represents a small abatement possibility across Eastern and Western Europe, replacing fossil fuels in smelting and fossil fuel operated mining equipment. **By 2050, remaining emissions can be reduced by approximately 90 to 95 percent compared to the baseline.**

Overall, during these three decades, solar generation is expected to have an important role in reducing the scope 2 emissions of copper production in Western Europe. The low Total Cost of Ownership (TCO) of solar power is expected to make PPAs an attractive option for sourcing green electricity. In Eastern Europe, solar power is expected to have insufficient capacity to be a cost-effective option and Scope 2 emissions are more likely to be abated through on-site wind generation, as well as access to fossil-free electricity through the grid.

Scope 1 and 2 emissions
Million tonnes CO_2e

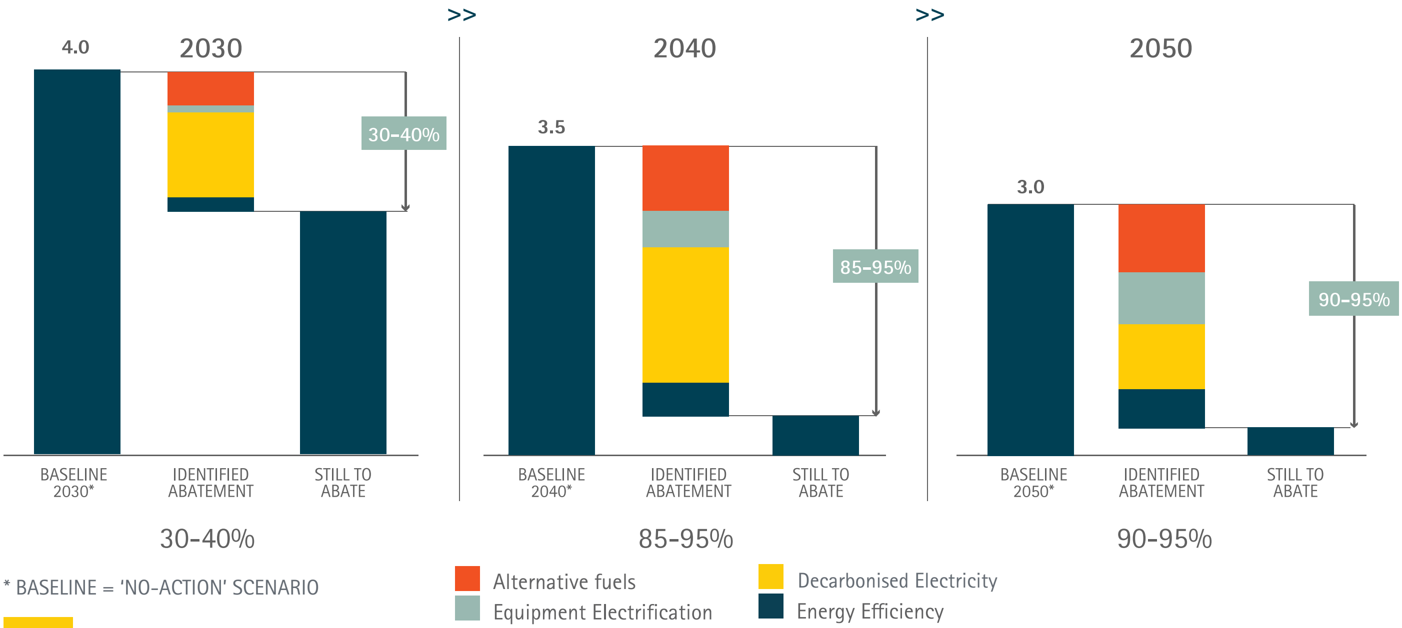


Figure 13 — Potential for Scope 1 and 2 Emissions Abatement (Source: MineLens asset decarbonisation tool; Team Analysis)

ICA members' commitment to abate Scope 1 & 2 emissions.

Based on this analysis, **the members of ICA in Europe commit to a goal of bringing their copper production to net zero Scope 1 and 2 greenhouse gas (GHG) emissions by 2050**, along the trajectory described above. Research and development efforts will be prioritised to unlock additional decarbonisation technologies that should allow reaching a full reduction of Scope 1 and 2 emissions.

This goal should be understood as incorporating the following considerations:

1/ This target is a collective goal reflecting the decarbonisation measures that ICA member companies are pursuing in Europe. Scope of activities, operating conditions and the speed of decarbonisation of the available power grids vary both among copper producers and across member states. These factors will impact the intermediate emission reduction that each member company can achieve by 2030 and 2040. Hence the emission abatement trajectory in Figure 13 should not be used as a benchmark to assess the interim performance of individual companies toward the 2050 net zero goal.

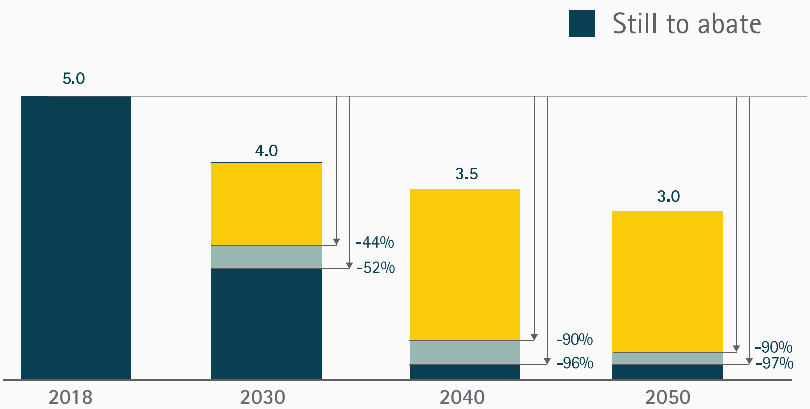
2/ This target is based on current decarbonisation technologies and analysis of their cost, availability at scale, and abatement potential. This model of trajectory toward net zero emissions is thus indicative and subject to change as these variables may fluctuate over time.

Comparison of Scope 1 and 2 abatement potential to the reference year 2018

Although the analysis performed chose to measure the abatement potential in year 2030, 2040 and 2050 in percentage of the GHG emissions that would have been generated without decarbonisation initiatives ("no-action scenario" baseline), it is also common practice to measure this potential as a percentage of the emissions generated during a reference year – the year 2018 for this analysis.

For the sake of completeness, we present this alternative comparison, although we give preference to a reduction percentage of a "no-action scenario" baseline (baseline which evolves across time), as it takes into account the evolution of production volumes and of CO_2 intensity of power grids.

Scope 1 & 2 emissions abatement potential in % of 2018 emissions
Million tonnes CO_2e



In this graph, the total volume of (for example) 2030 emissions still to be abated, which we have computed as 30 to 40 percent lower than the 2030 emissions in a no-action scenario (4 million tonnes–see Figures 12 and 13), ranges from 2.4 (-40 percent) to 2.8 (-30 percent) million tonnes. This range is 44 to 52 percent lower than the 5 million tonnes emitted in 2018.

ABATING SCOPE 3 EMISSIONS

Addressing the reduction of Scope 3 emissions presents additional challenges when compared to Scopes 1 and 2. First, 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 scope of these partnerships can be extensive if tier-2 and tier-3 suppliers collaborate to reduce emissions. Second, the availability of up-to-date, quality data on emissions factors from various suppliers, service providers or customers is still limited. This constraint makes the measurement of Scope 3 emissions and the identification of abatement solutions even more challenging.

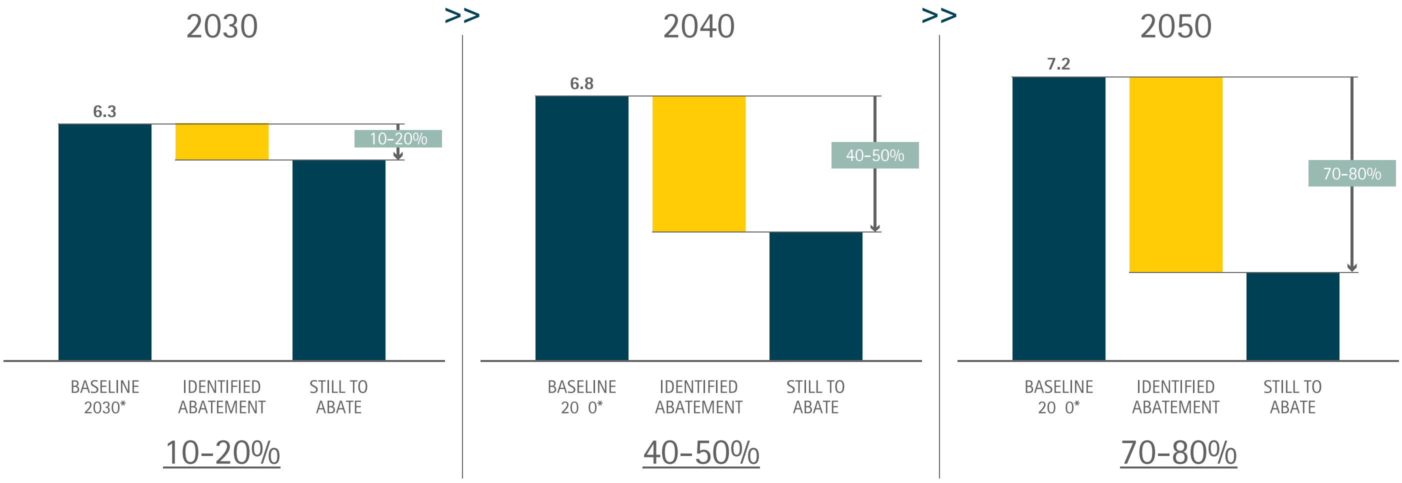
An initial assessment of the abatement potential for Scope 3 emissions from global copper production was performed for *Copper—The Pathway to Net Zero*. Currently, it has not been possible to conduct a detailed regional analysis looking at the abatement of Scope 3 emissions from copper production in Europe. The analysis in this section therefore relies on the global abatement potential identified for Scope 3 and should be considered as a preliminary assessment, subject to refinements based on further future investigation.

The analysis of Scope 3 emissions considered purchased goods and services, fuel- and energy related activities, transport upstream and downstream in the value chain, operational waste and end-of-life treatment of sold products, the categories that produce the bulk of Scope 3 emissions within the copper sector. When assessing the Scope 3 emissions of copper production in Europe, the imports of copper concentrates and anodes from non-EU countries were also considered.

The analysis identified potential decarbonisation levers related to decarbonised electrification, near shoring, alternative production technologies or fuels, and efficiency gains. In addition, increased circularity can reduce emissions in the treatment of end-of-life products or in waste generated in operations. These abatement levers are applicable to copper production at global level. In Europe, the efforts of the global copper industry to abate GHG emissions will also reduce the Scope 3 emissions of European copper producers as the carbon footprint of imported copper concentrates and anodes decreases.

Combining these levers could allow the EU copper producers to reduce Scope 3 emissions by around 10 to 20 percent by 2030, 40 to 50 percent by 2040 and 70 to 80 percent by 2050.

Scope 3 emissions
Million tonnes CO_2e



*BASELINE = 'NO-ACTION' SCENARIO

Figure 14 — Potential for Scope 3 Emissions Abatement (Source: MineLens asset decarbonisation tool; Team Analysis)

Active partnerships across the copper value chain will improve the capacity of the industry to reduce Scope 3 emissions. Establishing and managing such collaborations, however, will require substantial resources as well as agreements to ensure goals are reached. Contractual relationships with suppliers and customers should address problems related to compliance.

A positive perspective in this context is the commitment by all ICA members, at global level, to a goal of reaching net zero Scope 1 and 2 emissions by 2050 (see Section 2 of *Copper—The Pathway to Net Zero*). This commitment will significantly contribute to the reduction of the Scope 3 emissions of EU copper producers related to the import of copper concentrates.

ICA members' commitment related to Scope 3 emissions

ICA members in Europe will actively engage with the copper industry value chain with the ambition of reducing Scope 3 emissions – along the trajectory described above, **toward net zero by 2050.**

This ambition should be understood as incorporating the following considerations:

1/ As for Scopes 1 and 2, this is a collective ambition that should not be interpreted as a benchmark to assess the performance of individual members companies of ICA in reducing their Scope 3 emissions.

2/ This ambition has been defined to the best of our current knowledge, which is constrained by the challenges in addressing Scope 3 emissions noted above. As ICA members develop better techniques for measuring emissions and partnerships to abate them, they will review and likely revise this ambition. Industry goals thus may shift over time and will depend on the establishment of partnerships to build capacity. ICA members will work with their partners to identify further decarbonisation solutions to close the gap to net zero by 2050.

ICA members in Europe recognise that further measures will be required to bring copper production to net zero by 2050. They commit to pursuing research and development to further reduce Scope 1 and 2 emissions (for example, direct emissions linked to the presence of carbon in feed material) and establishing extensive partnerships with relevant stakeholders to lower Scope 3 emissions. This to bring the decarbonisation efforts of the ICA members in full alignment with the Paris Agreement.

This target to decarbonise production hinges on a set of key enabling conditions, including, for example, availability of decarbonised electricity at competitive prices, access to abatement technologies at scale, and a regulatory framework that incentivises investments. These enabling conditions are addressed in detail in the next section.

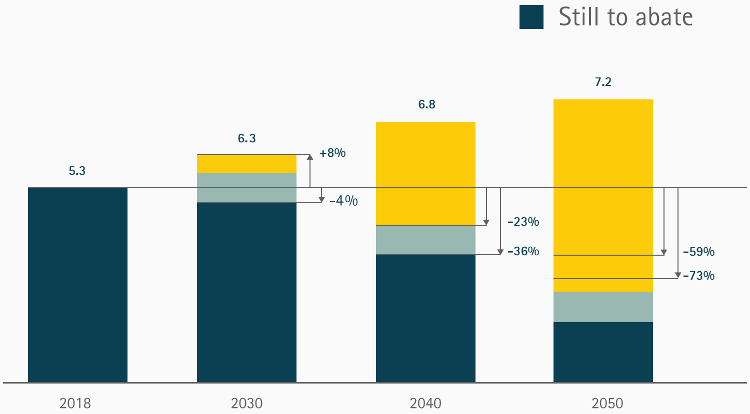
ICA members in Europe will work toward this target through a comprehensive commitment to sustainability.

ICA members in Europe will work toward this target through a comprehensive commitment to sustainability. In pursuing decarbonisation solutions, they undertake not only to mitigate negative impacts on other environmental categories—such as water, land or air—and local communities but also to maximize the positive impacts of such emissions' reductions by improving, for example, air quality and access to energy infrastructure. ICA members support The Copper Mark®, a voluntary assurance framework set up to promote the responsible production of copper and transparent reporting, which significantly contributes to sustainability. ICA members also recognize and adhere to core principles related to the transition to climate neutrality for all stakeholders.

Comparison of Scope 3 abatement potential to the reference year 2018

As for Scopes 1 & 2, we present, for the sake of completeness, the alternative comparison of Scope 3 emissions abatement potential as a percentage of such emissions generated in 2018.

Scope 3 emissions abatement potential in % of 2018 emissions
Million tonnes CO_2e



In this graph, the total volume of (for example) 2030 emissions still to be abated, which we have computed as 10 to 20 percent lower than the 2030 emissions in a no-action scenario (6.3 million tonnes–see Figures 12 and 14), ranges from 5.1 (-20 percent) to 5.7 (-10 percent) million tonnes. This range is respectively 4 percent lower and 8 percent higher than the 5.3 million tonnes emitted in 2018.

REQUIRED MEANS FOR REACHING THE DECARBONISATION TARGETS

Decreasing Scope 1 and 2 emissions for European copper production to net zero by 2050 will require substantial financial resources. ICA members in Europe estimate an aggregate investment by copper producers of at least 5.3 billion EUR at constant currency cost will be necessary to reach this target over the period from 2023 to 2050. Reducing emissions by 30-40 percent by 2030 is anticipated to require investments worth 1.3 billion EUR, while the heaviest investments are expected to be required between 2030 and 2040, totalling 3.4 billion EUR.

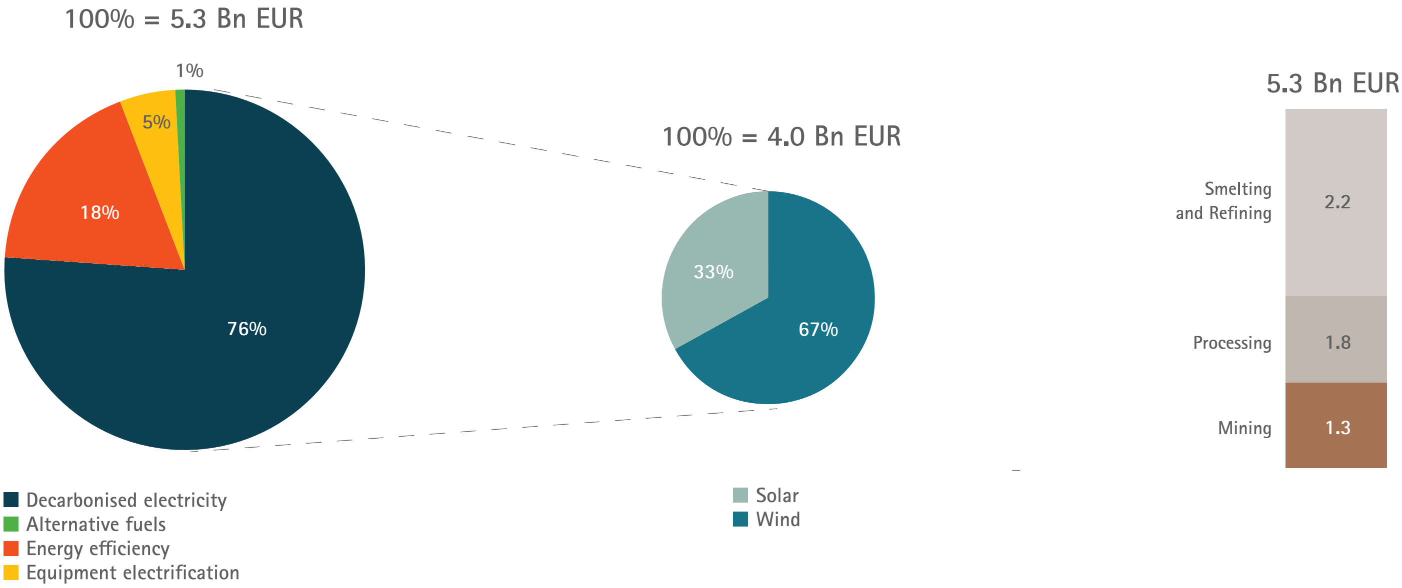


Figure 15 — Estimated Capital Expenditures to Reduce Scope 1 and 2 Emissions to Net Zero by 2050 (Source: MineSpans; MineLens; Team Analysis)

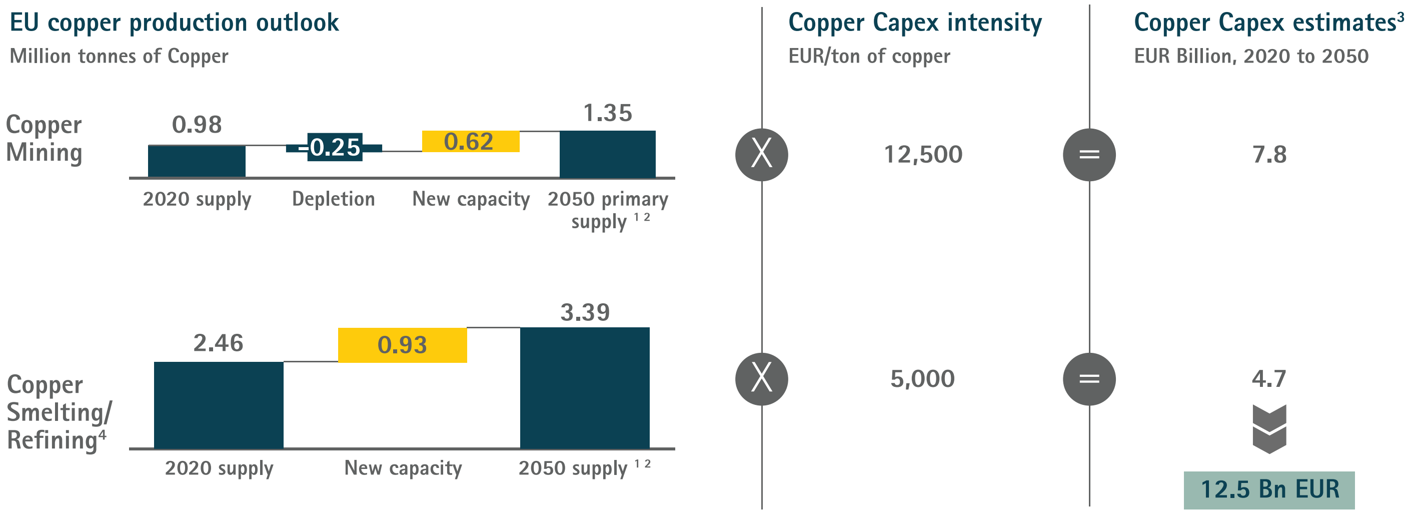
The minimum investment of 5.3 billion EUR is in addition to covering recurring capital expenditures to maintain operations ("maintenance Capex"). This estimate also excludes capital costs required to develop at scale the technologies that will enable copper producers to decarbonise (e.g. green hydrogen, battery-electric trucks) or to install the supporting infrastructure to deploy these technologies (e.g. distribution of decarbonised electricity). Several factors may cause this estimate to increase:

- Further research and development will be critical to bringing the emission reduction potential closer to 100 percent.
- New decarbonisation solutions may be identified and implemented.
- Abatement of Scope 3 emissions could trigger some joint investments with suppliers or customers.
- Base materials costs could keep rising above the industrial price index.

ICA members in Europe estimate an aggregate investment by copper producers of at least 5.3 billion EUR at constant currency cost will be necessary to reach this target over the period from 2023 to 2050.

Picture courtesy of Boliden

This shows that decarbonisation will require significant investments beyond the capital expenditure needed to expand production capacity to meet growing copper demand, estimated at 12.5 billion EUR between 2020 to 2050 (see Figure 16 below). However, ICA members in Europe believe these capital expenditures for decarbonisation, which amount to around 40 percent of the estimated growth investments, can be managed with an acceptable rate of return provided enabling conditions are met.



1. Based on the Base case for Refined copper demand by use end, 2020-2050, Mt; 2. Assume supply equals demand, includes ~ 1Mt of supply estimated to come from scrap in 2050; 3. Does not include specific Capex for secondary scrap facilities, nor Sustaining Capex; 4. Smelting & refining capacity to process concentrate and scrap volumes

Figure 16 — Estimated Capital Expenditure Required to Expand EU Copper Production to Meet the Growing Demand (Source: MineSpans Copper Demand Model Q3 2021, KULeuven, Team Analysis)

SECTION 3 - ENABLING CONDITIONS FOR REACHING THE DECARBONISATION GOALS OF ICA MEMBERS IN EUROPE

Six key enabling conditions must be met for ICA members in Europe to be able to achieve their decarbonisation targets:

1) access to a sufficient amount of fossil-free, competitively priced electricity;
2) availability of decarbonisation technologies from manufacturers at sufficient scale;
3) increased end-of-life collection rates of copper-containing products to allow increased recycling;
4) access to financing;
5) a global level playing field on carbon pricing;
6) a stable and fit-for-purpose regulatory framework that incentivises investments.

These are explained in more detail below.

Access to clean and competitively priced electricity in sufficient quantity is a pre-condition for decarbonising copper production in the EU.

1. ACCESS TO A SUFFICIENT AMOUNT OF FOSSIL-FREE, COMPETITIVELY PRICED ELECTRICITY

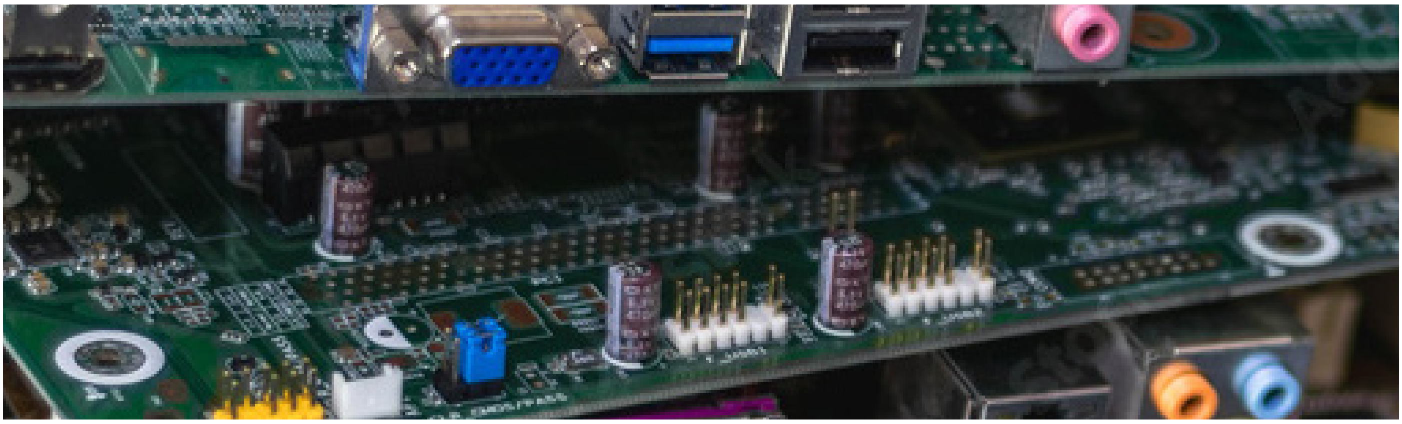
Access to clean and competitively priced electricity in sufficient quantity is a pre-condition for decarbonising copper production in the EU. European copper production sites consumed approximately 14.000 GWh of electricity in 2018, a figure expected to grow towards 2050 since production is forecast to increase by 1 percent per year and a large part of the sector decarbonisation efforts will occur through increased electrification of operations.

Unprecedented electricity prices in the last 18 months have increased the operational costs of copper miners, smelters and refiners in Europe and are causing a competitive disadvantage vis-à-vis producers in other regions where electricity prices remain lower. Electricity is already the most important energy source for copper smelting and refining in Europe and its relative importance will increase given the prevalent role of fossil-free electricity in decarbonising copper production in Europe. In the current situation, the unpredictability of prices is impacting on the ability of copper producing companies to make investments.

Political intervention is therefore needed to make changes in the EU's electricity market design to address the high cost of electricity for consumers and to ensure investment predictability. Steps should be taken to ensure that the price of electricity is no longer directly tied to the price of natural gas. This could be achieved through the implementation of a technology neutral price shock absorber mechanism that would apply in moments of extraordinarily high prices. At the same time, steps must be taken to facilitate the use of renewable Power Purchase Agreements (PPAs) by copper producers by introducing solutions to reduce shaping risk which currently makes these contracts expensive. In parallel, the deployment of additional fossil-free generation capacity must be accelerated and member states must be allowed to put support schemes in place to help energy-intensive industries in the EU remain competitive until sufficient new decarbonised electricity generation capacity is deployed.

2. AVAILABILITY OF DECARBONISATION TECHNOLOGIES FROM MANUFACTURERS AT SUFFICIENT SCALE

Decarbonisation technologies must be available from manufacturers at sufficient scale. Zero-emission haulage trucks, on-site storage systems for fossil-free energy and wind turbines are a few examples of technologies that need to be produced at scale to keep pace with rising production capacity and to meet the growing demand driven by the clean energy transition. As an example, by 2050, the world's open pit copper mines will require 16,000 zero-emission haulage trucks, twice the number currently in use.



3. INCREASED END-OF-LIFE COLLECTION RATES OF COPPER-CONTAINING PRODUCTS

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. The extent of GHG emission savings depends on the quality of the copper scrap, but the associated GHG emissions are always lower than the emissions from primary production. Secondary production 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. Also, production from high grade scrap—rather than copper ore—reduces by more than 85 percent the emissions from smelting and refining. This ratio is lower (70 percent) when low grade scrap is used.

Consequently, increasing the input rate of scrap in the production process lowers its carbon emission intensity while helping meet the growing demand for copper. To allow wider use of secondary raw materials recovered from waste, improvements to the EU legislative framework for products and waste are indispensable to facilitate (1) improved and larger collection of discarded products and materials (waste); (2) better sorting and treatment of waste streams to improve the quality of recovered materials; and (3) access to the secondary raw materials by the industry processing them into new products and materials.

To reach these goals, the following changes should be made to relevant EU legislation on products and waste:

- The **regulation on Waste Shipment**[3] should allow the export of waste outside the EU territory only when environmental and safety standards at the destination are equivalent to or higher than the EU ones. Moreover, the regulation should be more effective in imposing custom checks at the EU borders, to avoid circumvention practices (e.g. waste or secondary raw materials exported as used goods). Finally, the classification of waste streams shipped within the EU territory should be harmonised and the bureaucratic procedures simplified to facilitate shipments and recycling.

- The **directive on End-of-Life Vehicles**[4] should allow improved treatment of the discarded vehicles before their shredding. In particular, the legislation should ensure that copper harnesses, printed circuit boards, and electric and electronic equipment are separated before the shredding process, to avoid dispersing copper within the ferrous scrap.

3. Regulation (EC) No 1013/2006 of 14 June 2006 on shipments of waste
4. Directive 2000/53/EC of 18 September 2000 on end-of life vehicles

- The **directive on Waste from Electrical and Electronic Equipment**[5] (WEEE) should be reviewed to improve collection, separation and sorting processes. The directive should incentivise consumers to bring back their WEEE and producers to design their products in a way that facilitates dismantling and segregation of different parts and material fractions.

- The proposed **EU regulation on Ecodesign for Sustainable Products** that is currently under discussion should ensure the recyclability of products at the design stage, e.g. allowing for better separation of parts and, when feasible, materials, to increase the quality and homogeneity of segregated fractions.

Picture courtesy of KGHM Polska Miedź

4. ACCESS TO FINANCING

Between 2020 and 2050, the copper industry in the EU will need to invest approximately 12.5 billion EUR to meet increasing demand and an additional 5.3 billion EUR -at least- to reach decarbonisation targets, an average of 600 million EUR per year. Copper producers should have access to public and private funding to support innovation and the deployment of decarbonisation technologies to help meet the ambitious plans of ICA members in Europe to decarbonise their copper production. In this respect, it is important that ambitious yet realistic criteria that are fit for the copper production process are included in the Climate Delegated Act under the **EU Taxonomy framework**[6] to determine the manufacturing of copper as an activity that substantially contributes to climate change mitigation.

5. A GLOBAL LEVEL PLAYING FIELD ON CARBON PRICING

The EU Emission Trading System[7] **(ETS) must ensure there is a level playing field on the carbon costs paid by EU copper producers and non-EU copper producers.** Today, the EU's climate policies are much stronger than those of most other countries and regions. These policies lead to higher operational costs for copper producers in the EU, directly through the obligation to surrender emission allowances under the EU ETS for every ton of CO_2 emitted, and indirectly through the higher electricity prices that EU copper producers pay to power their production processes because utilities pass through the cost of carbon to their customers.

Copper producers are price-takers and cannot pass on the cost increases brought about by the EU ETS to consumers without losing market share to producers who do not face the same costs. This means that as long as third countries do not have climate policies resulting in equal climate costs for industry in the same timeframe as the EU, it is of crucial importance that the EU legal framework provides robust protection to avoid the relocation of production sites to countries outside the EU that have less stringent environmental regulations. Strong protection against carbon leakage is needed to deliver on the environmental goals of the ETS and to maintain the competitiveness of the European metals industry. With increasingly high carbon prices, it plays a crucial role in preserving a level playing field in the copper sector and enabling investments in decarbonisation.

5. Directive 2012/19/EU of 4 July 2012 on waste electrical and electronic equipment
6. Regulation (EU) 2020/852 of 18 June 2020 on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088
7. Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading

It is therefore important to keep the current **State Aid framework**[8] until 2030 to allow member states to compensate electro-intensive industries for the increased electricity prices they pay as a result of higher carbon costs that utilities pass on in the electricity price, and to ensure adequate free allocation under ETS in Phase 4. Currently, it is up to member states to decide whether to compensate energy-intensive industries such as copper producers for the higher electricity prices they pay due to the ETS, and not all member states give compensation. This distorts competition within the internal market, and it would be important for indirect cost compensation to be provided by all EU member states. Equally, the list of sectors eligible for indirect cost compensation within the ETS State aid Guidelines should be expanded to cover copper mining installations.

We understand the underlying idea behind the **Carbon Border Adjustment Mechanism (CBAM)** to introduce a level playing field for carbon costs between EU and non-EU producers, which would allow phasing out the current carbon leakage protection measures under the EU ETS. In practice, however, several important concerns remain as to the ability of CBAM to establish a real level playing field, in particular in relation to the treatment of EU exports, the inclusion of indirect emissions, circumvention and the on-the-ground application of CBAM. We are therefore concerned that a CBAM applied on the copper sector would not effectively replace the existing carbon leakage protection measures under the EU ETS.

Copper is not included in the list of sectors to which CBAM will apply in the first instance. However, we note the intention of the EU institutions to expand CBAM to other ETS sectors in the future. The extension of CBAM to new sectors must be carefully assessed on a case-by-case basis. It would therefore not be adequate to draw conclusions on the application of a CBAM for the copper sector based on the experience of the sectors included in the trial phase without a thorough assessment and dialogue with the industry, given the differences between value chains, the range of products and intermediates, and other sector-specific characteristics.

In this respect, the forthcoming EU Critical Raw Materials Act and the Net Zero Industry Act together with the existing EU legislative framework for chemicals and products are of key importance.

6. A REGULATORY FRAMEWORK THAT INCENTIVISES INVESTMENTS

The copper industry in the EU has to remain competitive to be able to invest in advancing decarbonisation and circularity. This requires a coherent and fit-for-purpose regulatory framework that provides legal clarity and predictability, together with a more ambitious industrial policy to support strategic raw material value chains that are essential for achieving the EU's objective to become a carbon neutral continent by 2050.

In this respect, the forthcoming EU Critical Raw Materials Act and the Net Zero Industry Act together with the existing EU legislative framework for chemicals and products are of key importance.

It is essential to ensure coherence between the policy objectives on decarbonisation, industrial policy, environmental protection, chemicals management, circular economy and resource efficiency. This requires an acknowledgement of the areas where these objectives may be in conflict. Coherent chemical and product regulations should allow an optimised and responsible

8. Communication from the Commission: Guidelines on certain State aid measures in the context of the system for greenhouse gas emission allowance trading post-2021

contribution of copper and its by-products, such as iron silicate, to the transition toward climate neutrality. Achieving the goals of the EU Green Deal will require the use of more metals for green and digital technologies, and the use of industrial by-products to mitigate the use of natural resources. The production of many metals is dependent on the production and use of carrier metals like copper. While some of these metals may have intrinsic hazardous properties, they may prove to not pose any concrete risk in their use. It is important that EU chemicals regulation is aligned with the wider sustainability and circular economy objectives to avoid making key strategic raw materials subject to disproportionate regulatory processes that are not fitted to their risk profile. The risk of unjustified restrictions or even bans and unpredictable compliance costs are proving real disincentives for investors to choose the EU over competing markets.

In line with the objective of creating a circular and sustainable economy, the EU policy framework should support the valorisation of secondary resources. As described in Section 1 related to copper's contribution to resource efficiency, iron silicate generated from the copper production process can contribute to the decarbonisation of the cement, concrete and road construction sectors, while also contributing to reducing other environmental emissions. To fully exploit this potential, a European framework should be put in place to facilitate industrial symbioses.

The **Critical Raw Materials Act** should recognize copper as a strategic raw material and take concrete steps to facilitate and accelerate permitting and financing for new mining, processing and recycling operations and expansions. This is essential to enable the copper industry to meet growing demand for copper. The Critical Raw Materials framework should:

• Grant easier permitting procedures and eligibility for financing when the project fulfils responsible production criteria via assurance frameworks and sustainability principles; for instance, projects that will deliver alignment with the EU Taxonomy criteria should follow a fast-track procedure.

• Grant strategic raw material projects access to EU and Member States' finance tools. Their importance should be placed on equal footing with other priority projects such as Projects of Common Interest and Important Projects of Common European Interest that profit from flexible State Aid instruments and EU funding.

• Provide for financial support of the European Investment Bank (EIB) and the European Bank for Reconstruction and Development (EBRD) for de-risking strategic projects.

The Net Zero Industry Act should follow a value chain approach focusing not only on the production of net zero technologies, but also on the strategic raw materials needed to produce them, making Europe a more attractive place to invest both upstream and downstream.

SECTION 4 – THE WAY FORWARD

Copper—The Pathway to Net Zero and this *Regional Focus: Europe* bring additional foresight on a challenging but critical journey toward carbon neutrality on which copper producers have already embarked, be it in Europe or in other parts of the world.

Copper producers in Europe are committed to implementing the following next steps to advance the decarbonisation of copper production:

- **Measuring progress** through a robust, aligned methodology for calculating the carbon footprint of copper production and a regular, transparent monitoring mechanism (to be established by end of 2024) that provides verifiable reports on progress at industry level;

- **Advancing decarbonisation in a responsible way**, supporting and enhancing communities and the environment around copper assets in Europe, for example through commitment to The Copper Mark®, an independent third-party assurance framework designed to provide all stakeholders with the confidence that certified copper production sites operate according to internationally accepted, responsible industrial practices;

- **Regularly updating the *Copper—The Pathway to Net Zero* and the *Regional Focus: Europe*** – at least every 5 years- to incorporate technological developments in decarbonisation and increased availability and quality of emissions data across the whole value chain;

- **Engaging in partnerships** to address the challenge of decarbonisation. Partnerships should not be limited to business stakeholders, since policymakers, civil society and academia also have a significant role to play to ensure we transition to a net zero economy by 2050.

In Europe, copper producers, together with the European Copper Institute, will continue to engage in a constructive dialogue with European policymakers, businesses and representatives of civil society to maximize the contribution of copper and the copper industry to achieving the objectives of the European Green Deal, in a responsible and sustainable way.

Glossary

Abbreviations

CAPEX: capital expenditures

CO_2e: carbon dioxide equivalent

ICA: International Copper Association

ICSG: International Copper Study Group

IEA: International Energy Agency

MACC: Marginal Abatement Cost Curve

PPA: Power Purchase Agreement

PV: photovoltaic

Terminology

Alternative fuels: e-fuels, biogas, biomethane, hydrogen and ammonia produced with non-fossil energy, hydrotreated vegetable oil (HVO), biochar

Archetypes: short for "archetypical production processes," combinations of major production stages and technologies of copper production

Copper industry: includes copper mines, smelters, refiners, recycling facilities and fabricators of semi-finished products from copper and copper alloys

Copper producers: includes copper mines, smelters, refiners and recycling facilities

Copper production: the production of refined copper from copper ore extracted from mines or copper scrap generated through recycling

Electricity mix: the mix of energy sources used to produce electricity in a particular country or region

End-of-life recycling rate: the share of copper-containing products reaching the end of their life cycle that is collected, separated and processed into copper scrap

End-of-life recycling input rate: the share of refined copper production originating from old scrap

Energy or clean energy transition: the transition from an economy based on fossil fuels to a climate neutral one

Decarbonised electricity: electricity generated from fossil-free energy sources

Mill-head grade: the metal content of mined copper ore going into a mill for processing

New scrap: scrap originating from waste in the fabrication of semi-finished and end-use products

Old scrap: scrap originating from the recycling of copper-containing products reaching end of life

Primary copper sources: copper ore from mining operations

Recycling input rate: the share of refined copper production originating from recycled material, both old and new scrap

Refined copper: copper with at least 99.99 percent purity, which results from a smelting and refining process

Scope 1 emissions: direct GHG emissions from owned or controlled sources

Scope 2 emissions: indirect GHG emissions associated with the purchase of electricity, steam, heat or cooling

Scope 3 emissions: all indirect GHG emissions not included in Scope 2 that occur in the value chain of a company, both upstream and downstream

Secondary copper sources: copper scrap from recycling

Semi-finished products: products fabricated from refined copper, sometimes alloyed with other metals, in the form of wire, rod, tube, sheet, plate, strip, castings, powder or other shapes. They are further transformed by downstream industries to produce copper-containing end-use products.

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