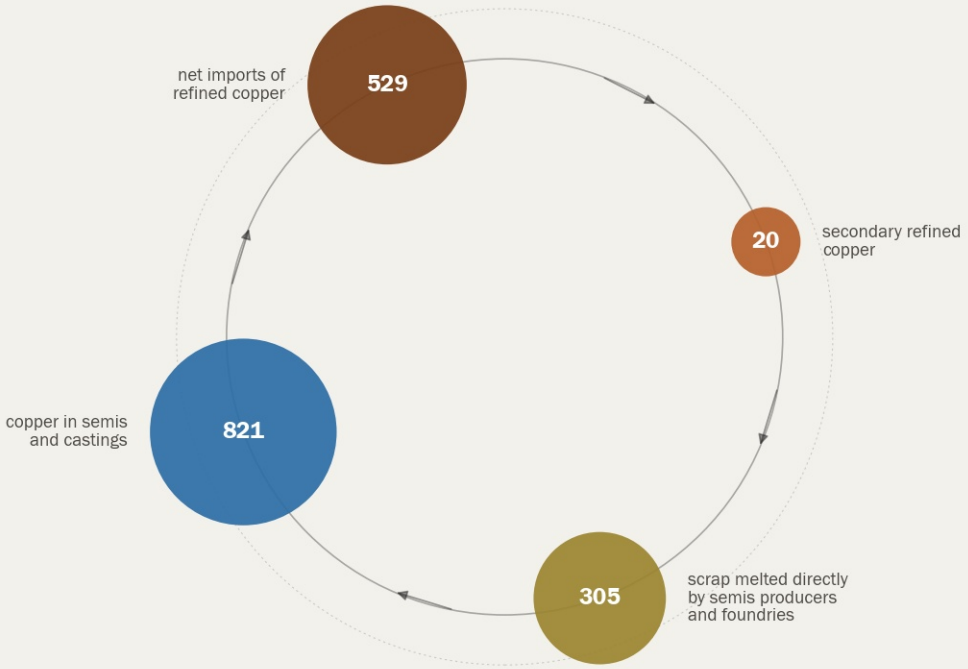
IGMNiR
Economic Chamber of Non-Ferrous Metals and Recycling

Copper in Italy, 2024 (kt Cu; circle area ∝ tonnes)



IGMNIR REPORT · NOVEMBER 2026

Copper in the Italian economy

Value, circularity and security of supply

An integrated assessment of the copper industry in Italy (CU-IT model)

Base year 2024 · Dynamic stock model 1960–2035 · Transparent, reproducible model

About this report. This report was prepared by the Economic Chamber of Non-Ferrous Metals and Recycling (IGMNiR). It presents CU-IT, an integrated model that estimates the economic, fiscal, environmental and strategic contribution of the copper industry to the Italian economy. Italy has no copper mine, no primary copper smelter and no electrolytic refinery; the model therefore covers five segments that work with imported cathode and with scrap – the collection and trading of copper scrap (I1), scrap-based copper production (I2), cathode-based copper production (I3), copper-alloy castings (I4) and the copper in wires and cables (I5). A dynamic model of copper in use links the industry to the stock of copper in Italian buildings, infrastructure and products. The annexes list all parameters and sources. The report was prepared with the support of artificial-intelligence (AI) tools for data processing, modelling and drafting.

Data cut-off: statistics 31 October 2026; legal and policy status 9 November 2026. **Base year:** 2024 (latest year with complete structural business statistics, PRODCOM and company reports); trade data to 2025. **Currency:** EUR, current prices. **Model version:** CU-IT v1.0 (run ID CUIT-1.0-e47162ffa3; random-number seed 20261118, a fixed numeric identifier); the model package – code, input data, scenarios and checks – is archived by IGMNiR. **Suggested citation:** IGMNiR (2026), *Copper in the Italian economy: value, circularity and security of supply. An integrated assessment of the copper industry in Italy (CU-IT model)*, Economic Chamber of Non-Ferrous Metals and Recycling, November 2026.

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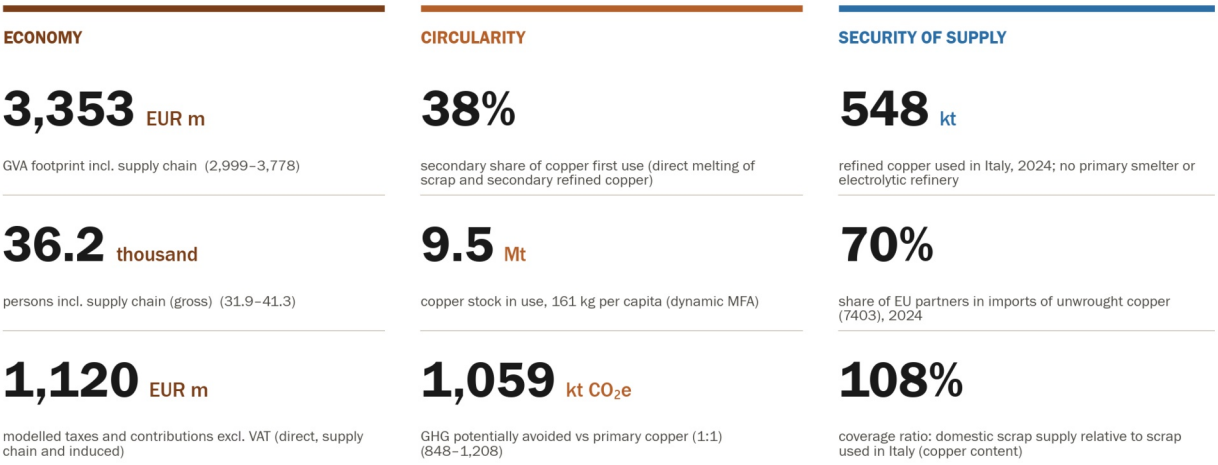
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How to read the numbers. The report uses three kinds of figures. *Observations* (O) are published statistics and company data – Eurostat structural business statistics (SBS), national accounts, PRODCOM and Comext, industry data (Assomet, Assofond) and company reports. *Estimates* (E) combine observations with allocations or calibrated parameters – the copper shares of scrap trading, castings and cables, the split of copper production (NACE 24.44) into scrap-based and cathode-based production, and the copper from scrap melted directly by semis producers and foundries (copper bridge). *Model results* (M) depend in addition on counterfactual or dynamic assumptions – supply-chain and induced effects, modelled taxes, the copper stock in use and the scrap it releases, the emissions and other burdens potentially avoided, their valuation and the scenarios. All economic results are gross contributions, not net effects of policy. Value added is at factor cost from SBS for all segments; it includes other subsidies on production, such as the compensation of indirect emission costs, which is not published by firm and is not quantified here. Taxes are model estimates; they attribute public revenue to the activity and are not a net fiscal balance.

Key findings

Italy has no copper mine, primary smelter or electrolytic refinery, yet it used 548.3 kt of refined copper in 2024 – almost all of it imported cathode. About 526 kt of it went into semis and castings (the rest, about 22 kt, into other uses) and, together with about 305 kt of copper from scrap melted directly, became about 821 kt of copper in wire rod, brass bars, tubes, strip and castings. Secondary copper supplied 38% of the copper first used in Italy in 2024.

FIGURE 1 The copper industry in Italy at a glance



Central estimates for 2024; ranges in brackets = P5–P95 of 10,000 Monte Carlo draws. Extended value chain: collection and trade of scrap, scrap-based and cathode-based copper production, copper-alloy castings, copper in wires and cables. GHG: conditional, substitution-based estimate, outside Italy. Source: IGMNiR CU-IT v1.0.

SEVEN FINDINGS

- **Value.** The extended copper value chain generated about EUR 1,810 million of gross value added in 2024 and employed about 16,900 people. Including the domestic supply chain the footprint is EUR 3,350 million and about 36,200 jobs (90% band EUR 3,000–3,780 million). Copper in wires and cables (I5) accounts for 47% of direct value added and copper production (I2 and I3) for 26%.
- **Recycling.** The recycling chain – collection and trade of scrap (I1) and scrap-based copper production (I2) – generated EUR 530 million of direct value added and about 4,600 jobs; EUR 1,090 million and about 11,800 jobs with the supply chain. Scrap-based production is attributed 37% of NACE 24.44, the share of scrap in the copper input of semis; this key is conservative for the recycling chain – keys based on Assomet data net of zinc or on the headcount of listed producers give EUR 600–690 million of direct value added.
- **Public finances.** Activity in the extended chain is associated with about EUR 1,120 million of taxes and social contributions excluding VAT (90% band EUR 1,000–1,270 million), of which EUR 750 million are labour taxes and contributions. Amounts of compensation of indirect emission costs received by copper firms are not published.
- **Copper in use.** The dynamic model estimates the copper stock in use in Italy at about 9.5 Mt (161 kg per person; 90% band 142–203). End-of-life products released about 330 kt of copper in 2024, of which about 190 kt was recovered. With new scrap this bottom-up supply of 319 kt is 43 kt below the domestic supply derived from scrap use and trade; after net exports of other secondary materials, 48 kt (90% band −13–108 kt) is reported as

unaccounted-for copper.

- **Environment.** Counting all secondary copper produced in Italy, including new scrap that returns from fabrication (recycled-content perspective), and replacing global average primary copper one-for-one, about 1,060 kt CO_2e were potentially avoided in 2024 (90% band 850–1,210 kt), with about 30 Mt of tailings and 19 million m^3 of blue water consumption, all outside Italy. Counting only copper from end-of-life products recovered in Italy, about 580 kt CO_2e (90% band 430–720 kt). Direct melting of scrap carries about 0.30 t CO_2e per tonne of copper (whole-site value, an upper estimate of the increment over melting cathode), against 3.64 t for global primary cathode (ICA data for 2023).
- **Security of supply.** Domestic refined output covers 3.6% of refined copper used. Imports of unwrought copper come mainly from EU partners (70%; largest supplier Bulgaria, 17%; HHI 1,032). Italy exported 40 kt (gross weight) more copper scrap than it imported in 2024; the coverage ratio of domestic scrap supply to scrap used is 108% with supply derived from scrap use and trade, and 95% with supply estimated bottom-up. Italy is a net exporter of copper tube and pipe fittings by value (CN 7412, EUR 743 million); excluding fittings, imports of copper semis (CN 7407–7411) exceeded exports by EUR 600 million, mainly in copper wire (CN 7408).
- **Outlook.** In the high-circularity scenario for 2035 direct melting rises to 365 kt of copper and direct value added to EUR 2,050 million; the additional secondary feed exceeds the growth of domestic scrap projected by the dynamic model by about 46 kt of copper.

TABLE 1 Headline results: central estimate and 90% parameter-uncertainty band

Indicator (2024)	Status	Central	P5	P50	P95	Unit
Direct GVA – recycling chain (I1+I2)	E	532	454	547	644	EUR m
Direct GVA – copper industry (I1–I4)	E	969	887	980	1,080	EUR m
Direct GVA – extended value chain (I1–I5)	E	1,811	1,678	1,824	1,973	EUR m
GVA incl. supply chain (Type I)	M	3,353	2,999	3,381	3,778	EUR m
GVA incl. induced (Type II)	M	3,938	3,523	3,970	4,433	EUR m
Direct employment	E	16,887	15,555	16,983	18,441	persons
Jobs incl. supply chain	M	36,193	31,902	36,498	41,321	persons
Jobs incl. induced	M	43,920	38,671	44,275	50,081	persons
Taxes and contributions (attribution, not net balance)	M	1,120	995	1,131	1,274	EUR m
GHG potentially avoided – secondary copper produced	M	1,059	848	1,027	1,208	kt CO_2e
– of which direct melting of scrap	M	1,017	819	989	1,164	kt CO_2e
GHG potentially avoided – collection-based	M	990	765	933	1,097	kt CO_2e
GHG potentially avoided – end-of-life copper only	M	575	429	558	724	kt CO_2e
GHG potentially avoided – substitution 0.5	M	469	358	449	537	kt CO_2e
Tailings potentially avoided	M	30.3	27.3	31.2	35.4	Mt
Secondary copper (direct melting and secondary refined)	E	324	299	333	372	kt Cu
Copper stock in use	M	9.5	8.4	9.9	11.9	Mt Cu
Old scrap recovered from end-of-life products	M	185	155	192	241	kt Cu
Unaccounted-for copper (balance residual)	M	48	−13	49	108	kt Cu
Secondary share of copper first use	E	38	36	39	41	%
Coverage ratio: domestic scrap supply / scrap used	E	108	107	108	109	%

Source: IGMNiR CU-IT v1.0; Monte Carlo 10,000 draws with Gaussian copula; "central" is the deterministic run with modal parameter values. P5–P95 describe parameter uncertainty within the model structure; structural alternatives give a wider range (Chapter 9). With the national input-output table of Italy (ISTAT, 2022) instead of FIGARO, GVA including the supply chain changes by −1.0%. Status: O observation, E estimate, M model result. Segments I1–I5: see Chapter 4. GVA, jobs and taxes are gross contributions; GVA is at factor cost from structural business statistics for all segments. Taxes exclude VAT and are model estimates. Emissions potentially avoided compare secondary copper produced in Italy (headline: all secondary copper, including new scrap; recycled-content perspective) with 1:1 substitution of global average primary cathode; they occur outside Italy and are not changes of the national inventory; the emission perspectives are alternatives and are not additive, except the sub-item of the headline. The secondary share relates direct melting and secondary refined copper to refined copper used plus direct melting; the coverage ratio relates the domestic supply of scrap (copper content), derived from scrap use and trade, to the scrap used in Italy. Unaccounted-for copper is the difference between this supply and the bottom-up estimate (dynamic model and new scrap), after other secondary materials.

01 Introduction

Copper conducts electricity and heat better than any other non-precious metal, resists corrosion and can be recycled repeatedly without loss of quality. These properties make it essential for power grids, electric motors, buildings, plumbing and vehicles. Italy has no copper mine, no primary copper smelter and no electrolytic refinery. It nevertheless used 548.3 kt of refined copper in 2024 – the sum of 19.7 kt of refined copper produced from scrap (PRODCOM) and 528.6 kt of net imports of refined copper (Comext) – and hosts a large copper semis industry: the wire-rod plant of Aurubis in Avellino, the brass-rod mills of the Brescia district, producers of tubes and strip, a fittings and valves industry and a large cable industry led by Prysmian and La Triveneta Cavi (Nexans). As reported by the association Assomet, the Italian copper industry used 1,013.3 kt of copper metal in 2024, of which 579.1 kt (57.1%) was based on scrap (Assomet 2026).

This report applies to Italy the integrated model that IGMNiR developed for copper in Poland and Germany. Because Italy has no smelter, the model is built around the copper bridge from semis production to direct melting of scrap, and it splits copper production (NACE 24.44) into scrap-based and cathode-based production. It adds a dynamic model of copper in use, route-level screening values for direct melting and secondary refining, stress tests and a replication package. The report describes the industry and its results; it does not assess policy options.

1.1 Questions addressed

01 How large is the copper industry in Italy – in output, value added and jobs – and how is it organised along the value chain?

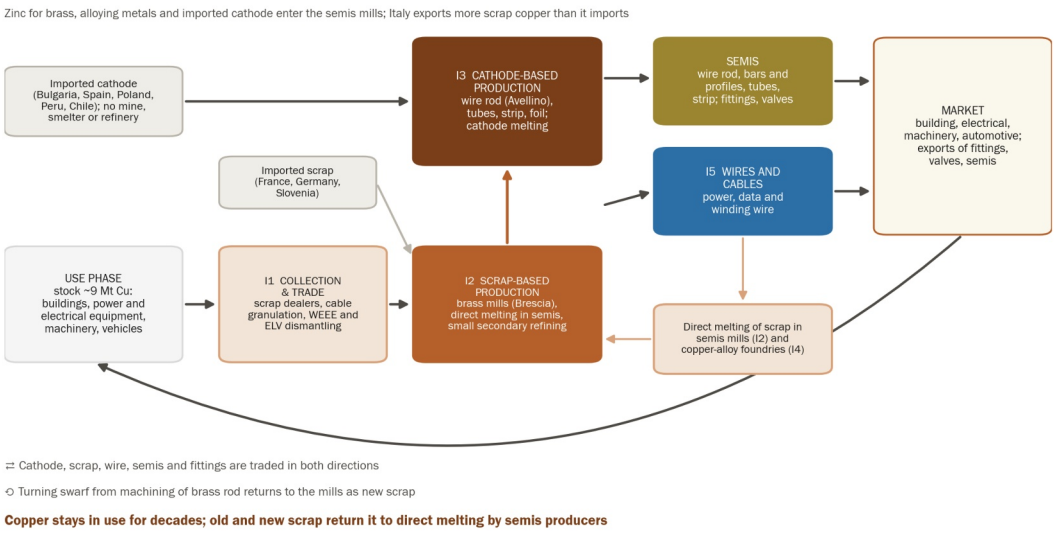
02 How much value added, employment and tax revenue does it support in the domestic supply chain and through household spending?

03 How much copper is in use in Italy, how much scrap does it release, and how does this compare with the scrap melted and traded?

04 Which emissions and other burdens does secondary copper produced in Italy potentially avoid compared with primary copper?

05 How dependent is the industry on imported cathode, wire and scrap, and how might its contribution change to 2035?

FIGURE 2 The copper value chain in Italy and the five segments of the CU-IT model



Source: IGMNiR.

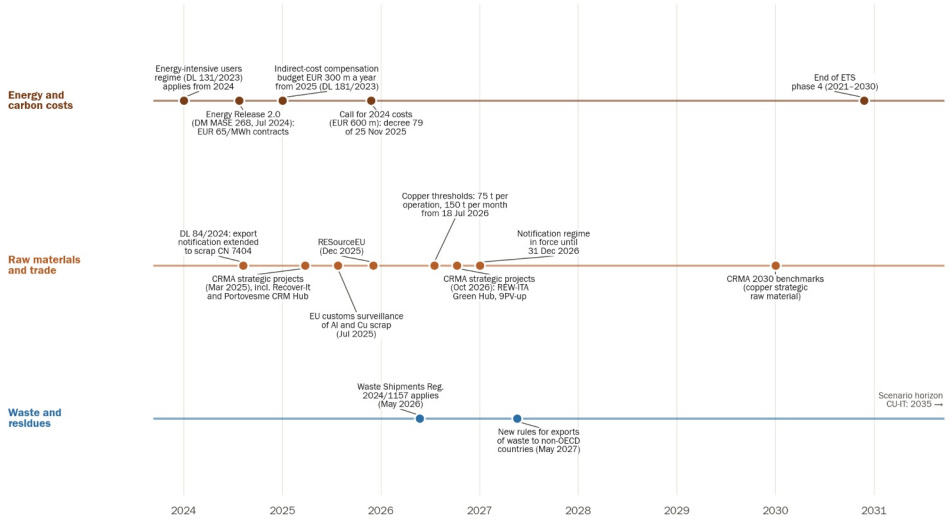
1.2 Structure of the report

Chapter 2 summarises the policy and regulatory context, Chapter 3 describes the industry, its trade and its copper balance, and Chapter 4 the CU-IT model. Chapters 5 to 8 present the economic and fiscal, physical, environmental and strategic results, Chapter 9 their uncertainty and limitations and Chapter 10 the scenarios to 2035. Chapter 11 summarises the results. The annexes document data sources, parameters, installations and terms.

02 Policy and regulatory context

The copper value chain in Italy is shaped by four groups of rules: the cost of electricity and of carbon embedded in it, emissions trading and corporate taxation, rules on trade in raw materials and scrap, and EU waste law. The figure below shows the main milestones; the sections below describe the measures in force on 9 November 2026.

FIGURE 3 Regulatory milestones for the copper value chain in Italy, 2024–2035



Source: DL 131/2023 (L. 169/2023); DM MASE 268 of 23 July 2024; D.Lgs. 47/2020 art. 29 and DM 466/2021; DL 181/2023; MASE directorial decree 79 of 25 November 2025; DL 84/2024 art. 14 (L. 115/2024); DL 21/2022 art. 30; DPCM 11 February 2026 (GU No. 64 of 18 March 2026); COM(2025) 125; COM(2025) 945; Regulations (EU) 2024/1252 and 2024/1157; European Commission, CRMA strategic projects (March 2025, October 2026). Legal status 9 November 2026.

2.1 Electricity costs and compensation of indirect emission costs

Copper production (NACE 24.44) is on the EU carbon-leakage list (Decision (EU) 2019/708) and is among the sectors eligible for compensation of indirect emission costs passed on in electricity prices under the Commission's ETS State aid Guidelines (Communication 2020/C 317/04). Italy introduced this compensation by D.Lgs. 47/2020 (art. 29); the implementing rules are set by DM 466/2021 of the ministry responsible for the environment and energy. The annual budget was EUR 150 million for the costs of 2021–2024 and was raised to EUR 300 million a year from 2025 by DL 181/2023 (art. 4-octies). Applications for compensation of the costs of 2024 were opened by directorial decree No. 79 of 25 November 2025 (call of EUR 600 million from the Fund for the energy transition; aid intensity up to 75%). The decrees list beneficiaries but the amounts received by individual copper firms are not published; CU-IT therefore does not quantify public support for the copper industry, and the compensation remains part of value added at factor cost (Chapter 5).

TABLE 2 Compensation of indirect emission costs in Italy, all eligible sectors (EUR million)

Costs of year	Annual budget	Amount granted	Beneficiary firms	Legal basis
2020	–	90	191	D.Lgs. 47/2020, art. 29
2021	150	140 + 6.7	229	DM 466/2021
2022	150	140 + 10.6	251	DM 466/2021
2023	150	–	–	DM 466/2021
2024	600 (call)	–	–	Decree No. 79 of 25 Nov 2025

Costs of year	Annual budget	Amount granted	Beneficiary firms	Legal basis
from 2025	300	–	–	DL 181/2023

Source: D.Lgs. 47/2020; DM 466/2021; DL 181/2023; decrees of the ministry responsible for the environment and energy approving the lists of beneficiaries. Status O. Amounts granted for 2023 and 2024 and amounts per firm or per sector are not shown because they were not available in published form on 31 October 2026. For 2024 the call opened by decree No. 79 is shown instead of the annual budget.

Two national measures lower electricity costs for energy-intensive users. Since 2024 the reduced system charges for energy-intensive companies (*energivori*) follow DL 131/2023, approved under State aid rules by Commission decision C(2023) 9135 of 19 December 2023 (SA.109500; European Commission 2023); the eligibility conditions were set by a ministerial decree in July 2024. The *Energy Release 2.0* mechanism (DM MASE 268/2024 of 23 July 2024) gives energy-intensive companies access to electricity from renewable sources at EUR 65/MWh under two-way contracts, in return for investment in new renewable capacity; a decree of 29 July 2025 introduced a competitive procedure for the allocation. Copper producers can qualify for both measures if they meet the electricity-intensity criteria; firm-level amounts are not published.

2.2 Emissions trading and taxation

The production and processing of copper is covered by the EU emissions trading system only where combustion units with a total rated thermal input above 20 MW are operated. IGMNiR did not identify an Italian installation registered under copper production in the EU emissions trading registry; Italian semis producers and foundries melt cathode and scrap in electric induction and gas-fired furnaces of smaller size. Corporate income is taxed by IRES at 24%, and the regional tax on productive activities IRAP is levied at a standard rate of 3.9%. CU-IT applies IRES (24.0%) to a taxable share of the operating surplus; IRAP is recorded in the national accounts as an other tax on production, so it is contained in the input-output coefficients of taxes on production and, in part, in the implicit tax rate on labour. The implicit tax rate on labour, including social contributions, was 43.86% in Italy in 2024 against 37.09% in the EU-27 (DG TAXUD 2026).

2.3 Raw materials and trade

Copper is a strategic raw material under the Critical Raw Materials Act (Regulation (EU) 2024/1252), whose benchmarks for 2030 cover extraction, processing and recycling in the EU. Three strategic projects selected under the Act and located in Italy are designated for copper-bearing streams: Recover-It (Circular Materials, Veneto; recovery of nickel, copper and platinum-group metals from wastewater) in the first list of March 2025, and REW-ITA Green Hub (copper, cobalt, tungsten) and 9PV-up (9-Tech, Meolo; recycling of photovoltaic panels) in the second list of October 2026 (European Commission 2025b; 2026). The Portovesme CRM Hub (Glencore, Sardinia), selected in March 2025, is designated for lithium and manganese from battery recycling; according to press reports it also recovers copper. The European Steel and Metals Action Plan (COM(2025) 125; European Commission 2025a) and the RESourceEU Action Plan (COM(2025) 945; European Commission 2025c) address scrap availability at EU level; since July 2025 the Commission has monitored imports and exports of ferrous, aluminium and copper scrap through customs surveillance (European Commission, DG TAXUD 2025).

At national level, art. 30 of DL 21/2022, as amended by DL 84/2024 (art. 14, converted by Law 115/2024), extended to scrap of copper (CN 7404), aluminium (7602) and zinc (7902) the obligation to notify exports to countries outside the EU to the ministries responsible for enterprises and for foreign affairs 60 days in advance. Failure to notify is subject to a penalty of 30% of the value of the operation, at least EUR 30,000. The original thresholds were 250 tonnes per operation or 500 tonnes a month; for copper scrap the DPCM of 11 February 2026 lowered them to 75 tonnes per operation or 150 tonnes a month from 18 July 2026. The regime applies until 31 December 2026. It is a notification requirement and does not restrict exports within the EU, which received 53% of Italian copper scrap exports in 2024 (Chapter 3).

2.4 Waste and scrap

Copper scrap that meets the end-of-waste criteria or is shipped as green-listed waste moves freely within the EU. The new Waste Shipments Regulation (Regulation (EU) 2024/1157) applies from 21 May 2026 and introduces digital procedures; from 21 May 2027 exports of waste, including copper scrap, to countries outside the OECD are allowed only to countries that have asked to receive them and can manage them in an environmentally sound way. Exports of copper scrap from Italy to China, India and other non-OECD destinations therefore depend on these lists from 2027.

03 The copper industry in Italy

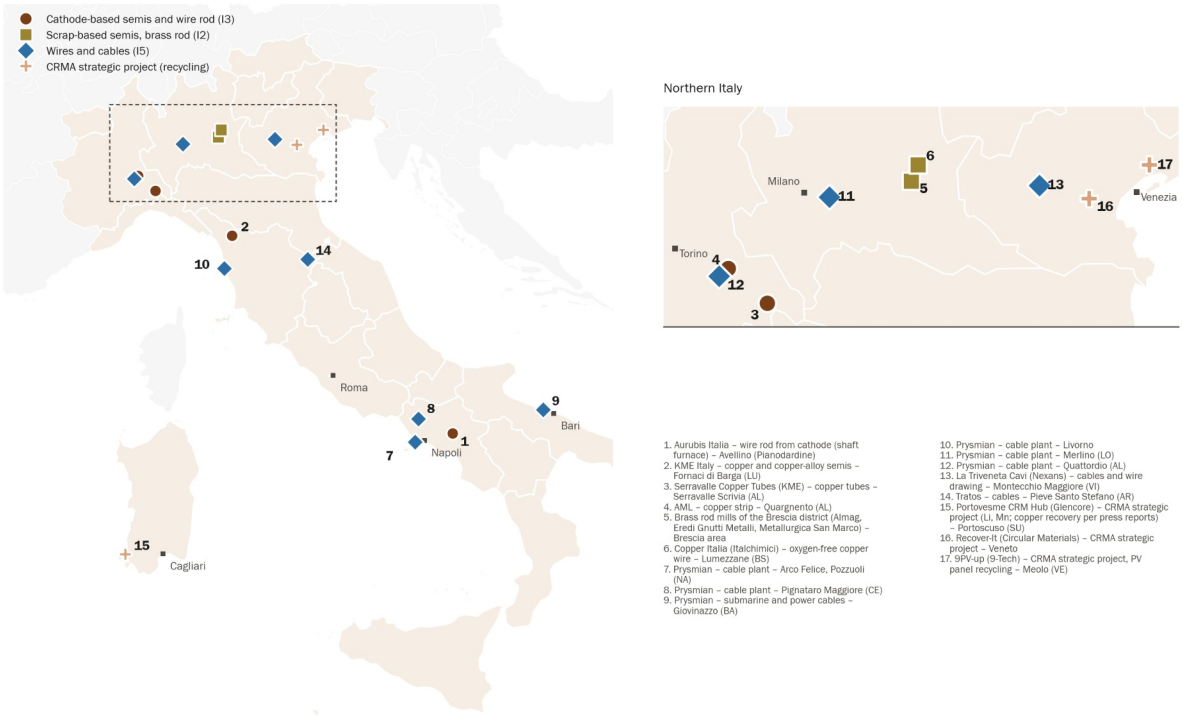
The Italian copper industry starts from imported cathode and from scrap. The largest single plant is the wire-rod mill of Aurubis Italia in Avellino, which melts cathode in a shaft furnace and cast 177.2 kt of wire rod in 2023 (90 employees at 30 September 2024); the 2024 output, annualised from January–September data, was about 187 kt (Aurubis Italia 2024; Aurubis 2025). KME Italy produces copper and copper-alloy semis in Fornaci di Barga and Mortara and copper tubes through Serravalle Copper Tubes; AML produces strip in Quargnento (KME 2025). The brass-rod mills of the Brescia district – among them Almag, Metallurgica San Marco and Eredi Gnutti Metalli – melt mainly scrap: Almag reported a recycled share of 93.1% of its metal input in 2023 (Almag 2024). The cable industry includes six Italian plants of Prysmian and La Triveneta Cavi, owned by Nexans since June 2024 (Prysmian 2025; Nexans 2024).

TABLE 3 Main copper producers in Italy – key data, 2024

Company and site	Segment	Activity and output	Revenue, EUR m	Employees	Status
Aurubis Italia, Avellino	I3	wire rod from cathode; ≈187 kt (annualised), 177.2 kt in 2023	–	90 (Sep 2024)	O/E
KME Italy, Fornaci di Barga, Mortara	I2/I3	copper and alloy semis; 53.4 kt; scrap input 32.2 kt, primary 11.0 kt	≈363	479 (end-2025)	O/E
Serravalle Copper Tubes (KME)	I3	copper tubes	≈112	217	O/E
AML, Quargnento	I3	copper strip; 7.3 kt	–	–	O
Almag, Roncadelle	I2	brass rods; foundry output 153.7 kt (2023), 93.1% recycled input	348.1	264 (2024)	O/E
Metallurgica San Marco	I2	brass rods	234.1	≈130	E
Eredi Gnutti Metalli	I2	brass rods and profiles	189.7	173 (2025)	E
HME Brass Italy (Hailiang)	I2	brass semis	≈182	181 (2025)	E
Prysmian, Italy	I5	power, telecom and submarine cables; six plants	6,363 (incl. holding)	2,631	O
La Triveneta Cavi (Nexans)	I5	low- and medium-voltage cables, wire drawing	≈805	≈700	E
General Cavi	I5	cables (manufacturing and distribution)	919	131	E

Source: Aurubis Italia EMAS environmental statement (2024); Aurubis (2025); KME (2025); Almag (2024); Prysmian (2025, country-by-country data for Italy); Nexans (2024); company filings as reported by business-information services for Metallurgica San Marco, Eredi Gnutti Metalli, HME Brass Italy, La Triveneta Cavi and General Cavi. Data for 2024 unless stated; headcounts refer to different dates (2024 or 2025, as stated). "≈" and status E: derived or rounded values (revenue of KME Italy and Serravalle Copper Tubes derived from group data; Avellino output annualised). Revenues include metal value and goods for resale and are not comparable with value added; the revenue of General Cavi includes distribution.

FIGURE 4 Main copper semi-fabricators, cable makers and CRMA strategic projects with copper-bearing streams in Italy



Source: IGMNiR; Aurubis Italia EMAS environmental statement (2024); company reports and websites (KME, Almag, Eredi Gnutti Metalli, Metallurgica San Marco, Prysmian, Nexans, Tratos); European Commission, CRMA strategic projects (March 2025, October 2026); GISCO boundaries. Locations approximate. Numbers refer to Annex C.

3.1 Official statistics

Structural business statistics classify 51 enterprises to copper production (NACE 24.44) in Italy in 2024. They employed 3,741 persons and generated EUR 479.7 million of value added at factor cost on a turnover of EUR 5,011.9 million. The class covers wire rod, semis of copper and copper alloys and secondary refined copper; it excludes copper-alloy castings (24.54, shared with zinc and other non-ferrous castings), wires and cables (27.32) and the trade and processing of scrap (46.77 and 38.3), which CU-IT includes with copper shares (Chapter 4).

TABLE 4 Structural business statistics for the activities of the copper value chain, Italy, 2024

NACE	Activity	Enterprises	Persons employed	Turnover, EUR m	Production value, EUR m	Value added, EUR m	Personnel costs, EUR m	VA per person, EUR k
C 24.44	Copper production	51	3,741	5,011.9	5,015.5	479.7	229.1	128.2
C 24.54	Casting of other non-ferrous metals	244	4,408	1,590.6	1,612.5	352.8	205.1	80.0
C 27.32	Other electronic and electric wires and cables	387	10,936	8,092.5	8,039.0	1,123.3	540.0	102.7
G 46.77	Wholesale of waste and scrap	4,101	15,225	11,599.5	2,742.8	1,155.7	444.4	75.9
E 38.3	Materials recovery	3,046	35,434	14,528.0	13,733.9	2,943.5	1,393.6	83.1

Source: Eurostat (2026), structural business statistics (sbs_ovw_act). Status 0. Value added at factor cost. Production value of wholesale (46.77) is the trade margin; turnover includes the value of goods resold. 24.54 includes zinc, copper-alloy and other non-ferrous castings; 38.3 covers recovery of all sorted materials.

Italy produces only small quantities of refined copper, all from scrap and other secondary materials. PRODCOM reports 19.7 kt of unwrought refined copper in 2024 and 22.8 kt of anodes and other unrefined copper; for 2020–2022 the USGS reports 9.9–15.4 kt of secondary refined copper (USGS 2025). Refined copper used in Italy is therefore almost entirely imported: net imports of refined copper were 528.6 kt in 2024, and apparent use, defined as production plus net imports, was 548.3 kt.

TABLE 5 **Refined copper balance of Italy, 2020–2024 (kt)**

Item	2020	2021	2022	2023	2024
Refined copper produced (PRODCOM 24.44.13.30)	71.5	–	21.5	–	19.7
Secondary refined copper (USGS)	15.0	15.4	9.9	–	–
Net imports of refined copper (Comext)	419.7	578.5	606.9	547.5	528.6
Apparent use (PRODCOM + net imports)	491.2	–	628.4	–	548.3

Source: Eurostat PRODCOM and Comext (refined copper, CN 7403 11–19; Eurostat 2026); USGS (2025). Status 0; apparent use is derived. "–" not available or confidential. PRODCOM and USGS differ in 2020 and 2022; CU-IT uses PRODCOM for 2024.

PRODCOM records a large production of semis (production quantity): 444.1 kt of bars, rods and profiles (mostly brass), 370.7 kt of wire rod, 86.9 kt of tubes and 54.0 kt of plates, sheets and strip in 2024, besides 293.7 kt of unwrought copper alloys and master alloys and 86.2 kt of tube fittings. The total value of production in NACE 24.44 reported by PRODCOM was EUR 6,160 million.

TABLE 6 **Production of copper, copper-alloy semis and copper conductors, Italy, 2022–2024**

PRODCOM	Product	2022, kt	2023, kt	2024, kt	2024, EUR m
24.44.12.00	Anodes and unrefined copper	17.7	16.6	22.8	151.9
24.44.13.30	Refined copper, unwrought	21.5	–	19.7	120.5
24.44.13.70	Copper alloys and master alloys, unwrought	290.4	284.2	293.7	947.5
24.44.22.00	Bars, rods and profiles	573.2	443.9	444.1	1,459.9
24.44.23.30	Wire rod (> 6 mm)	374.6	367.3	370.7	1,075.6
24.44.23.50	Wire 0.5–6 mm	140.1	134.3	103.6	248.0
24.44.23.70	Wire ≤ 0.5 mm	52.4	49.4	39.9	224.2
24.44.24.00	Plates, sheets and strip	91.0	54.3	54.0	380.0
24.44.25.00	Foil ≤ 0.15 mm	10.3	9.6	–	–
24.44.26.30	Tubes and pipes	91.1	79.8	86.9	859.3
24.44.26.50	Tube and pipe fittings	71.8	83.0	86.2	696.1
27.32.11.00	Winding wire	262.0	249.0	204.6	1,430.5
27.32.13.80	Other conductors ≤ 1 kV	612.6	543.0	477.2	3,066.5
27.32.14.00	Insulated conductors > 1 kV	297.3	298.9	295.8	1,382.7

Source: Eurostat PRODCOM (DS-059358; Eurostat 2026), production quantity (PRODQNT) and value (PRODVAL), gross weight. Status 0. "–" confidential or not available. Conductors (27.32) are given by the weight of the product, including insulation and non-copper conductors.

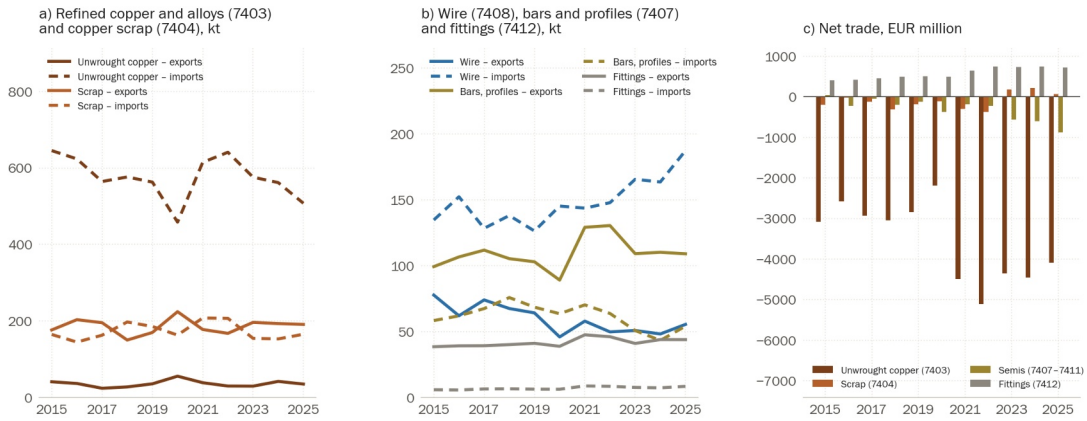
3.2 Trade

Italy imported 561.6 kt of unwrought copper and copper alloys (CN 7403) in 2024, of which 526.7 kt of cathode, and exported 42.0 kt; the trade deficit in unwrought copper was EUR 4,450 million. Imports came mainly from EU smelters and refineries – 70% from EU partners; the largest suppliers were Bulgaria, Spain and Poland, and the Herfindahl–Hirschman index of partner countries was 1,032. Italy also imported 163.5 kt of copper wire (CN 7408; 39% from Germany) and exported 48.2 kt. In semis excluding fittings (CN 7407–7411) imports

exceeded exports by EUR 600 million, of which EUR 1,010 million in wire (CN 7408); in tube and pipe fittings (CN 7412) exports exceeded imports by EUR 740 million.

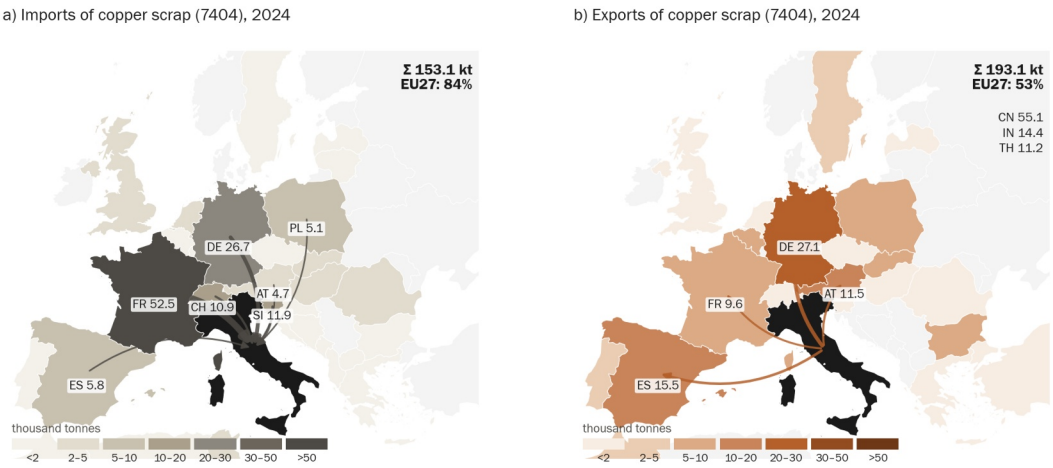
In copper scrap (CN 7404) Italy exported 193.1 kt and imported 153.1 kt (gross weight) in 2024. Imports came mostly from the EU (84%; France 34%), while 53% of exports went to EU partners and 29% to China. The unit value of imports (EUR 6,210/t) was slightly above that of exports (EUR 6,030/t); CU-IT applies copper contents of 77% to imports and 75% to exports. In copper content, Italy was a net exporter of 27.0 kt of copper in scrap.

FIGURE 5 **Foreign trade in copper by stage of processing, 2015–2025**



Source: Eurostat Comext DS-045409 (gross weight); IGMNiR CU-IT.

FIGURE 6 **Origins of copper scrap imports and destinations of copper scrap exports, 2024**



Source: Eurostat Comext (DS-045409), CN 7404, gross weight; GISCO boundaries; IGMNiR CU-IT. Partners outside the map are listed at the top right.

3.3 Secondary feed and the recycling of copper

Because Italy has no smelter, almost all its secondary copper is scrap melted directly by semis producers and foundries: brass mills melt brass scrap and turnings with some cathode and zinc, and producers of copper tubes, strip and special wire melt clean copper scrap with cathode. Statistics do not report this quantity. CU-IT derives it from a copper bridge: the copper contained in semis and castings produced in Italy, less the refined copper used to make them. The bridge (table below) gives 294.6 kt of copper from scrap melted directly in 2024. The model recomputes the bridge in every Monte Carlo draw from the uncertain copper contents and adds a term d_ref for the difference between apparent refined use and the refined copper that actually entered

semis and castings (stock changes, uses not covered): central +10 kt, range −30 to +70 kt. Annual apparent use of refined copper includes stock changes, and the same bridge gives about 270–360 kt for the individual years 2022–2024; the central term therefore sets direct melting at the average of the bridge for 2022–2024 (305 kt) rather than at the single year 2024. The upper end of the range reflects plant input data and the data of Assomet discussed below. Unwrought copper alloys (293.7 kt) are an intermediate product of the same mills and foundries and are excluded to avoid double counting, as are fittings made from bars and tubes and wire drawn from wire rod.

TABLE 7 Bridge from semis production to copper from direct melting, Italy, 2024 (kt)

Item	PRODCOM / NACE	Gross, kt	Cu, %	Cu, kt	Status
Wire rod	24.44.23.30	370.7	100	370.7	O/E
Bars, rods and profiles (mainly brass)	24.44.22.00	444.1	62	275.3	O/E
Plates, sheets and strip	24.44.24.00	54.0	85	45.9	O/E
Tubes and pipes	24.44.26.30	86.9	98	85.2	O/E
Foil (2023; 2024 confidential)	24.44.25.00	9.6	100	9.6	O/E
Copper in semis				**786.7**	E
Copper-alloy castings (Assofond)	24.54	48.8	70	34.2	O/E
Copper in semis and castings				**820.9**	E
less: apparent use of refined copper				−548.3	O
plus: refined copper in other uses (chemicals, alloying, powders)				22.0	E
Copper from scrap melted directly (bridge)				**294.6**	E
Uncertainty term d_ref: stock changes and uses not covered (central; range)				10 (−30 to +70)	E
Copper from scrap melted directly, model central (bridge + d_ref)				**304.6**	E
Excluded: unwrought copper alloys (intermediate)	24.44.13.70	293.7		–	O
Excluded: tube fittings (made from bars and tubes)	24.44.26.50	86.2		–	O
Excluded: wire ≤ 6 mm (drawn from wire rod)	24.44.23.5/7	143.5		–	O

Source: Eurostat PRODCOM 2024; Assofond (2025); IGMNiR CU-IT. Status: O observation, E estimate. Copper contents are IGMNiR assumptions: wire rod and foil are copper, tubes include some alloy tubes (98%); bars and profiles are mostly free-cutting brass (CW614N, CW617N; 57–59% copper) with some copper bars – average 62% (range 59–67%); strip includes copper and alloys; castings are mainly casting brasses (57–63% Cu) and bronzes (84–90% Cu). Home scrap that circulates within a mill is not part of the bridge, because it does not add to output. Wire codes 24.44.23.50 and 24.44.23.70.

Plant data give an independent cross-check. Applying the scrap share of metal input reported by individual plants to the copper content of each product group gives 314–390 kt of copper from directly melted scrap (table below), against 305 kt in the central model and 265–365 kt over the range of d_ref. The plant-based range lies in the upper part of the model range. It rests on few plants – brass mills dominate it – and reported recycled shares may include scrap returned by customers and scrap remelted within the plant, which the bridge does not count.

TABLE 8 Plant-based cross-check of copper from directly melted scrap, Italy, 2024 (kt Cu)

Product group	Cu in output	Scrap Cu, low	Scrap Cu, high	Plant basis
Bars, rods and profiles (brass mills)	275.3	234.0	256.3	Almag 2023: 93.1% recycled input (upper end); 85% (lower end)
Wire rod, Avellino	187.0	0.0	3.7	Aurubis Italia: cathode plus at most 2% clean by-products
Wire rod, other producers	183.7	0.0	18.4	no plant data; 0–10% assumed
Tubes	85.2	29.0	46.0	Serravalle Copper Tubes: 34% purchased scrap, 54% incl. own scrap

Product group	Cu in output	Scrap Cu, low	Scrap Cu, high	Plant basis
Plates, sheets and strip	45.9	27.5	34.4	KME Italy: purchased scrap ≈68% of external metal input; 60–75% applied
Foil	9.6	0.0	0.0	from cathode
Copper-alloy castings	34.2	23.9	30.7	casting brasses and bronzes; 70–90% assumed
Total	**820.9**	**314.4**	**389.6**	

Source: IGMNiR CU-IT v1.0; Almag (2024); Aurubis Italia (2024); Serravalle Copper Tubes (2025); KME (2025); Eurostat PRODCOM 2024. Copper in output as in the bridge. Scrap shares are plant values applied to the whole product group; status E.

The bridge can also be compared with the data of Assomet. As reported by Assomet, 57.1% of the copper metal used by the Italian copper industry in 2024 was scrap-based (55.0% in 2023 and 62.5% on average in 2018–2024), while in CU-IT secondary copper is 38.0% of copper first used and 39.0% of the copper input of semis and castings. The two shares are on different mass bases – gross weight of metal including zinc and other alloying elements against copper content – and are not comparable without a mass bridge (table below). The gross weight of semis and castings in PRODCOM and Assofond (1,014.1 kt) is almost equal to the total reported by Assomet (1,013.3 kt) and contains about 191 kt of zinc and other alloying elements. Deducting them from the scrap-based quantity leaves about 388 kt of copper, against 324 kt of secondary copper in CU-IT. The remaining difference can arise from scrap remelted within the industry (run-around scrap and repeated remelting via unwrought alloys), from customer-owned scrap processed on toll, and from stock changes in refined copper; statistics do not separate these items.

TABLE 9 Mass bridge between Assomet data and the CU-IT copper balance, Italy, 2024 (kt)

Item	kt	Status
Gross weight of semis and castings (PRODCOM, Assofond)	1,014.1	O
Copper metal used, gross weight, as reported by Assomet	1,013.3	O
Copper content of semis and castings	820.9	E
Zinc and other alloying elements	191.5	E
Scrap-based output, gross weight, as reported by Assomet	579.1	O
less zinc and alloying elements (all attributed to scrap-based output)	−191.5	E
Scrap-based output, copper content (upper estimate)	**387.6**	E
Secondary copper in CU-IT (direct melting and secondary refining)	324.3	E
Difference	**63.3**	E
of which up to: upper end of the stock-change term d_ref	60.0	E
not quantified: run-around scrap, repeated remelting via unwrought alloys, customer-owned scrap on toll	–	–
Scrap-based share: Assomet (gross weight) / CU-IT (copper content, first use)	57.1% / 38.0%	O/E

Source: Assomet (2026); Assofond (2025); Eurostat PRODCOM 2024; IGMNiR CU-IT v1.0. Status: O observation, E estimate. Copper contents as in the bridge. Attributing all zinc to scrap-based output gives an upper estimate of its copper content, because part of the zinc enters brass as primary metal.

The bridge also bears on the value of production. SBS production value of copper production (24.44) was EUR 5,015.5 million in 2024, while the copper contained in the semis above was worth about EUR 6,640 million at the average LME price of EUR 8,450/t. PRODCOM unit values are also below the metal price – EUR 2,900/t for wire rod and EUR 3,290/t for bars and profiles. Almag reported revenue of EUR 348.1 million on 153.7 kt of foundry output, about EUR 2,260 per tonne, also far below the value of the metal in brass. The PRODCOM value of 24.44 (EUR 6,160 million) is itself above SBS output. With a metal share of 72% of output, the metal purchases implied for scrap-based production correspond to EUR 4,340 per tonne of copper in scrap feed, against about EUR 8,060 per tonne of copper in imported scrap; the same calculation for cathode-based production gives a similarly low price, so the ratio reflects the level of 24.44 output rather than the pricing of scrap. These relations are consistent with a substantial part of production being processed on toll or from metal

owned by customers – for example turnings returned by machining firms – for which only the conversion fee enters output, and/or with differences in coverage and valuation between SBS (enterprises classified by main activity) and PRODCOM (production by any enterprise); statistics do not report these shares. If toll processing explains the gap, value added is not affected; if coverage does, value added and employment of copper production are understated.

TABLE 10 Secondary copper and its supply, Italy, 2024 (kt Cu)

Item	kt Cu	Status
Secondary refined copper (PRODCOM)	19.7	O
Copper from scrap melted directly (bridge)	304.6	E
Secondary copper produced	**324.3**	E
Copper in scrap used (feed, before melting and refining losses)	334.7	E
Imports of scrap, CN 7404 (153.1 kt gross at 77% Cu)	117.9	O/E
Exports of scrap, CN 7404 (193.1 kt gross at 75% Cu)	144.9	O/E
Net imports of copper in scrap	−27.0	E
Domestic scrap supply, residual (feed less net imports)	**361.7**	E
Old scrap recovered (dynamic MFA)	185.3	M
New scrap from fabrication (17% of copper in semis)	133.7	E
Domestic scrap supply, bottom-up	**319.1**	M
Difference (residual less bottom-up)	42.6	M
Coverage ratio: domestic supply (residual) / scrap used	108%	E
Coverage ratio: domestic supply (bottom-up) / scrap used	95%	M
Secondary share of copper first use	38.0%	E

Source: Eurostat PRODCOM and Comext 2024; IGMNiR CU-IT (M2 mass balance, M2b dynamic MFA). Status: O observation, E estimate, M model result. Melting yield 97% for direct melting and copper recovery in secondary refining as in Annex B. Trade statistics do not separate copper from brass scrap or new from old scrap.

The residual estimate of domestic scrap supply (362 kt) exceeds the bottom-up estimate from the dynamic model and new scrap (319 kt) by 43 kt. Italy also exported, net, about 5 kt of copper in other secondary materials (copper ash and residues, waste of electrical and electronic equipment), so that 48 kt of copper remain unaccounted for; the 90% band of this residual is −13–108 kt. It depends mainly on the direct-melting bridge (copper content of brass bars and the d_ref term), the rate of new scrap and, in the dynamic model, the per-capita inflow of copper into use and the collection rates; the first table below shows how far each of these causes moves the residual, and the table of copper flows by node shows where it enters the balance.

TABLE 11 Reconciliation of unaccounted-for copper: change by candidate cause, 2024 (kt Cu)

Candidate cause (parameter)	Range tested	At low value	At high value
Stock changes and uses not covered in the bridge (d_ref)	−30 to +70	−41.2	61.9
Per-capita inflow of copper into use (dynamic MFA)	0.90 to 1.50	33.7	−67.4
Rate of new scrap from fabrication	0.13 to 0.21	31.5	−31.5
End-of-life collection and recovery rates	0.95 to 1.20	25.3	−16.8
Product lifetimes	0.80 to 1.20	−18.5	20.5
Copper content of brass bars and profiles	0.59 to 0.67	−11.5	19.1
Copper content of traded scrap (CN 7404)	0.70 to 0.85	−2.8	3.2
Inflow into use in 1960	0.20 to 0.45	2.1	−3.2
Copper recovery in secondary refining	0.92 to 0.97	0.7	−0.4

Source: IGMNiR CU-IT v1.0, module M6; one-at-a-time change of the central residual (48 kt; 90% band −13–108 kt) when each parameter is set to the low or high end of its range in Annex B. A negative value reduces the residual. Not modelled: copper in scrap traded without declaration or misclassified, copper in exported products (machinery, appliances, vehicles) collected abroad, and the use of scrap outside semis mills and foundries (for example copper compounds).

TABLE 12 Copper flows by node, Italy, 2024 (kt Cu)

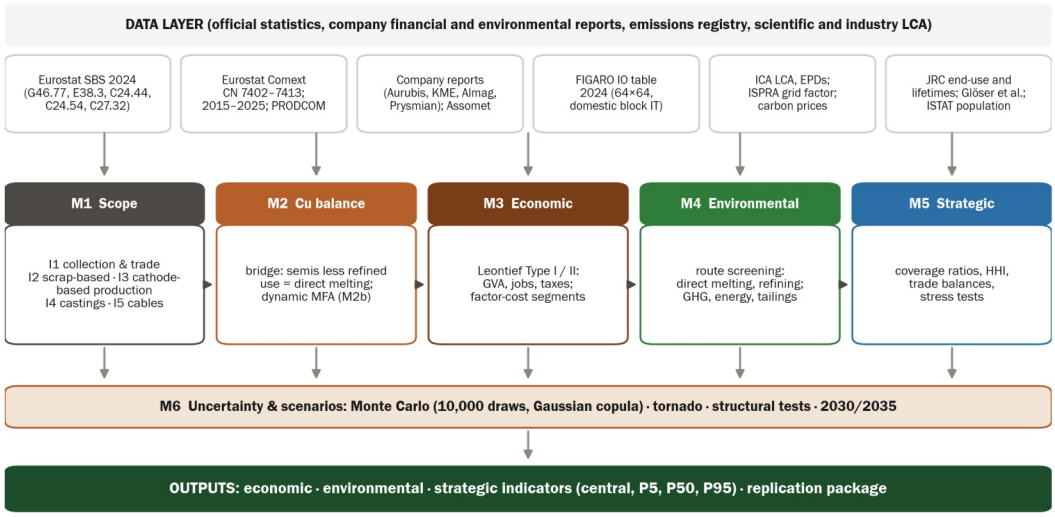
Node and flow	kt Cu	Status
1. Refined copper		
Secondary refined copper produced	19.7	O
Net imports of refined copper	528.6	O
Apparent use	548.3	O
less other uses (chemicals, alloying, powders)	−22.0	E
Refined copper into semis and castings	526.3	E
2. Semis mills and foundries		
Copper from scrap melted directly	304.6	E
Copper in semis and castings	820.9	E
New scrap arising at fabricators (returns to node 3)	133.7	E
3. Scrap pool		
Old scrap recovered (node 4)	185.3	M
New scrap (node 2)	133.7	E
Net imports of copper in other secondary materials (CN 2620 30, 8549)	−5.0	E
Unaccounted-for copper (balance residual)	**47.6**	M
Domestic supply	361.7	E
less net exports of scrap (copper content)	−27.0	E
Scrap used: to direct melting	314.0	E
Scrap used: to secondary refining	20.7	E
Melting and refining losses	10.5	E
4. Copper in use		
Inflow into use	370.2	M
End-of-life outflow	331.3	M
Collected	256.0	M
Recovered as old scrap	185.3	M
Stock in use (kt)	9,480	M

Source: IGMNiR CU-IT v1.0. Status: O observation, E estimate, M model result. Negative net imports are net exports. The inflow into use is copper in products entering the Italian stock, including imported products and excluding exported ones; it is not equal to the copper in semis produced in Italy. Unaccounted-for copper is the domestic supply derived from scrap use and trade less old scrap, new scrap and net imports of other secondary materials; it is a balance residual, not an observed flow.

04 The CU-IT model

CU-IT follows the architecture of IGMNiR's integrated models for the non-ferrous metals and adapts it to copper in Italy, an economy without copper mining, primary smelting or electrolytic refining but with a large semis, brass and cable industry. It links six modules: scope and allocation (M1), a copper mass balance with a dynamic model of copper in use (M2 and M2b), an input-output model of economic and fiscal effects (M3), an environmental module with route-level screening values (M4), strategic indicators and stress tests (M5) and an uncertainty and scenario module (M6). A replication script recomputes value added and employment from the published package files, and a quality-control script compares the key numbers of the English and Polish versions.

FIGURE 7 Architecture of the CU-IT model



Source: IGMNiR.

4.1 Scope and segments

The model distinguishes five segments, all built from Eurostat structural business statistics (SBS) for Italy in 2024. **I1** is the copper share of wholesale of waste and scrap (46.77) and materials recovery (38.3), allocated separately for value (18% and 5%) and employment (11% and 4.5%). **I2** and **I3** split copper production (NACE 24.44) into a scrap-based and a cathode-based part. The split key is the share of copper from scrap – melted directly by semis producers or refined from scrap – in the copper of semis (37% in the central case). It is recomputed from the copper balance in every Monte Carlo draw and is an input-based attribution: Italian mills commonly melt cathode and scrap together, and SBS does not separate scrap-based from cathode-based production. The key is conservative for the recycling chain; alternative keys are tested in Section 5.2. **I4** is the copper-alloy share (38%) of casting of other non-ferrous metals (24.54), in which zinc die-casting is also large. **I5** is the copper-conductor share (75%) of the manufacture of wires and cables (27.32). Value added is at factor cost for all segments; Italy publishes no amounts of compensation for indirect emission costs by firm, so no public support is deducted or added.

TABLE 13 Segments of the CU-IT model, 2024 (central estimate)

Segment	Basis	Output, EUR m	GVA, EUR m	Persons	GVA per person, EUR k
I1 Collection and trade of scrap	SBS 46.77, 38.3 × copper shares	1,180	355	3,270	109
I2 Scrap-based copper production	SBS 24.44 × 0.37	1,847	177	1,380	128
I3 Cathode-based copper production	SBS 24.44 × 0.63	3,169	303	2,360	128
I4 Copper-alloy castings	SBS 24.54 × 0.38	613	134	1,680	80
I5 Copper in wires and cables	SBS 27.32 × 0.75	6,029	842	8,200	103

Source: IGMNiR CU-IT v1.0; Eurostat SBS 2024 (sbs_ovw_act). Output is the production value; for I1 it is the trade margin of wholesale (46.77) plus the output of recovery (38.3). Value added at factor cost. I2 and I3 share the productivity of NACE 24.44 by construction, because SBS gives only the total.

4.2 Copper mass balance

The physical module works in tonnes of copper. Italy refines copper only from scrap (19.7 kt in 2024, PRODCOM) and uses imported cathode for the rest. Copper from scrap melted directly by semis producers and foundries (S_dm) is not published; CU-IT derives it from a bridge. Copper in semis is estimated from PRODCOM volumes and copper contents – wire rod 370.7 kt, bars, rods and profiles 444.1 kt at 62% copper (mostly brass), strip 54.0 kt at 85%, tubes 86.9 kt at 98% and foil 9.6 kt – giving 787 kt; copper-alloy castings add 34.2 kt (48.8 kt at 70% copper). Refined copper used in semis is apparent refined use (548.3 kt: production plus net imports of the refined subheadings of CN 7403) less about 22 kt of other uses, i.e. 526.3 kt. The difference, 295 kt, is copper from scrap melted directly. The bridge is recomputed in every Monte Carlo draw from the uncertain copper contents, with an additional term d_ref (−30 to +70 kt) for stock changes and uses not covered by apparent refined use. Unwrought alloys (293.7 kt), fittings and wire drawn from rod are intermediate or downstream products and are excluded to avoid double counting.

Secondary copper S is secondary refined copper plus S_dm (324 kt). Copper in secondary feed C follows from S and recovery rates (335 kt). The domestic supply of scrap copper is estimated in two independent ways: residually, as C less copper in net imports of scrap (CN 7404 at 77% copper in imports and 75% in exports, from unit values relative to the LME price for a brass-rich scrap mix), and bottom-up, as old scrap recovered from end-of-life products (dynamic model, Chapter 6) plus new scrap from fabrication in Italy (17% of copper in semis: turning swarf from the machining of brass rod in Italy, strip punching, wire drawing and cable making, tubes and castings). Because Italy exports more copper in scrap than it imports, net imports are negative (−27.0 kt) and the residual domestic supply (362 kt) exceeds the copper in secondary feed. The difference between the residual and the bottom-up estimate, less net imports of other secondary materials, is reported as unaccounted-for copper (48 kt).

$$\text{S_dm} = \text{Cu in semis} + \text{Cu in castings} - (\text{refined use} - \text{other uses}) + \text{d_ref} \qquad \text{A_res} = C - cu_{7404} \cdot M_{7404} + (cu_{7404} - \delta) \cdot X_{7404} \qquad \text{A_bu} = \text{old scrap recovered} + \text{r_new} \cdot \text{Cu in semis}$$

4.3 Dynamic model of copper in use

No dynamic material-flow model of copper for Italy was found in the literature; the closest Italian analogue is the dynamic model of aluminium in use by Ciacci et al. (2013). Module M2b is an inflow-driven stock model for 1960 to 2035, started in 1900 to build up the stock in use. The inflow of copper into use equals population (ISTAT 2025) times a per-capita inflow, anchored to the EU-28 value for 2014 reported by the Joint Research Centre (5.91 kg per person; Passarini et al. 2018) and scaled for Italy by a factor of 1.10 (range 0.90–1.50). Because Italy has no primary refinery, the time path of the per-capita inflow follows Italian net imports of refined copper per person (Comext, 1988–2024, index 2014 = 1), smoothed with a five-year centred moving average to remove stock changes and the timing of trade. Before 1988 the index rises linearly from 30% of its 2014 level in 1960 (range 20–45%, consistent with refined copper use of 192 kt in 1965 and 226 kt in 1968 reported in the US Bureau of Mines, Minerals Yearbook 1968); after 2024 it grows by 0.5% a year. The inflow is split into

five end uses with the JRC shares; each cohort leaves use after a normally distributed lifetime with a standard deviation of 0.3 times the mean. Collection and recovery rates by waste stream are taken from Glöser et al. (2013) and scaled by 1.10 towards European levels, for which an end-of-life recycling rate of about 60% is reported (Ciacci et al. 2017; Soulier et al. 2018).

TABLE 14 Parameters of the dynamic model of copper in use: end uses

End use	Share of inflow, %	Mean life, years	SD, years	Waste stream	Collection, %	Recovery, %
Buildings and construction	34	40	12.0	Construction and demolition	72	65
Electrical and electronic equipment	29	25	7.5	Industrial electrical	66	46
Industrial machinery	20	18	5.4	Industrial non-electrical	68	50
Transport	9	16	4.8	End-of-life vehicles	91	49
Consumer and general products	8	8	2.4	Waste electrical and electronic equipment	63	34

Source: Passarini et al. (2018), JRC, EU-28 2014 (shares and lifetimes); Glöser et al. (2013), global 2010 (collection and end-of-life recovery by waste stream). Assignment of end uses to waste streams by IGMNiR. Shown before scaling; in the Monte Carlo simulation lifetimes, collection and recovery rates are scaled jointly (Annex B).

TABLE 15 Parameters of the dynamic model of copper in use: inflow

Element	Value (range)	Source
Anchor: EU-28 inflow into use per person, 2014	5.91 kg	Passarini et al. (2018)
Scaling factor for Italy (k_in)	1.10 (0.90–1.50)	IGMNiR (C)
Time path 1988–2024	net imports of refined copper per person, 5-year centred moving average, 2014 = 1	Comext CN 7403 (refined subheadings)
Level in 1960 relative to 2014 (r60)	0.30 (0.20–0.45)	US Bureau of Mines, Minerals Yearbook 1968 (1965, 1968)
Growth of per-capita inflow 2025–2035 (g_in)	0.5% (0.0–2.0%)	IGMNiR (C)
Population 1961–2035	50.6 m (1961) – 57.6 m (2035)	ISTAT (2025), censuses and median projection
Lifetime scaling (lt_scale)	1.00 (0.80–1.20)	IGMNiR (C)
Collection and recovery scaling (coll_scale)	1.10 (0.95–1.20)	IGMNiR (C)

Source: IGMNiR CU-IT v1.0, module M2b. C: IGMNiR assumption. Before 1960 the inflow declines by 3.5% a year back to 1900.

4.4 Economic, fiscal, environmental and strategic modules

Indirect and induced effects are computed with Leontief Type I and Type II multipliers from the domestic block of the Eurostat FIGARO input-output table for Italy (2024, 64 products; for the latest year partly projected by Eurostat from macroeconomic statistics), closed for households with a tax rate on labour income of 43.86% (implicit tax rate on labour, Italy 2024; DG TAXUD 2026) and a propensity to consume of 0.90. Purchases within the chain – scrap, cathode, unwrought alloys and semis – are removed from the first-round demand: metal-bearing inputs are 72% of the output of copper production, 55% of copper-alloy castings and 65% of the copper share of cable output; the other intermediate inputs follow the parent product column. For scrap collection and trade (I1) the first round equals the domestic input coefficients of the parent FIGARO products (wholesale trade; waste collection and materials recovery), excluding chain products, times segment output. Employment coefficients come from national accounts for 2024; by construction they reproduce total employment of 26,510 thousand persons, so this is a construction check rather than a validation. Indirect and induced jobs are persons

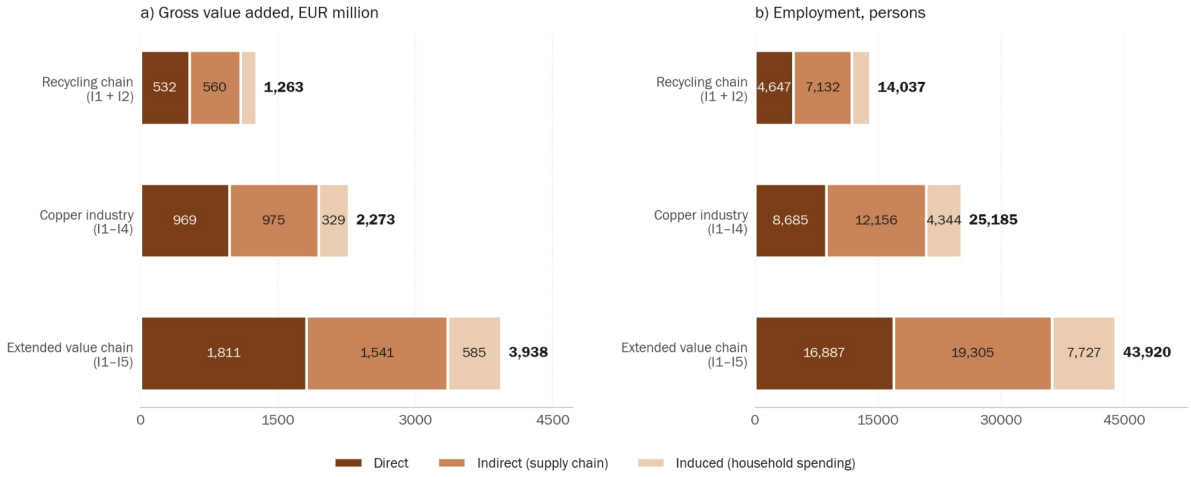
in national-accounts terms, direct jobs are SBS persons employed; direct value added is at factor cost, indirect and induced value added at basic prices.

Taxes are estimated per segment: labour taxes and social contributions as the tax rate on labour applied to labour cost, corporate income tax (IRES, 24.0%) on a share of operating surplus net of other taxes on production, and net taxes on production and on products used from FIGARO coefficients, net of other subsidies; IRAP is recorded by ISTAT as an other tax on production and is therefore part of these coefficients. The environmental module compares secondary copper produced in Italy with primary copper cathode, using screening values for direct melting and secondary refining (Chapter 7). Uncertainty is propagated by a Monte Carlo simulation of 10,000 draws from triangular distributions of all parameters in Annex B, with correlated groups linked by a Gaussian copula, and complemented by one-at-a-time and structural sensitivity analysis.

05 Economic and fiscal contribution

In 2024 the extended copper value chain in Italy generated EUR 1,811 million of direct gross value added and employed 16,900 people. Domestic suppliers added EUR 1,541 million and 19,300 jobs, and household spending of the wages paid a further EUR 585 million and 7,700 jobs. The value-added multiplier is 1.85 (Type I) and 2.17 (Type II). Copper in wires and cables (I5) is the largest segment (47% of direct value added), followed by scrap collection and trade (I1, 20%). The recycling chain (I1 and I2) has a Type I multiplier of 2.05.

FIGURE 8 Economic footprint of the copper value chain in Italy, 2024



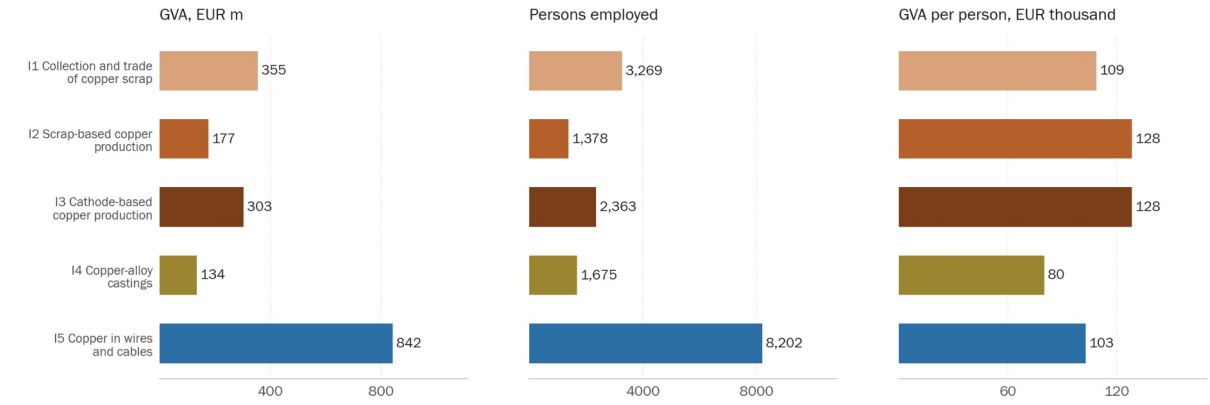
Source: IGMNiR CU-IT v1.0; Eurostat SBS 2024, PRODCOM 2024, FIGARO 2024, Comext; central estimate.

TABLE 16 Economic contribution by segment, 2024 (central estimate)

Segment	GVA direct	GVA Type I	GVA Type II	Jobs direct	Jobs Type I	Taxes
I1 Collection and trade of scrap	355	721	826	3,270	8,050	222
I2 Scrap-based copper production	177	371	437	1,380	3,730	123
I3 Cathode-based copper production	303	637	751	2,360	6,410	210
I4 Copper-alloy castings	134	215	259	1,680	2,660	75
I5 Copper in wires and cables	842	1,409	1,665	8,200	15,350	491
Recycling chain (I1+I2)	532	1,092	1,263	4,650	11,780	344
Copper industry (I1–I4)	969	1,944	2,273	8,690	20,840	630
Extended value chain (I1–I5)	1,811	3,353	3,938	16,890	36,190	1,120

Source: IGMNiR CU-IT v1.0. EUR million and persons. Type I adds the domestic supply chain, Type II also household spending. Taxes: labour taxes and social contributions, income taxes and taxes on production in all rounds, excluding VAT.

FIGURE 9 Direct GVA, employment and productivity by segment, 2024



Source: IGMNiR CU-IT v1.0; Eurostat SBS 2024, PRODCOM 2024, FIGARO 2024, Comext; central estimate.

Value added per person is EUR 128 thousand in copper production (NACE 24.44, 51 enterprises and 3,741 persons employed), EUR 103 thousand in cables and EUR 109 thousand in scrap collection and trade. The split of NACE 24.44 into I2 and I3 follows the copper input and is not a measurement of the value added of remelting itself, which is not observed: the scrap-based segment I2 receives EUR 177 million and 1,380 persons, the cathode-based segment I3 EUR 303 million and 2,360 persons. Section 5.2 shows the results under alternative split keys.

TABLE 17 Reconciliation of employment and turnover with official, company and association data, 2024

Scope	Persons	Turnover, EUR m	Value added (factor cost), EUR m	Source
SBS NACE 24.44 copper production (all enterprises)	3,741	5,012	480	Eurostat SBS 2024
Listed producers in 24.44: KME Italy (2025), Almag, Metallurgica San Marco, Eredi Gnutti Metalli (2025), Serravalle Copper Tubes, HME Brass Italy (2025), Aurubis Italia, Avellino	1,534	1,429 (excl. Aurubis Italia)	–	Company reports
Listed producers as share of SBS 24.44	41%	29%	–	
I2 + I3 in CU-IT (= SBS 24.44)	3,741	–	480	Identity by construction
SBS NACE 27.32 wires and cables (all enterprises)	10,936	8,092	1,123	Eurostat SBS 2024
Listed cable makers: Prysmian (Italy), La Triveneta Cavi (Nexans), General Cavi	3,462	–	–	Company reports
I5 in CU-IT (copper share of 27.32)	8,202	6,069	842	SBS × copper share
I4 copper-alloy castings (share of 24.54)	1,675	–	134	SBS × copper-alloy share
I1 collection and trade of scrap (copper shares)	3,269	2,814	355	SBS 46.77, 38.3
I1–I5	**16,887**	–	**1,811**	CU-IT
Assomet: copper metal use, of which scrap-based (kt, gross)	1,013.3 / 579.1	–	–	Assomet (2026)

Source: Eurostat SBS 2024; KME (2025); Almag (2024); Aurubis Italia (2024); Prysmian (2025); Nexans (2024); other company data from published financial statements; Assomet (2026). Headcounts refer to 2024 unless marked, so years are mixed; revenues of Metallurgica San Marco, Eredi Gnutti Metalli and HME Brass Italy are from company filings as reported by business-information services. The revenue of Aurubis Italia is not published separately. Prysmian Italy includes staff of plants and Italian offices. The listed producers cover a part of the industry; the remainder consists of smaller mills, wire drawers and cable makers. Assomet reports copper metal use and scrap-based output in gross weight, including the zinc in brass.

TABLE 18 Definitions and results of the IGMNiR copper models for Italy, Germany and Poland, 2024

Item	CU-IT (Italy)	CU-DE (Germany)	CU-PL (Poland)
Scope of the extended chain	I1–I5: scrap, scrap-based and cathode-based production, castings, cables	D1–D5: scrap, secondary and primary refining, semis and castings, cables	C1–C5: scrap, secondary copper, mining and smelting, semis, cables

Item	CU-IT (Italy)	CU-DE (Germany)	CU-PL (Poland)
Mining and primary smelting	none	primary smelting, no mining	both
Value added basis	SBS, factor cost	company accounts and SBS	company accounts and SBS
Direct GVA, EUR m	1,811	4,071	3,085
GVA Type I, EUR m	3,353	6,328	4,401
Jobs Type I	36,200	65,600	53,000
Secondary copper, kt	324	459	167
GHG potentially avoided, kt CO_2e	1,059	1,281	441

Source: IGMNiR CU-IT v1.0; IGMNiR (2026), CU-DE v1.0; IGMNiR (2026), CU-PL v1.2 (central estimates). The three models share their method but differ in scope and data basis; values are gross contributions in each country and are not a ranking. A dash means that the indicator is not reported in that model.

The input-output results depend on how purchases within the chain are separated from other inputs and on the aggregation of FIGARO into 64 products, in which copper is part of basic metals (CPA C24) and cables part of electrical equipment (CPA C27). The table below compares the central treatment with a conservative variant that also removes purchases of metal products, electronics, electrical equipment and machinery from the first round, with a variant that keeps domestic metal purchases (and therefore counts some transactions within the chain twice), with the FIGARO table for 2023, with the national input-output table of Italy, with value added at basic prices for all segments, with a first round of scrap collection and trade (I1) that spreads all SBS intermediate consumption over the parent column, and with joint extremes of the parameters that drive the first round. The Type I multiplier of I1 is above that of its parent products because SBS reports a lower ratio of value added to output than FIGARO.

TABLE 19 Sensitivity of the input-output results to construction choices, 2024

Variant	GVA direct, EUR m	GVA Type I, EUR m	Multiplier	Jobs Type I
Central: metals, ores, scrap and scrap trade removed	1,811	3,353	1.85	36,200
Conservative: also metal products, electronics, electrical equipment, machinery removed	1,811	3,034	1.67	32,100
Domestic metal purchases kept (double counting within the chain)	1,811	4,896	2.70	53,600
Supply-chain effects −20%	1,811	3,045	1.68	32,300
Supply-chain effects +20%	1,811	3,661	2.02	40,100
FIGARO 2023 instead of 2024	1,811	3,350	1.85	36,000
National symmetric input-output table of Italy, 2022 (ISTAT) instead of FIGARO	1,811	3,318	1.83	36,400
Basic prices for all segments incl. I1 (FIGARO net other taxes on production)	1,843	3,384	1.84	36,200
I1 first round from all SBS intermediate consumption on the parent column	1,811	3,430	1.89	37,200
Joint parameter extremes, low	1,479	2,172	1.47	22,200
Joint parameter extremes, high	2,180	5,007	2.30	56,000

Source: IGMNiR CU-IT v1.0; FIGARO 2024 and 2023 (naio_10_fcp_ip4); symmetric input-output table of Italy, 2022, transmitted by ISTAT (Eurostat naio_10_cp1700). The first-round vectors by 64 CPA products, the multiplier vectors and the extraction date and SHA-256 hash of the input-output files are part of the model package (Annex A).

FIGARO is a Eurostat construction that balances national tables across countries. As an independent check, the model was run with the symmetric input-output table of Italy for 2022 that ISTAT transmits to Eurostat (product by product, domestic and imported use), converted to the same 64 products. With this table, GVA including the supply chain is EUR 3,318 million (−1.0% against FIGARO 2024) and jobs including the supply chain 36,400 (0.4%). The Type II result is 9% lower (3,587 against EUR 3,938 million), because the household closure uses the domestic share of household consumption, which is lower in the national table. The multipliers of the products used by CU-IT are compared in the table below.

TABLE 20 Multipliers from FIGARO and from the national input-output table of Italy

Product	GVA I, FIGARO 2024	GVA I, FIGARO 2023	GVA I, ISTAT 2022	GVA II, FIGARO 2024	GVA II, ISTAT 2022	Jobs I, FIGARO 2024	Jobs I, ISTAT 2022
Wholesale trade (G46)	1.87	1.86	1.79	2.17	1.92	1.84	1.76
Waste collection, treatment and recovery (E37–39)	2.04	2.08	2.11	2.45	2.30	2.54	2.65
Basic metals (C24)	2.97	2.92	2.99	3.55	3.23	3.37	3.40
Fabricated metal products (C25)	2.07	2.06	2.16	2.47	2.36	1.94	1.98
Electrical equipment (C27)	2.05	2.08	2.14	2.45	2.33	2.18	2.18
CU-IT extended chain (I1–I5)	1.85	1.85	1.83	2.17	1.98	2.14	2.15

Source: IGMNiR CU-IT v1.0; Eurostat FIGARO (naio_10_fcp_ip4) and symmetric input-output table of Italy transmitted by ISTAT (naio_10_cp1700, 2022; real-estate products and public-administration products mapped to the FIGARO classification). Multipliers are ratios of total (direct plus indirect, plus induced for Type II) to direct GVA or jobs of one euro of final demand for the product; for the chain they are the ratios of the CU-IT results to direct GVA and employment. Employment coefficients of both tables use national-accounts employment for 2024.

The table below shows how the first round is built for each segment. Of EUR 11,027 million of intermediate consumption, EUR 8,195 million are copper, scrap, cathode, zinc and other metal-bearing inputs bought within the chain or imported; they are removed, so that the purchases of a mill from a scrap dealer or of a cable maker from a rod mill are not counted twice. The remaining EUR 2,832 million of other inputs – energy, services, transport, consumables – are spread over products with the structure of the parent input-output column, and only their domestic part (EUR 2,050 million) enters the Leontief model. The first-round vectors by 64 products are part of the model package.

TABLE 21 Intermediate consumption by segment and the first round of the input-output model, 2024 (EUR million)

Segment	Output	GVA	Intermediate consumption	Chain inputs removed	Other inputs	Domestic first round	Indirect GVA
I1 Collection and trade of scrap	1,180	355	825	328	498	455	366
I2 Scrap-based copper production	1,847	177	1,670	1,330	340	266	195
I3 Cathode-based copper production	3,169	303	2,866	2,281	584	456	334
I4 Copper-alloy castings	613	134	479	337	142	111	81
I5 Copper in wires and cables	6,029	842	5,187	3,919	1,268	763	566
Extended chain	12,838	1,811	11,027	8,195	2,832	2,050	1,541

Source: IGMNiR CU-IT v1.0; Eurostat SBS 2024; FIGARO 2024. Chain inputs: metal-bearing inputs (metal share of output) for I2–I5; for I1 the inputs of scrap, metals and ores and of wholesale and waste services in the parent column. Other inputs at all origins; the domestic first round excludes imports. Indirect GVA is Type I.

All economic results are gross contributions: they measure the value added and jobs associated with the activity, not what would be lost if it stopped. A loss would depend on substitution by imports of semis and cables, on the reuse of labour and capital and on the export of scrap now melted in Italy, which the model does not represent. The only reduction case quantified is the stress scenario S3 (Chapter 10), in which GVA including the supply chain is EUR 3,147 million in 2030, 6% below 2024.

TABLE 22 Supply-chain value added by supplying product, extended value chain, 2024

Supplying product (CPA)	GVA, EUR m	Share, %
Fabricated metal products	148	9.6
Legal, accounting and management consulting	115	7.5
Warehousing and transport support	96	6.2
Land transport	95	6.2
Real estate services	85	5.5
Financial services	83	5.4
Electricity, gas and steam	69	4.5

Supplying product (CPA)	GVA, EUR m	Share, %
Security, building and office support services	64	4.2
Other products	785	50.9
Total supply-chain GVA	1,541	100.0

Source: IGMNiR CU-IT v1.0; Type I indirect effects (Leontief inverse of the domestic FIGARO block applied to the first-round vectors).

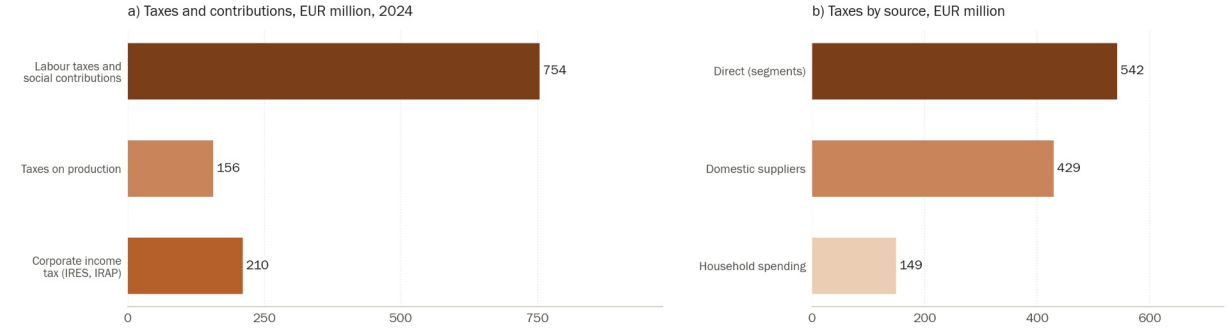
5.1 Taxes, public revenue and public support

Activity in the extended chain is associated with about EUR 1,120 million of taxes and social contributions excluding VAT: EUR 542 million in the segments themselves, EUR 429 million at domestic suppliers and EUR 149 million through household spending. Labour taxes and social contributions account for EUR 754 million, at a tax rate on labour of 43.86% (EU-27 37.09%; DG TAXUD 2026); a higher rate moves taxes up and induced effects down, because it shifts income from net wages to the state. Corporate income is taxed with IRES (24%); IRAP is recorded by ISTAT as an other tax on production and enters through the FIGARO coefficients of taxes on production. All taxes are model estimates; the income taxes paid by individual copper firms were not compiled.

The tax rate on labour is a macroeconomic implicit rate for the whole Italian economy; it is applied to the personnel costs of each segment from structural business statistics, which per person employed are EUR 34.1 thousand in scrap collection and trade, EUR 61.2 thousand in copper production (I2 and I3, same SBS class), EUR 46.5 thousand in copper-alloy castings and EUR 49.4 thousand in wires and cables. The effective rate of corporate income tax of copper firms is not observed; the model applies the statutory IRES rate to an assumed taxable share of operating surplus (Annex B). The total therefore attributes public revenue to the activity; it is not a net fiscal balance, because public support received by the industry is not quantified.

Copper production (NACE 24.44) is on the EU list of sectors exposed to a risk of carbon leakage (Decision 2019/708), so Italian copper producers are eligible for compensation of indirect emission costs under D.Lgs. 47/2020 (art. 29) and DM 466/2021. The ministry publishes the total budget and the number of beneficiaries, but not the amounts received by copper firms; the compensation is therefore described in Chapter 2 and not quantified here. Other measures for energy-intensive users (DL 131/2023) and the Energy Release 2.0 contracts are likewise not attributed to copper firms.

FIGURE 10 Taxes and contributions linked to the copper value chain, 2024



Source: IGMNiR CU-IT v1.0; implicit tax rate on labour, Italy 2024 (Eurostat); FIGARO 2024. Model estimates; VAT excluded. Compensation of indirect emission costs to copper firms is not published by firm and is not shown.

TABLE 23 Taxes and contributions by category, 2024 (EUR million)

Category	EUR m	Status	Basis
(i) Segments: labour taxes and social contributions	361	M	43.86% × labour cost (SBS)
(ii) Segments: corporate income tax (IRES)	95	M	24.0% × taxable share of operating surplus
(iii) Segments: net taxes on production and on products used, net of other subsidies (incl. IRAP)	86	M	FIGARO coefficients

Category	EUR m	Status	Basis
(iv) Domestic suppliers (Type I)	429	M	FIGARO
(v) Induced by household spending (Type II)	149	M	FIGARO, closed for households
Taxes and contributions, total (excl. VAT)	**1,120**		
Public support not quantified: compensation of indirect emission costs (D.Lgs. 47/2020), energy-intensive users regime (DL 131/2023), Energy Release 2.0	–		Amounts by firm not published

Source: IGMNiR CU-IT v1.0. Labour cost is personnel costs as reported in structural business statistics (gross wages and salaries plus employer social contributions). The rate of 43.86% is the implicit tax rate on labour for Italy in 2024 (taxes and compulsory social contributions on employed labour income relative to compensation of employees plus payroll taxes; DG TAXUD 2026). IRAP is recorded by ISTAT as an other tax on production (D.29) and is contained in the FIGARO coefficients of rows (iii) to (v); the operating surplus taxed by IRES is net of other taxes on production.

5.2 Split keys and boundaries with other IGMNiR reports

The split of NACE 24.44 into scrap-based (I2) and cathode-based (I3) production changes the recycling chain but not the copper industry or the extended chain. The central key (36.8%) is the share of copper from scrap – melted directly or refined from scrap – in the copper of semis plus secondary refined output, computed from the copper balance of each run; with the bridge term d_ref at its limits it ranges from 31.9% to 44.3%. The key is conservative for the recycling chain. Alternative keys give higher shares: the PRODCOM value share of scrap-intensive products – brass bars and profiles, unwrought alloys, refined copper and anodes – (43%); the scrap-based share reported by Assomet net of the zinc and other alloying elements in brass (50%); the gross-weight share reported by Assomet (57.1%), which includes zinc; and the headcount of the listed producers of brass rods and copper semis, about 70% of which work in mills that melt mainly scrap. The value added of scrap collection and trade (I1) is allocated with a value key; allocating it with the employment key lowers it, as shown in the last row.

TABLE 24 **Alternative split keys of copper production (NACE 24.44), 2024 (EUR million)**

Key	Scrap-based share, %	GVA I2	GVA I3	GVA I1+I2	GVA I1+I2 Type I
Copper-input key from the balance (central)	36.8	177	303	532	1,092
Copper-input key, bridge term d_ref low	31.9	153	327	508	1,042
Copper-input key, bridge term d_ref high	44.3	212	267	568	1,167
PRODCOM value share of scrap-intensive products	43.0	206	273	561	1,154
Assomet scrap-based share net of zinc	50.0	240	240	595	1,225
Assomet scrap-based share, gross weight	57.1	274	206	629	1,297
Headcount of listed producers	70.0	336	144	691	1,427
Central key; I1 value added with the employment key	36.8	177	303	436	911

Source: IGMNiR CU-IT v1.0; Eurostat SBS and PRODCOM 2024; Assomet (2026); company reports for the headcount key. The copper industry (I1–I4) and the extended chain (I1–I5) are the same under all split keys of NACE 24.44.

The output of copper production is low relative to the copper it processes. The production value of NACE 24.44 (EUR 5,016 million) is lower than the value of the copper contained in the PRODCOM volumes of semis at the 2024 LME price (EUR 6,645 million); PRODCOM values per tonne are EUR 2,901 for wire rod and EUR 3,287 for bars, rods and profiles, against an LME copper price of EUR 8,446 per tonne, and Almag reported revenue of about EUR 2,260 per tonne of foundry output. The metal inputs attributed to I2 correspond to EUR 4,338 per tonne of copper in scrap feed, against about EUR 8,060 per tonne of copper in imported scrap; the same calculation for I3 gives EUR 4,335 per tonne of refined copper, against an import unit value of EUR 8,560 per tonne, so the ratio reflects the level of 24.44 output, not the pricing of scrap. These relations are consistent with toll processing (conversion of customer-owned metal, including turning swarf returned by machining customers) and/or with differences in coverage and valuation between SBS, which classifies whole enterprises by main activity, and PRODCOM, which records production by any enterprise. If toll processing explains the gap, value added is not affected but the metal share is overstated, which understates the first round of I2 and I3 (case

m3_low in Chapter 9); if coverage explains it, value added and employment of copper production are understated.

TABLE 25 Boundaries with other IGMNiR reports

Activity	CU-IT	Other IGMNiR report	Treatment
Aurubis smelters in Germany (Hamburg, Lünen)	–	CU-DE	German sites; the Avellino rod plant of Aurubis Italia is in CU-IT (I3)
Copper industry in Poland	–	CU-PL	Separate country; no overlap
Brass (copper-zinc alloys)	I2, I3	–	Included in copper production by gross weight; copper content used in the balance; zinc not separated in value terms
Zinc and aluminium die-casting in NACE 24.54	–	–	Excluded by the copper-alloy share of 24.54

Source: IGMNiR; IGMNiR (2026), CU-DE and CU-PL.

5.3 Comparison with other studies of copper in Italy

Other sources on copper in Italy and on copper flows in Europe use different units of analysis, years, methods and boundaries. The matrix below records the scope, method, key results and data access of each source and its relation to CU-IT; it is not a ranking of quality. Several of them cover the EU rather than Italy and serve as methodological references. The search did not identify a public study for Italy that combines value added, a copper mass balance, a dynamic stock model, route-level emissions and supply-security indicators.

TABLE 26 Studies and statistics of copper in Italy and Europe: scope, methods, results and data access

Source	Scope	Method	Key results	Data access	Relation to CU-IT
Assomet (2026), figures for 2024 as reported by Assomet; statistical publication of the association	Italian copper and copper alloys, gross weight, 2018–2024	Industry statistics	Copper metal use 1,013.3 kt; scrap-based output 579.1 kt (57.1%)	Paid publication; summary figures public	Cross-check of direct melting (mass bridge, Chapter 3)
Assofond (2025), annual report	Italian foundries, 2024	Industry statistics	Copper-alloy castings 48.8 kt of 777.5 kt non-ferrous castings	Public report	Physical anchor of I4
USGS (2025), Minerals Yearbook, Italy	Mineral industry of Italy, 2018–2022	Official statistics compilation	Secondary refined copper 7.2–15.4 kt a year	Public tables	Cross-check of PRODCOM refined output (19.7 kt in 2024)
ICSG (2025), Copper Statistical Yearbook	Copper production and use by country, 2015–2024	Statistical compilation	Refined copper use and production series	Paid publication	Reference series for refined copper use
Fondazione per lo Sviluppo Sostenibile (2025), Il Riciclo in Italia 2025	Recycling chains in Italy	Sector data of recycling consortia and associations	Recycling rates and markets of secondary raw materials by chain	Public report	Context of I1; definitions differ
Circular Economy Network, ENEA (2026), Rapporto sull'economia circolare in Italia 2026	Circular economy of Italy compared with EU countries	Indicator report	Circular material use rate 21.6%; 46.6% of materials processed come from abroad	Public report	Context; no copper model
WM Strategy (2026), Italy: Copper Market	Italian copper market	Market study	Market size, trade, prices and forecasts 2026–2031	Commercial, not consulted	Not used

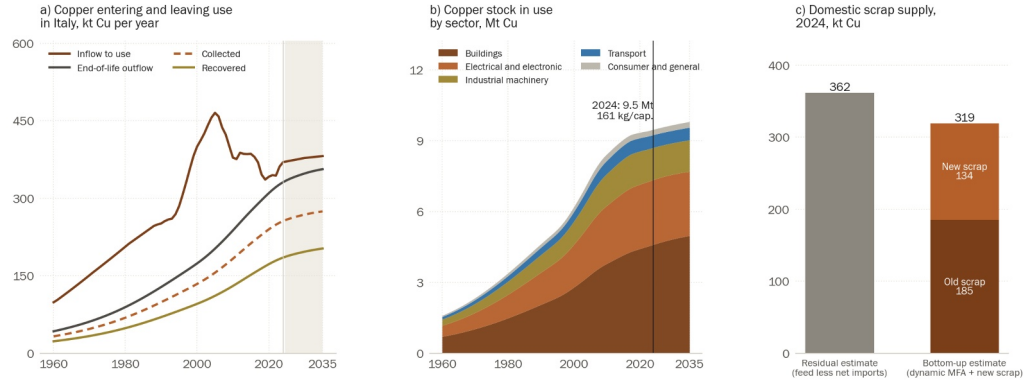
Source	Scope	Method	Key results	Data access	Relation to CU-IT
ENEA (2022), ARCADIA Italian LCA database (BDI-LCA)	Life-cycle inventories, Italy	Process LCA (EF format)	Cable recycling dataset with a "Copper, recycled" process (Italian grid; cables 30% copper)	Public datasets	Not used numerically (Chapter 7)
Ciacci et al. (2017)	Copper in use, EU	Dynamic material flow analysis	Stock 160–200 kg per person; end-of-life recycling rate about 60%	Open-access article	Range for stock per person and recycling rate
Passarini et al. (2018)	Aluminium, copper and iron, EU-28, 2014	Material flow analysis (JRC)	EU inflow of copper into use 5.91 kg per person	Public report	Anchor of the inflow in M2b
Soulier et al. (2018)	Copper flows, EU-28, 1910–2014	Dynamic stock-flow model	End-of-life recycling rate about 61%	Journal article	Comparison of recycling indicators
Ciacci et al. (2020)	Copper demand and recycling, EU-28, to 2050	Material flow analysis, regression, LCA	Old scrap supplies at most about 65% of demand in most scenarios	Journal article	Context of scenarios
Ciacci et al. (2013)	Aluminium in use, Italy	Dynamic material flow analysis	Method for an Italian in-use stock model	Journal article	Method analogue; no copper results
ISPRA (2026), Rapporti 430/2026	CO_2 factor of Italian electricity	Inventory-based statistics	192.6 g/kWh (consumption) and 209.4 g/kWh (production), 2024	Public report	Input to the screening values (Chapter 7)

Source: as listed; IGMNiR CU-IT v1.0. Assomet data as published by the association in April 2026; the definition of scrap-based output (gross weight, treatment of home scrap) is not published in detail. Commercial studies are described by their published scope only.

06 Copper in use and scrap supply

The dynamic model estimates that about 9.5 Mt of copper was in use in Italy at the end of 2024, or 161 kg per person (90% band 142–203 kg). Buildings hold 49% of the stock, electrical and electronic equipment 29% and industrial machinery 14%. In 2024 about 370 kt of copper entered use and 331 kt left it in end-of-life products, of which 256 kt was collected and 185 kt recovered as old scrap. With the slow growth of the inflow and a stable population, the stock grows only slightly to 9.8 Mt in 2035, and old scrap recovered rises to 203 kt.

FIGURE 11 Copper in use in Italy, 1960–2035, and domestic scrap supply in 2024



Source: IGMNiR CU-IT v1.0, module M2b; inflow-driven stock model 1960–2035; inflow shaped by Italian net imports of refined copper (Comext); JRC (Passarini et al. 2018) end-use shares and lifetimes (normal, SD = 0.3 × mean); Glöser et al. (2013) collection and recovery by waste stream; population ISTAT. Model estimates; 2025–2035 under the central inflow growth of 0.5% a year.

TABLE 27 Copper stock in use and end-of-life flows by end use, 2024 and 2035

End use	Stock 2024, Mt	End of life 2024, kt	Recovered 2024, kt	Stock 2035, Mt	End of life 2035, kt
Buildings and construction	4.60	80	52	4.98	106
Electrical and electronic	2.75	102	47	2.72	114
Industrial machinery	1.36	82	41	1.33	74
Transport	0.54	37	18	0.53	33
Consumer and general	0.23	30	10	0.24	30
Total	9.48	331	185	9.81	356

Source: IGMNiR CU-IT v1.0, module M2b, central parameters. 2035 under per-capita inflow growth of 0.5% a year from 2025.

The stock per person is within the range of European estimates: the JRC reports about 140 kg per person for the EU-28 in 2014 (Passarini et al. 2018) and Ciacci et al. (2017) 160–200 kg. The modelled inflow into use (370 kt, 6.3 kg per person) is much smaller than the copper first used by Italian industry (853 kt of refined copper and directly melted scrap). The difference reflects new scrap returned to the mills and the copper contained in net exports of copper-bearing products – fittings, valves, machinery, appliances and cables – which is not observed and is the main source of uncertainty of the inflow; it is covered by the range of the scaling factor. The bottom-up domestic scrap supply (319 kt: old scrap 185 kt and new scrap 134 kt) is 43 kt below the residual estimate from secondary feed and trade (362 kt). After net exports of 5 kt of copper in other secondary materials, 48 kt (90% band −13–108 kt) remains unaccounted for. It may reflect apparent refined use that did not enter semis in 2024 (stocks), new scrap above the assumed rate, stocks in the scrap trade, or scrap recovered from end-of-life products above the rates assumed.

TABLE 28 Sensitivity of the dynamic model

Case	Stock 2024, kg/person	End of life 2024, kt	Recovered 2024, kt	EoL recycling rate, %	Recovered 2035, kt
Central	161	331	185	56	203
Lifetimes −20%	133	360	204	57	213
Lifetimes +20%	185	298	165	55	190
Inflow factor 0.85	124	256	143	56	157
Inflow factor 1.4	205	422	236	56	258
Inflow 1960 at 20% of 2014	160	328	183	56	202
Inflow 1960 at 45% of 2014	161	336	189	56	204
Collection and recovery +15%	161	331	194	58	212
No inflow growth after 2024	161	331	185	56	203
Inflow growth 2% a year	161	331	185	56	204
Inflow +25% in 1998–2008	172	368	206	56	217
Constant per-capita inflow 1990–2024 (EU-type path)	167	348	198	57	213
Log-normal lifetimes	161	333	186	56	204
Recovery from vehicles −50%	161	331	175	53	194
Buildings 40% of inflow	166	323	184	57	204

Source: IGMNiR CU-IT v1.0, module M2b. One parameter or assumption changed at a time. The inflow factor scales the per-capita inflow relative to the EU-28 value of the JRC. The constant path replaces the Italian net-import index by a flat per-capita inflow from 1990 to 2024. Many end-of-life vehicles leave Italy as used cars, which the case with recovery from vehicles −50% illustrates.

Recycling indicators differ in definition. In CU-IT, 77% of the copper in end-of-life products is collected and 72% of the collected copper is recovered, giving an end-of-life recycling rate of 56%, against EU estimates of about 60% (Ciacci et al. 2017; Soulier et al. 2018); CU-IT applies the waste-stream rates of Glöser et al. (2013) scaled by 1.10. Secondary copper supplies 38% of copper first used, while Assomet reports a scrap-based share of 57.1% in gross weight; the difference reflects mainly the zinc content of brass scrap and the gross-weight basis (Chapter 3). The indicators are shown side by side in the table and are not converted into each other.

TABLE 29 Copper recycling indicators: CU-IT and published values

Indicator and definition	CU-IT 2024	Published	Source of published value
Collection rate: collected / end-of-life outflow	77%	–	Glöser et al. (2013) rates by waste stream
Processing yield: recovered / collected	72%	–	
End-of-life recycling rate: recovered / end-of-life outflow (same year)	56%	about 60% (EU); about 61% (EU-28)	Ciacci et al. (2017); Soulier et al. (2018)
Lagged rate: old scrap recovered 2024 / inflow to use 1989 (35 years)	74%	–	
Recycled content: secondary copper / copper first used	38%	57.1% (gross weight)	Assomet (2026)
Secondary share of refined copper production	100%	19.7 kt secondary refined, no primary refining	PRODCOM 2024; USGS (2025)
End-of-life recycling input rate: old scrap recovered / copper first used	22%	–	

Source: IGMNiR CU-IT v1.0; Ciacci et al. (2017); Soulier et al. (2018); Assomet (2026). The published values refer to the EU or use gross weight; they are shown side by side and are not converted into each other. No end-of-life recycling rate specific to Italy was found.

The model has three limitations that bear on the stock and the old scrap it releases. First, the inflow into use is shaped by net imports of refined copper per person, a proxy for the copper entering the Italian stock; it is not an apparent consumption of copper in final products (domestic output of copper-bearing products plus imports less exports), which would require copper contents of several hundred product codes. Second, the level of the inflow is anchored to the EU value of the JRC and scaled by an assumed factor (1.10, range 0.90–1.50). Third,

the copper recovered from end-of-life products was not compared with administrative data on waste of electrical and electronic equipment, end-of-life vehicles or construction and demolition waste, nor the stock with an inventory of buildings and networks. The comparison with the EU range of 160–200 kg per person (Ciacci et al. 2017) confirms the order of magnitude, not the Italian value.

07 Environmental contribution

According to data of the International Copper Association for 2023, as reported in the Aurubis Environmental Footprint Declaration (Aurubis 2026), a tonne of primary copper cathode produced worldwide carries a cradle-to-gate footprint of about 3.64 t CO_2e (3.96 t in the ICA Copper Environmental Profile with 2019 data, ICA 2023; 2.80 t in Nuss and Eckelman 2014). Italy imports all its primary copper as cathode, mostly from European smelters (70% of imports of unwrought copper by consignment). Secondary copper in Italy is produced mainly by direct melting of scrap in semis mills and foundries (305 kt) and to a small extent by secondary refining (19.7 kt). Direct melting avoids smelting and refining; its additional burden relative to melting cathode is scrap collection and preparation and the extra energy for melting and refining the scrap in the furnace.

TABLE 30 Screening values for the Italian copper routes, t CO_2e per t Cu (2024)

Component	t CO_2e/t	Basis	Source
Electricity of melting, casting and processing (site)	0.154	0.80 MWh/t Cu × 192.6 g/kWh	Almag (2024); ISPRA (2026)
Natural gas (furnaces, annealing)	0.073	1.31 GJ/t Cu × 56.1 kg CO_2/GJ	Almag (2024); IPCC (2006)
Scrap collection, transport, preparation and melt losses (residual)	0.073	Screening estimate	IGMNiR (C)
Direct melting (whole-site values per t Cu; upper estimate of the increment over cathode melting)	**0.30**	range 0.20–0.45	
Secondary refining in Italy (small furnaces)	**1.50**	range 1.00–2.20	IGMNiR (C)
Secondary copper, weighted by output	**0.37**	weights 305 kt and 19.7 kt	
Primary copper cathode, global average	3.64	range 2.80–3.96	ICA data for 2023 (Aurubis 2026)

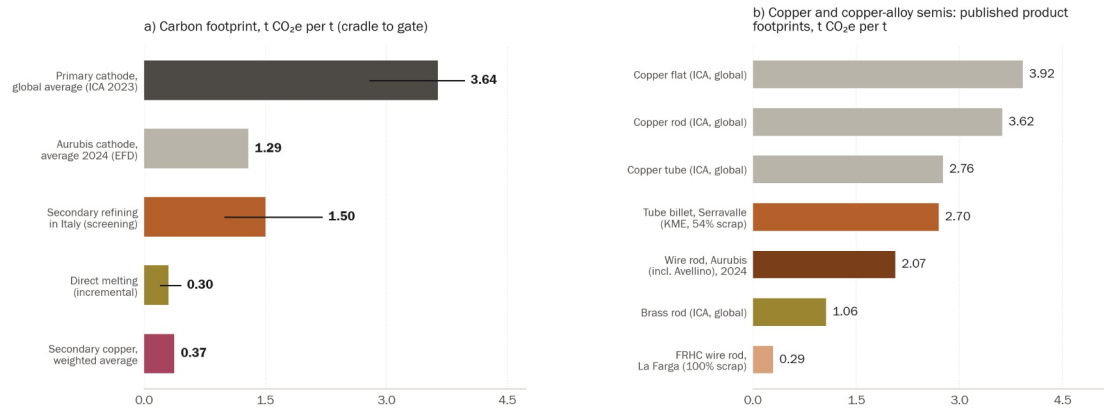
Source: IGMNiR CU-IT v1.0. Electricity and gas per tonne from the sustainability report of Almag, a brass-rod producer with 93.1% recycled input (site-wide values for 2023 per tonne of brass, which include extrusion and drawing, divided by the copper content of brass to give values per tonne of copper); because they cover the whole site, the total is an upper estimate of the increment over melting cathode. The electricity part follows the grid factor in the Monte Carlo simulation and in the structural cases. The scrap-preparation residual is not measured. Italian secondary refining is small and no site data were found; its value is an assumption between direct melting and the literature value of 1.8 t for secondary copper (Nuss and Eckelman 2014).

TABLE 31 Published carbon footprints of copper and copper-alloy semis, t CO_2e per t

Product	t CO_2e/t	Source	Note
Copper rod, global average	3.62	ICA/IWCC/CDA (2024)	Cradle to gate, 2019–2021 data
Copper tube, global average	2.76	ICA/IWCC/CDA (2024)	Cradle to gate
Copper flat products, global average	3.92	ICA/IWCC/CDA (2024)	Cradle to gate
Brass rod, global average	1.06	ICA/IWCC/CDA (2024)	High recycled content
Lead-free brass rod, global average	2.10	ICA/IWCC/CDA (2024)	
Wire rod, Aurubis (Hamburg, Olen, Avellino, Emmerich), 2024	2.07	Aurubis (2026)	37% recycled content
Tube billet, Serravalle Copper Tubes (KME), 2024	2.70	Serravalle Copper Tubes (2025)	54% scrap (20% own, 34% purchased)
FRHC wire rod, La Farga (100% scrap)	0.29	La Farga (2023)	Wind power
Brass mill, Scope 1 and 2 only, Almag 2023	0.172	Almag (2024)	Gate to gate, site emissions

Source: as listed. Product footprints include the metal input and are not directly comparable with the incremental screening values above. The low footprint of brass rod reflects its high scrap content; the Almag value covers site emissions only.

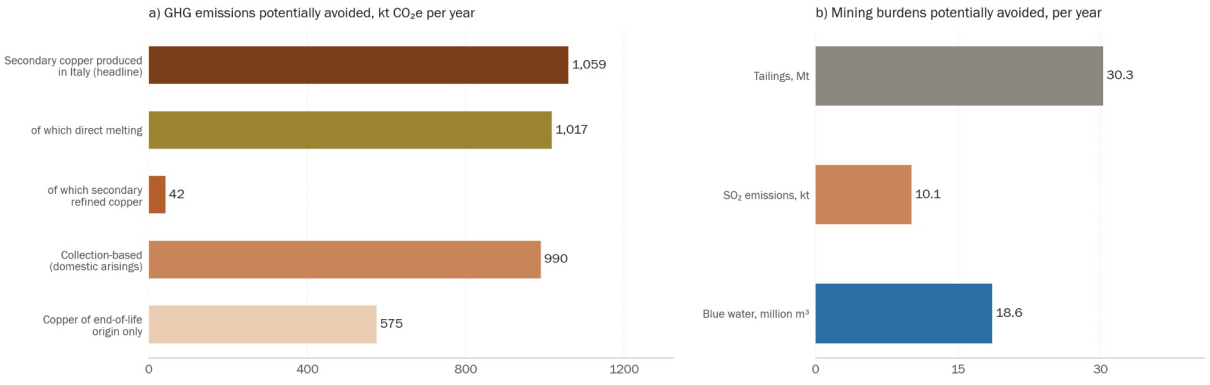
FIGURE 12 Carbon footprint of copper routes and published product footprints of semis



Source: ICA data for 2023 as reported by Aurubis (2026); ICA (2023); Nuss and Eckelman (2014); Aurubis Environmental Footprint Declaration 2026 (cathode, wire rod incl. Avellino); ICA/IWCC/CDA semis LCA (2024); La Farga EPD S-P-02032; Serravalle Copper Tubes EPD (2024 data). Direct melting and secondary refining: IGMNiR screening values (Chapter 7); not ISO 14044 comparative LCAs. Lines show ranges in Annex B.

On this basis all secondary copper produced in Italy – including new scrap that returns from fabrication, i.e. a recycled-content perspective – potentially avoided 1,059 kt CO_2e in 2024 (90% band 848–1,208 kt): 1,017 kt from direct melting and 42 kt from secondary refined copper. New scrap recirculates between fabricators and mills and, because Italy is a net exporter of scrap, part of it would otherwise be remelted abroad; counting only copper from end-of-life products recovered in Italy (old scrap from the dynamic model) gives 575 kt (90% band 429–724 kt), and counting domestically arising scrap of both kinds (collection-based perspective) 990 kt. Valued at the average EU ETS price of 2024 the emissions potentially avoided correspond to EUR 69 million, and at the EIB shadow cost of carbon to EUR 220 million (EIB 2020; EEA 2025). Secondary copper also potentially avoided about 30.3 Mt of flotation tailings, 10.1 kt of SO_2 and 18.6 million m^3 of blue water, and 15.5 PJ of primary energy. These burdens would arise in the mining and smelting countries that supply primary copper, not in Italy; the results are not changes of the Italian emission inventory.

FIGURE 13 Emissions and mining burdens potentially avoided by secondary copper produced in Italy, 2024



Source: IGMNiR CU-IT v1.0, module M4; 1:1 substitution of global average primary copper cathode (ICA 2023) by secondary copper produced in Italy; avoided burdens arise outside Italy. Bars in a) are alternative attributions and are not additive, except the two sub-items of the headline.

7.1 Structural sensitivity

The headline compares secondary copper with the global average of primary cathode. Italy imports its cathode mainly from EU partners (70% of CN 7403 in 2024). Weighting the displaced cathode by origin – EU origins at the average of the European smelters of Aurubis (1.29 t CO_2e/t), other origins at the ICA global average – gives 2.00 t CO_2e/t and 527 kt CO_2e potentially avoided; the footprints of the individual EU smelters supplying Italy are not all published, so this case is illustrative. The 1:1 substitution is an attributional comparison of two

production routes, not an observed response of the market; a consequential view would ask how much primary production changes when secondary supply changes, which depends on prices and is shown only by the substitution factors 0.8 and 0.5. The value of 1.5 t CO_2e/t for secondary refining is a screening assumption, because no Italian site data are published. The values are per tonne of copper; zinc, which makes up about two fifths of brass, is outside the comparison. The Italian LCA database ARCADIA of ENEA contains a cable-recycling dataset with a process for recycled copper based on the Italian electricity mix (ENEA 2022); it describes cable granulation rather than melting and is not used numerically.

TABLE 32 Structural sensitivity of the emissions and tailings potentially avoided (2024)

Case	Headline, kt CO_2e	Direct melting, kt CO_2e	Secondary refined, kt CO_2e	Collection-based, kt CO_2e	Secondary footprint, t/t	Tailings, Mt
Central case	1,059	1,017	42	990	0.37	30.3
Substitution 0.8	823	796	28	770	0.37	24.3
Substitution 0.5 (market response)	469	463	6	439	0.37	15.2
Copper of end-of-life origin only (old scrap recovered in Italy)	575	552	23	990	0.37	16.5
Displaced cathode from an EU smelter (1.29, Aurubis average)	297	301	−4	278	0.37	30.3
Displaced cathode weighted by import origin (2.00: EU 70% at the Aurubis average, other origins at the ICA average)	527	517	10	492	0.37	30.3
Primary footprint 2.80 (Nuss and Eckelman)	787	761	26	736	0.37	30.3
Primary footprint 3.96 (ICA, 2019 data)	1,165	1,116	49	1,089	0.37	30.3
Italian grid, production basis (209.4 g/kWh)	1,055	1,013	42	987	0.39	30.3
EU average electricity (213 g/kWh)	1,054	1,012	42	986	0.39	30.3
Secondary refining 1.8 (Nuss and Eckelman)	1,053	1,017	36	985	0.39	30.3
Direct melting 0.20 t/t	1,090	1,048	42	1,019	0.28	30.3
Direct melting 0.45 t/t	1,014	972	42	948	0.51	30.3
Bridge term d_ref −30 kt (less direct melting)	926	884	42	908	0.38	26.6
Bridge term d_ref +70 kt (more direct melting)	1,260	1,218	42	994	0.36	35.9
Copper content of brass bars 59%	1,015	973	42	982	0.38	29.1
Copper content of brass bars 67%	1,134	1,091	42	1,003	0.37	32.4

Source: IGMNiR CU-IT v1.0. The headline is positive in all cases. If the displaced cathode had the footprint of the Aurubis average (1.29 t CO_2e/t), the emissions potentially avoided would be 297 kt, and secondary refining in Italy would have a slightly higher footprint than that cathode (−4.2 kt). The grid factor matters little, because electricity is a small part of the burden of direct melting compared with the footprint of primary copper.

7.2 Boundaries and comparability

The screening values are not comparative life-cycle assessments under ISO 14044. The value for direct melting answers a narrower question than a product footprint: by how much does a tonne of copper from directly melted scrap add to the emissions of melting cathode, given that the semis are produced in Italy either way? Because it is built from whole-site data, it overstates this increment. Published product footprints (previous table) include the metal input, use market-based or supplier-specific electricity and apply different cut-off and allocation rules; the Aurubis cathode average (1.29 t CO_2e per tonne in 2024) reflects five European smelters with 44% recycled

content. The table below summarises the boundaries, and the matrix after it the methodological characteristics of each footprint used.

TABLE 33 System boundaries of the footprints compared

Footprint	Value, t CO_2e/t	Electricity	Co-products	Status
ICA global primary cathode (2023 data, as reported by Aurubis)	3.64	Regional grids	Mass at mining; system expansion and economic allocation at smelting	Industry LCA, ISO 14040/44
Aurubis cathode, weighted average 2024	1.29	Market-based	System expansion; economic allocation for precious metals	Company declaration
CU-IT direct melting (whole-site, per t Cu)	0.30	Location-based IT, 192.6 g/kWh	Not needed (single output)	Screening estimate
CU-IT secondary refining in Italy	1.50	Location-based IT	Not allocated	Screening assumption
Nuss and Eckelman (2014), secondary copper	1.8	ecoinvent	ecoinvent	Scientific literature

Source: ICA data for 2023 as reported by Aurubis (2026); ICA (2023); Nuss and Eckelman (2014); IGMNiR CU-IT v1.0.

TABLE 34 Methodological characteristics of the footprints used

Element	ICA global primary	Aurubis cathode (EFD)	ICA/IWCC/CDA semis	CU-IT direct melting	CU-IT secondary refining
Functional unit	1 t cathode	1 t cathode (average of 5 smelters)	1 t semi-finished product	1 t copper in semis	1 t secondary refined copper
System boundary	Cradle to gate	Cradle to gate	Cradle to gate	Scrap to semis; whole-site values, upper estimate of the increment over cathode melting	Cradle to gate (screening)
Allocation	Mass (mining); system expansion and economic (smelting)	System expansion; economic for precious metals	As in ICA cathode; scrap cut-off	Not needed (single output)	Not needed (single output)
Upstream	Primary data of member mines	Supplier-specific	ICA cathode and scrap	Scrap preparation (residual)	Scrap preparation
Electricity	Regional grids	Market-based	Regional grids	Location-based, 192.6 g/kWh	Location-based
Recycled content / cut-off	Primary only	44% recycled content	Global average recycled content	Scrap, cut-off	Scrap, cut-off
Sensitivity in CU-IT	Range 2.80–3.965; EU cathode case	Structural case	Benchmark only	Range 0.20–0.45; grid	Range 1.0–2.2; literature case
Data quality	Industry LCA (ISO 14040/44)	Company declaration	Industry LCA	Site data of one mill plus estimate	IGMNiR assumption

Source: ICA (2023); Aurubis (2026); ICA/IWCC/CDA (2024); IGMNiR CU-IT v1.0.

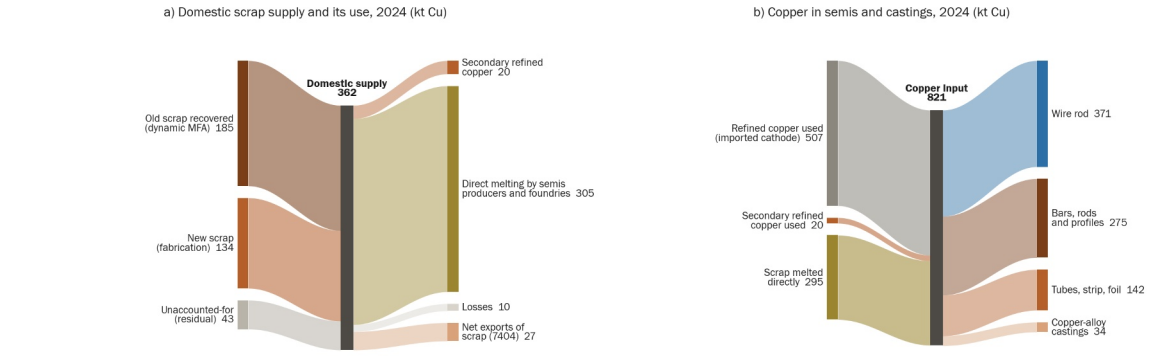
7.3 Uncertainty from the counterfactual

The emissions potentially avoided depend more on the counterfactual than on the screening values. Across the cases in Section 7.1 the headline result ranges from 297 to 1,260 kt CO_2e. Three choices dominate. First, the substitution ratio: if secondary copper partly adds to supply, the result falls proportionally (469 kt at 0.5). Second, the displaced copper: imports come mostly from EU smelters with footprints well below the global average, giving 297 kt; the headline uses the global average because the displaced tonne cannot be identified. Third, the quantity of direct melting (926–1,260 kt across the range of the bridge term) and the treatment of new scrap: counting only copper from end-of-life products gives 575 kt.

08 Strategic contribution

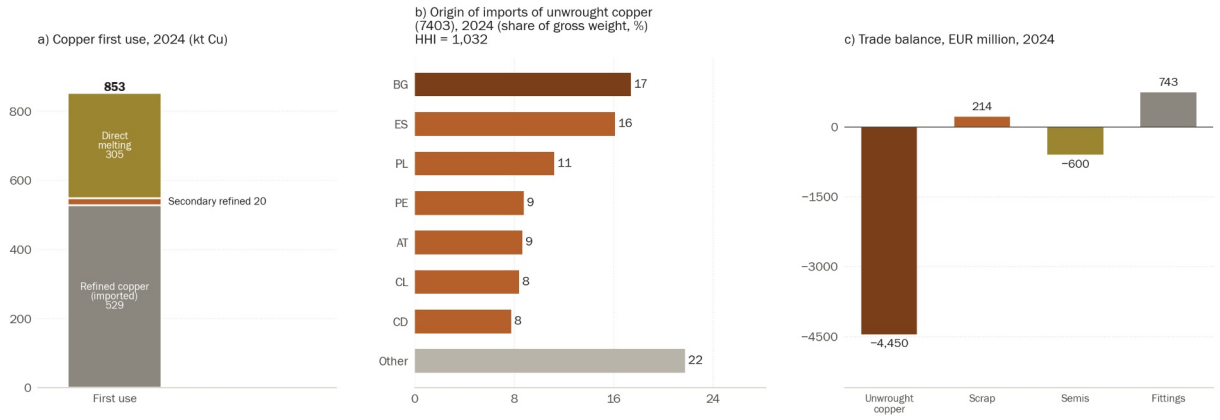
Italy has no copper mine, no primary smelter and no electrolytic refinery. In 2024 it refined 19.7 kt of copper from scrap, 3.6% of the 548 kt of refined copper it used; the rest was imported as cathode. Including direct melting, secondary copper supplied 38% of copper first used. The coverage ratio of scrap – domestic scrap supply relative to scrap used, in copper content – is 108%: Italy exports more copper in scrap (145 kt) than it imports (118 kt). Imports of unwrought copper come mainly from EU partners (70%), with Bulgaria the largest supplier (17%), followed by Spain and Poland. Scrap is imported mainly from France and other EU countries and exported to China, Germany and other destinations. Italy is a net exporter of copper fittings and a net importer of other semis, mainly wire.

FIGURE 14 Domestic scrap supply and copper in semis and castings in Italy, 2024



Source: Eurostat PRODCOM and Comext 2024 (refined copper net imports, CN 7404 at 80% Cu in imports and 78% in exports); IGMNiR CU-IT mass balance (M2) and dynamic MFA (M2b). Direct melting is derived from the copper bridge; unaccounted-for copper is a balance residual.

FIGURE 15 Supply security indicators for copper, 2024



Source: IGMNiR CU-IT v1.0; Eurostat PRODCOM and Comext (DS-045409; imports by country of origin for extra-EU and consignment for intra-EU trade). HHI: Herfindahl–Hirschman index of partner countries (0–10,000).

TABLE 35 Concentration of copper trade by partner country, 2024

Flow	kt, gross weight	HHI	Largest partner	Top 5, %	EU partners, %
Imports of unwrought copper (7403)	561.6	1,032	BG 17%	62	70
Imports of copper scrap (7404)	153.1	1,656	FR 34%	70	84

Flow	kt, gross weight	HHI	Largest partner	Top 5, %	EU partners, %
Exports of copper scrap (7404)	193.1	1,281	CN 29%	64	53
Imports of copper wire (7408)	163.5	2,658	DE 39%	90	88
Exports of copper wire (7408)	48.2	990	ES 17%	63	69

Source: Eurostat Comext (DS-045409); IGMNiR CU-IT v1.0. HHI: Herfindahl–Hirschman index of partner countries (0–10,000). Country of consignment for intra-EU trade, country of origin for extra-EU imports; intra-EU consignment hides the origin of re-exported material.

TABLE 36 Stress indicators for the Italian copper value chain, 2024 basis

Test	Size	Relative effect
Electricity price +EUR 50/MWh in copper production	EUR 24.0 m a year	5.0% of GVA of I2 + I3 (EUR 480 m), 480 GWh
Loss of the largest supplier of unwrought copper (BG)	98 kt gross	17.8% of refined copper used if not replaced
Loss of all scrap imports	118 kt Cu	35.2% of copper in secondary feed if not replaced; copper in scrap exports is 1.23 times copper in scrap imports
Outage of the Avellino wire-rod plant for one month	15.6 kt of wire rod	Avellino supplies 38% of domestic availability of rod and wire; one month equals 3.2% of annual availability; stocks and deliveries from other plants not modelled
Loss of the largest supplier of copper wire (DE)	64.4 kt gross	39% of wire imports; 13.2% of domestic availability of rod and wire

Source: IGMNiR CU-IT v1.0. Static, first-order effects at 2024 volumes, without price, substitution or contractual responses; they are not forecasts. Electricity: 480 GWh of copper production (IGMNiR estimate from site data of mills). Unwrought copper: share of the largest partner in gross weight of CN 7403 imports (including a small quantity of alloys), related to refined copper used. Wire rod: Avellino output 187 kt a year (annualised 2024; Aurubis Italia 2024) against 370.7 kt of PRODCOM wire rod. Domestic availability of rod and wire: production plus net imports of CN 7408.

TABLE 37 Strategic indicators for the copper value chain

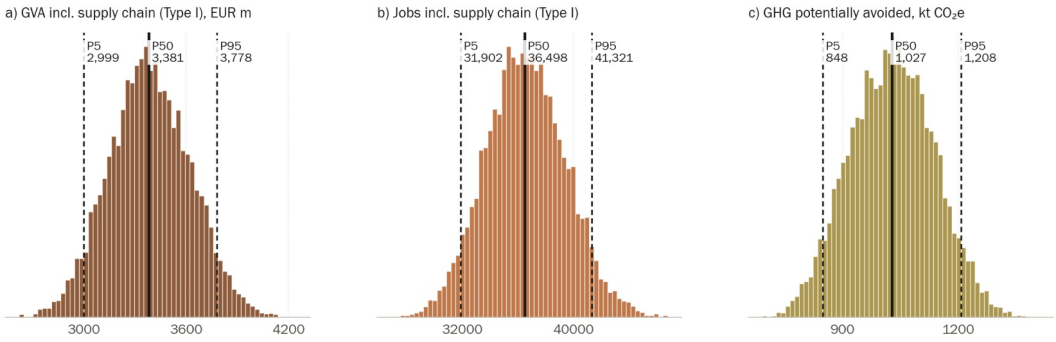
Indicator	Value	Source
Refined production / refined use	3.6%	PRODCOM; Comext
Secondary share of copper first use	38%	CU-IT
Coverage ratio of scrap (domestic supply / scrap used, Cu): residual / bottom-up	108% / 95%	CU-IT
Copper in net imports of scrap, kt	−27.0	Comext; CU-IT
Unwrought copper imports: HHI / EU share	1,032 / 70%	Comext
Scrap imports: HHI / EU share	1,656 / 84%	Comext
Scrap exports: HHI / EU share	1,281 / 53%	Comext
Trade balance, unwrought copper (7403), EUR m	−4,450	Comext
Trade balance, scrap (7404), EUR m	+214	Comext
Trade balance, semis excl. fittings (7407–7411) / fittings (7412), EUR m	−600 / +743	Comext

Source: IGMNiR CU-IT v1.0. HHI by partner country as recorded in trade statistics, gross weight. The coverage ratio describes the copper balance of scrap and is not a measure of supply security on its own. Trade balances in current EUR.

09 Uncertainty, checks and limitations

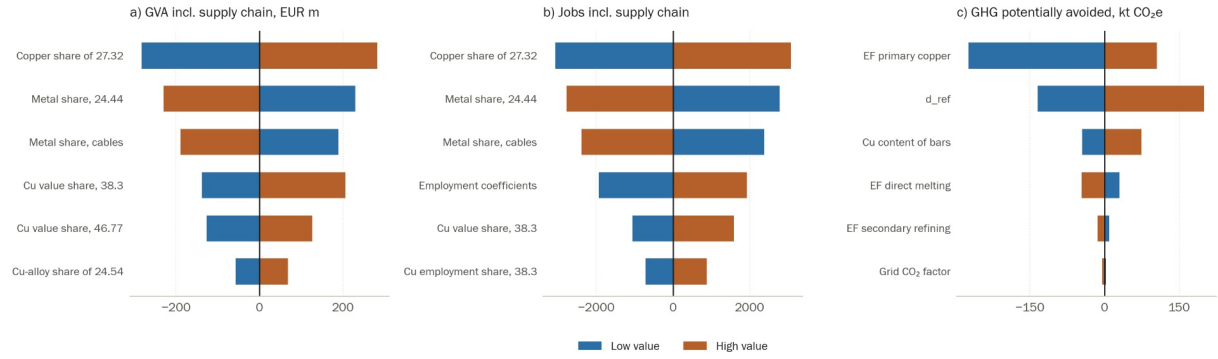
The 90% band of GVA including the supply chain is EUR 2,999–3,778 million, of jobs including the supply chain 31,900–41,300 and of the emissions potentially avoided 848–1,208 kt CO_2e. The economic results are driven mainly by the copper share of cable production (NACE 27.32), the metal share of copper production (NACE 24.44) and the metal share of cable output; the emissions potentially avoided mainly by the footprint of primary copper and the quantity of scrap melted directly (copper bridge). The median of the emissions potentially avoided (1,027 kt) is below the central value (1,059 kt) because the range of the primary footprint is skewed to lower values.

FIGURE 16 Monte Carlo distribution of key results



Source: IGMNiR CU-IT v1.0, module M6; 10,000 draws, triangular distributions with Gaussian copula (Annex B), seed 20261118. Parameter-uncertainty band, not a statistical confidence interval.

FIGURE 17 Sensitivity of results to individual parameters



Source: IGMNiR CU-IT v1.0, module M6; one-at-a-time sensitivity on Annex B ranges; extended value chain.

TABLE 38 Robustness of the uncertainty band to the statistical design

Design	GVA Type I, EUR m (P5–P95)	Jobs Type I (P5–P95)	GHG potentially avoided, kt (P5–P95)
Reference (4,000 draws, seed 7)	2,987–3,782	31,800–41,300	848–1,204
No correlation	3,067–3,696	32,800–40,200	848–1,204
Correlation 0.95 in all groups	2,972–3,804	31,600–41,700	848–1,204
PERT distributions	3,005–3,738	32,000–40,800	886–1,200

Source: IGMNiR CU-IT v1.0, module M6. Separate test design (4,000 draws, seed 7) compared with the headline run (10,000 draws, seed 20261118). Convergence: with other seeds and 20,000 draws the percentiles of the economic and emission results change by at most 0.6%; balance residuals such as unaccounted-for copper converge more slowly. Correlations are set in the normal space of the copula, so rank correlations are slightly lower. The emission band hardly depends on the correlation settings, because its main drivers are not in correlated groups.

TABLE 39 Structural tests of the economic and fiscal results

Case	GVA I1+I2	GVA I1–I5	GVA Type I	Jobs Type I	Taxes
Central case	532	1,811	3,353	36,200	1,120
Supply-chain effects −20%	532	1,811	3,045	32,300	1,021
Supply-chain effects +20%	532	1,811	3,661	40,100	1,220
FIGARO 2023 instead of 2024	532	1,811	3,350	36,000	1,038
National input-output table of Italy, 2022 (ISTAT)	532	1,811	3,318	36,400	897
Conservative first round	532	1,811	3,034	32,100	1,009
Basic prices for all segments	541	1,843	3,384	36,200	1,120
Metal share of copper production 64%	532	1,811	3,582	39,000	1,194
Metal share of copper production 80%	532	1,811	3,124	33,400	1,047
Copper-alloy share of castings 28%	532	1,776	3,296	35,500	1,100
Copper-alloy share of castings 50%	532	1,854	3,421	37,000	1,144
Copper share of cables 60%	532	1,643	3,071	33,100	1,022
Copper share of cables 90%	532	1,980	3,635	39,300	1,218
Assomet gross split key for I2/I3	629	1,811	3,353	36,200	1,120
I1 value added with the employment key	436	1,716	3,171	35,100	1,080
I1 first round from all SBS intermediate consumption	532	1,811	3,430	37,200	1,145
Joint parameter extremes, low	404	1,479	2,172	22,200	732
Joint parameter extremes, high	689	2,180	5,007	56,000	1,661

Source: IGMNiR CU-IT v1.0. EUR million and persons. Joint low: low copper value and employment shares of scrap trade and recovery, low copper shares of castings and cables, high metal shares of copper production, castings and cables, supply-chain effects −20%. Joint high: the opposite, with supply-chain effects +20%.

TABLE 40 Parameter-uncertainty band and range of structural cases

Result	P5	P95	Structural minimum	Structural maximum
GVA Type I, EUR m	2,999	3,778	2,172	5,007
Jobs Type I	31,900	41,300	22,200	56,000
GHG potentially avoided, kt CO_2e	848	1,208	297	1,260

Source: IGMNiR CU-IT v1.0. The structural range covers the cases in the tables above and in Section 7.1, which change boundaries, datasets or allocation rules or combine several parameter extremes at once; the variant that keeps domestic metal purchases is excluded because it double-counts transactions within the chain. The Monte Carlo band reflects joint parameter uncertainty with correlations. The two ranges answer different questions and are not combined.

The Monte Carlo band is conditional on the architecture of the model: it describes the spread of results when the parameters of Annex B vary within their ranges, given the segments, the bridge, the input-output table and the system boundaries chosen. It does not cover errors in the classification of enterprises and products in the source statistics, the choice of boundaries or alternative model structures; the range of structural cases is therefore wider than the parameter band, and the two ranges are not combined into one probability interval.

9.1 Consistency checks

TABLE 41 Consistency checks of the CU-IT model

Check	Model or source 1	Reference	Reference source
Secondary refined copper: PRODCOM 2024 vs USGS 2018–2022 range, kt	19.7	7.2–15.4	PRODCOM 24441330; USGS (2025)
Wire rod: PRODCOM vs Aurubis Avellino, kt	370.7	187.0	PRODCOM 24442330; Aurubis Italia (2024)
Employment: model total vs national accounts 2024 (construction check), thousand	26,510	26,510	FIGARO; nama_10_a64_e
I2 + I3 value added vs SBS 24.44, EUR m	480	480	Identity by construction

Check	Model or source 1	Reference	Reference source
Gross weight of semis and castings (PRODCOM, Assofond) vs copper metal use reported by Assomet, kt	1,014.1	1,013.3	PRODCOM; Assofond (2025); Assomet (2026)
Scrap-based share of copper input: CU-IT vs Assomet (gross weight), %	39.0	57.1	CU-IT; Assomet (2026)
Copper in cables (model) vs domestic availability of rod and wire, kt	464	486	PRODCOM; Comext 7408
Domestic scrap supply: bottom-up vs residual, kt Cu	319	362	Dynamic model (M2b); feed and trade
Implied feed price of I2 vs copper in imported scrap, EUR/t Cu	4,338	8,060	CU-IT; Comext; LME (2025); ECB (2026)
Unit value of scrap imports and exports vs refined imports, EUR/t gross	6,206 / 6,028	8,560	Comext 7404, 7403
Monte Carlo convergence (other seeds, 20,000 draws), max. change of percentiles, %	0.6	–	CU-IT, module M6
Replication from package files, max. absolute difference	0.002	0	Replication script

Source: IGMNiR CU-IT v1.0. Rows 1–2 compare independent sources; rows 3–5 test the construction; rows 6–10 compare model estimates with independent data (the scrap-based share differs in definition: gross weight including zinc in Assomet, copper content in CU-IT; the implied feed price is low because the output of 24.44 is low relative to the copper processed, Section 5.2); rows 11–12 test the computation. The employment check is an identity of the construction, not a validation.

9.2 Limitations

- **Split of copper production.** SBS gives only the total of NACE 24.44; the split into scrap-based (I2) and cathode-based (I3) production is an input-based attribution, not a measurement. It affects the recycling chain but not the totals.
- **Output of copper production.** SBS output of NACE 24.44 is low relative to the copper processed; this is consistent with toll processing and/or with differences in coverage and valuation between SBS and PRODCOM. The extent of toll processing is not published; if coverage explains the gap, value added and employment of copper production are understated.
- **Anodes and secondary refining.** PRODCOM reports anodes and unrefined copper as well as refined copper produced from scrap, and imports of anodes and blister (CN 7402) rose in 2023–2025; the producers were not identified and the anode stage is not modelled separately.
- **Direct melting.** The quantity of scrap melted directly is not published and is derived from PRODCOM volumes, assumed copper contents (brass bars in particular) and apparent refined use; it drives the physical and environmental results for secondary copper.
- **Unaccounted-for copper.** The residual and bottom-up estimates of domestic scrap supply differ; the difference is reported, not distributed among flows.
- **Dynamic model.** No dynamic material-flow model of copper for Italy exists in the literature. The inflow is anchored to the EU average and shaped by net imports of refined copper, because the copper in net exports of products is not observed; lifetimes are EU averages and collection rates global averages scaled towards European levels.
- **Data confidentiality.** Some SBS and PRODCOM cells for Italian copper production are small or partly confidential; segment shares of 24.54 and 27.32 are estimates.
- **Environmental values.** The values for direct melting and secondary refining are screening estimates based on one brass mill and assumptions; they are not ISO 14044 comparative assessments. Substitution of primary copper is assumed one-for-one in the headline case.
- **Input-output model.** FIGARO 2024 is partly projected by Eurostat; multipliers assume fixed technical coefficients and unconstrained supply; FIGARO aggregates copper with other basic metals (CPA C24) and cables with other electrical equipment (CPA C27). Direct value added is at factor cost, indirect and induced value added at basic prices. Results are gross contributions.

- **Public support.** The compensation of indirect emission costs and other energy measures received by copper firms are not published by firm and are not quantified.
- **Scenarios.** The scenarios have no feedback between scrap prices, scrap quality, export decisions, product replacement and plant capacities.
- **Trade data.** HHI uses partner countries in trade statistics; intra-EU trade is recorded by consignment, and gross weight of scrap and unwrought alloys differs from copper content.

10 Scenarios to 2035

The scenarios are illustrative combinations of assumptions, not forecasts. They keep 2024 prices and input-output coefficients and change volumes, footprints and labour productivity (+0.5% a year). Old scrap recovered follows the dynamic model; refined copper use and the cathode-based segment follow the copper bridge (copper in semis and castings less direct melting). S1 (2030) assumes moderate growth of direct melting and of cable production with grid investment. S2 (2035) assumes high circularity: more direct melting and secondary refining within the assumed capacities, growth of cables and semis, a smaller cathode-based segment and lower footprints of both primary and secondary copper. S3 (2030) is a stress case with lower activity in all segments except cables.

The scenarios have no feedback between scrap prices, scrap quality, scrap exports and the use of capacity: the volumes of direct melting and secondary refining are set exogenously and are limited only by assumed capacities. They therefore show the economic and environmental consequences of given volumes, not whether these volumes are economically feasible. Not modelled are the supply of scrap by quality and its alloy composition, the premium for high-grade scrap, the cost of sorting and preparation, the cost of energy and the availability and price of cathode.

TABLE 42 Scenario assumptions (change versus 2024)

Driver	S1 2030	S2 2035	S3 2030
Secondary refined copper	0%	+20%	−15%
Direct melting of scrap	+8%	+20%	−15%
Scrap collection and trade (I1)	+5%	+12%	−10%
Copper-alloy castings (I4) and copper in semis	0%	+5%	−10%
Copper in cables (I5)	+10%	+20%	0%
Footprint of primary copper	−5%	−12%	−5%
Footprint of secondary copper	−15%	−30%	−5%

Source: IGMNiR CU-IT v1.0. Direct melting is limited to 420 kt and secondary refining to 30 kt of copper. Additional secondary feed has a lower recovery (92%) and a 30% higher footprint than the 2024 feed mix, reflecting lower-grade scrap. The scrap-based segment I2 follows secondary copper output; refined copper use and the cathode-based segment I3 are derived from the copper bridge (copper in semis and castings less direct melting) and are not set separately.

TABLE 43 Copper balance in the scenarios (kt Cu)

Item	2024	S1 2030	S2 2035	S3 2030
Secondary refined copper	20	20	24	17
Direct melting	305	329	365	259
Refined copper used	548	514	518	502
Old scrap recovered (dynamic model)	185	197	203	197
Additional copper in secondary feed vs 2024	0	26	70	−50
Additional domestic scrap vs 2024 (old and new)	0	11	24	−2
Difference to be met by imports, lower exports or higher collection	0	15	46	−48

Source: IGMNiR CU-IT v1.0. In S2 direct melting reaches 365 kt, 87% of the assumed capacity of 420 kt. A positive difference means that the additional feed exceeds the growth of domestic scrap projected by the dynamic model; in 2024 Italy exported 27.0 kt more copper in scrap than it imported.

TABLE 44 Physical interpretation of a lower secondary footprint in S2 (example for direct melting)

Component	2024	S2 2035, example	Change assumed
Electricity, t CO_2/t	0.154	0.080	Grid factor 100 g/kWh in 2035 (example)
Natural gas, t CO_2/t	0.073	0.062	Furnace efficiency (−15%)

Component	2024	S2 2035, example	Change assumed
Scrap collection, transport and preparation, t CO_2e/t	0.073	0.062	Lower-carbon transport and preparation (−15%)
Direct melting, t CO_2e/t Cu	0.30	0.20	Scenario assumption for all secondary routes: 30% lower (0.21 for direct melting)

Source: IGMNiR CU-IT v1.0. The changes are examples consistent with the order of magnitude of the assumed reduction; their technical and economic feasibility has not been assessed.

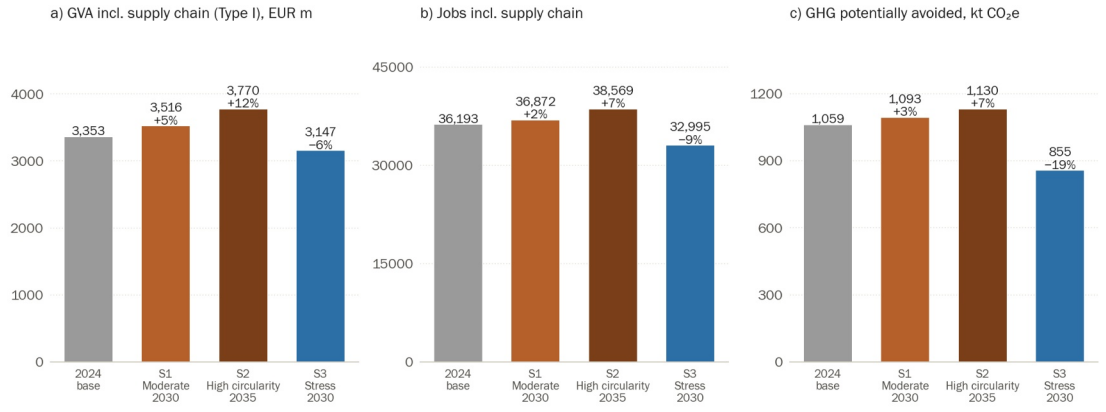
TABLE 45 Decomposition of the change in emissions potentially avoided from 2024 to scenario S2, kt CO_2e

Step	Emissions potentially avoided	Change
2024 base	1,059	–
More secondary copper (volume)	1,271	212
Lower-grade marginal feed	1,264	−7
Lower secondary footprint	1,300	36
Lower primary footprint	1,130	−170
S2 2035	1,130	71

Source: IGMNiR CU-IT v1.0; sequential decomposition in the order shown. A lower footprint of primary copper reduces the emissions avoided by each tonne of secondary copper.

In S1 direct value added rises to EUR 1,907 million and in S2 to EUR 2,047 million; in S3 it falls to EUR 1,709 million. Employment including the supply chain changes less than value added because labour productivity rises by 0.5% a year: 36,900 jobs in S1, 38,600 in S2 and 33,000 in S3, against 36,200 in 2024 (without the productivity adjustment 38,000, 40,700 and 34,000). The emissions potentially avoided rise to 1,130 kt CO_2e in S2: more secondary copper adds 212 kt, while the lower footprint of primary copper removes 170 kt. In S2 the additional secondary feed exceeds the growth of domestic scrap by 46 kt of copper; in S3 domestic scrap exceeds the lower feed by 48 kt.

FIGURE 18 Scenario results: change versus 2024



Source: IGMNiR CU-IT v1.0; 2024 prices; assumptions in the scenario table; labour productivity +1% a year; footprints of both routes decline over time.

11 Summary

The copper value chain generated about EUR 1,810 million of direct value added in 2024 and EUR 3,350 million with its domestic supply chain, and supported about 36,200 jobs including the supply chain. Copper in wires and cables accounts for 47% of direct value added, copper production for 26%, the collection and trade of scrap for 20% and copper-alloy castings for 7%. Taxes and contributions associated with the chain amount to about EUR 1,120 million excluding VAT.

Secondary copper – about 305 kt melted directly by semis producers and foundries and 19.7 kt refined – supplied 38% of copper first used in Italy. The copper stock in use of about 9.5 Mt releases about 330 kt a year at end of life, of which 56% is recovered. Domestic scrap supply derived from scrap use and trade exceeds the scrap used (coverage ratio 108%; 95% with supply estimated bottom-up), and Italy was a net exporter of 27.0 kt of copper in scrap. Replacing primary copper one-for-one, secondary copper produced in Italy potentially avoided about 1,060 kt CO_2e in 2024, including new scrap returning from fabrication, and about 580 kt CO_2e counting only copper from end-of-life products; together with 30 Mt of tailings, these burdens arise outside Italy.

Refined copper used in Italy is almost entirely imported; 70% of imports of unwrought copper came from EU partners in 2024 and the partner concentration index was 1,032. Italy is a net exporter of copper tube and pipe fittings and a net importer of other copper semis, mainly wire, by value. The economic results depend most on the copper share of cable production (NACE 27.32), the metal share of copper production (NACE 24.44) and the metal share of cable output, and the emissions potentially avoided on the footprint of primary copper and the quantity of scrap melted directly (copper bridge). In the scenarios to 2035 direct value added ranges from EUR 1,710 million (stress, 2030) to EUR 2,050 million (high circularity, 2035); in the high-circularity scenario the additional secondary feed exceeds the growth of domestic scrap projected by the dynamic model by about 46 kt of copper.

A Data sources and trade

TABLE 46 Main data sources of the CU-IT model

Domain	Source	Use in CU-IT
Structural business statistics	Eurostat sbs_ovw_act, Italy, 2021–2024	Output, value added, employment, labour costs, turnover (46.77, 38.3, 24.44, 24.54, 27.32)
Production and trade	Eurostat PRODCOM (DS-059358), 2019–2024; Comext DS-045409, 2015–2025	Semis, wire rod, refined copper and castings; CN 7402–7413, partners, unit values
Input-output and national accounts	Eurostat FIGARO naio_10_fcp_ip4, 2024 (2023 as test); symmetric table of Italy transmitted by ISTAT (naio_10_cp1700, 2022) as validation; nama_10_a64(_e)	Domestic coefficients, value added, household demand; employment
Company and industry data	Aurubis (Avellino), KME, Almag, Prysmian, Nexans (La Triveneta Cavi) reports; Assomet (2026); Assofond (2025)	Plant output, inputs, energy and employment; copper use and scrap-based output; castings
Taxes and public support	DG TAXUD, Data on Taxation Trends 2026; Italian legal acts on compensation of indirect emission costs and energy-intensive users	Tax rate on labour; description of national schemes
Electricity	ISPRA, Rapporti 430/2026; Eurostat nrg_pc_205	Grid CO_2 factor (consumption and production basis); industrial electricity prices
Dynamic model of copper in use	Passarini et al. (2018, JRC); Glöser et al. (2013); ISTAT population; Comext refined copper net imports	End-use shares, lifetimes, collection and recovery rates; inflow path
Life-cycle data	ICA (2023); ICA/IWCC/CDA (2024); Nuss and Eckelman (2014); Aurubis (2026); product EPDs	Footprints, energy, tailings, acidification, water

Eurostat data as available on 31 October 2026.

TABLE 47 Foreign trade in copper by product, Italy, 2024

CN	Product	Imports, kt	Exports, kt	Imports, EUR m	Exports, EUR m	Balance, EUR m
7402	Unrefined copper, anodes	11.6	14.0	55	120	65
7403	Refined copper and alloys, unwrought	561.6	42.0	4,807	357	−4,450
740311	– of which cathodes	526.7	19.7	4,527	163	−4,364
740321	– of which brass, unwrought	6.5	12.1	42	91	49
7404	Copper waste and scrap	153.1	193.1	950	1,164	214
7405	Master alloys of copper	0.9	0.9	9	12	4
7406	Copper powders and flakes	3.5	6.2	39	59	20
7407	Copper bars, rods and profiles	43.3	110.1	336	827	491
7408	Copper wire	163.5	48.2	1,443	437	−1,006
7409	Copper plates, sheets and strip	73.4	40.2	700	370	−330
7410	Copper foil	2.3	6.4	34	69	35
7411	Copper tubes and pipes	42.0	54.3	393	603	210
7412	Copper tube or pipe fittings	7.3	43.9	139	883	743
7413	Stranded wire and cables of copper	21.2	8.1	210	82	−128

Source: Eurostat Comext (DS-045409), 2024. Quantities in gross weight. Flows include re-exports. Copper ores and concentrates (CN 2603) are negligible (below 0.2 kt). Unit values of copper scrap (CN 7404): imports EUR 6,206/t, exports EUR 6,028/t, against an LME copper price of EUR 8,446/t (LME 2025; ECB 2026); unit value of cathode imports EUR 8,595/t.

TABLE 48 First-round domestic demand by segment and product group, 2024 (EUR m)

Product group (CPA)	I1	I2	I3	I4	I5
Electricity, gas, steam	20.5	33.6	57.6	14.0	33.6
Coke and refined petroleum	5.3	6.0	10.4	2.5	1.7
Chemicals	9.1	9.8	16.8	4.1	22.2
Rubber and plastics	5.7	10.2	17.5	4.2	69.2
Transport and storage	77.8	35.2	60.5	14.7	75.6
Repair and installation	8.7	1.1	2.0	0.5	10.7
Fabricated metal, machinery	21.0	65.5	112.4	27.3	139.1
Professional and support services	130.8	28.2	48.4	11.8	126.0
Motor-vehicle trade and retail trade	10.8	3.8	6.5	1.6	27.8
Other products	165.8	72.0	123.6	30.0	257.5
Total domestic first-round demand	455.3	265.6	455.6	110.5	763.4
Intermediate consumption excl. metal inputs (I1: all), incl. imports	497.6	340.5	584.2	141.7	1,267.8
Domestic first round relative to the row above	92%	78%	78%	78%	60%

Source: IGMNiR CU-IT v1.0; FIGARO 2024 domestic and all-origin coefficients. For I1 the first round equals the domestic input coefficients of the parent products (CPA_G46, CPA_E37-39), with purchases within the chain removed and without rescaling, times output; for I2–I5 purchases of metals, ores, scrap, wholesale trade and waste services (CPA_C24, CPA_B, all of CPA_G46, CPA_E37-39) are excluded as purchases within the chain and the remaining inputs are rescaled with the all-origin structure of the parent product. The full vectors by 64 CPA products are in the model package (file 04).

TABLE 49 Specification of the input-output module

Element	Specification
Table	Eurostat FIGARO, product-by-product, 2024 (naio_10_fcp_ip4, edition of July 2026); 2023 table as a structural test; domestic block (origin IT), 64 CPA products; validation with the national symmetric table of Italy for 2022 (ISTAT via Eurostat naio_10_cp1700), converted to the 64 FIGARO products
Multipliers	Type I: $L = (I - A_d)^{-1}$; Type II: households endogenised – labour income × (1 − tax rate on labour) × propensity to consume, spent with the domestic household consumption structure of FIGARO
Employment	Persons employed 2024 (nama_10_a64_e) per unit of output, by CPA product; by construction the coefficients reproduce total employment of 26,509.6 thousand persons in Italy in 2024 (a construction check)
I1 first round	Domestic input coefficients of CPA_G46 (46.77) and CPA_E37-39 (38.3) excluding chain products, times the output of the copper share; structural test: all SBS intermediate consumption spread over the parent column
I2–I5 first round	Non-metal intermediate inputs = output − GVA − metal share × output; distributed with the all-origin structure of CPA_C24 (I2–I4) or CPA_C27 (I5) excluding metals, ores and scrap; domestic part enters the Leontief model
Value added	All segments from structural business statistics (value added at factor cost); indirect and induced value added at basic prices (FIGARO); conversion of direct value added to basic prices with FIGARO net other taxes on production as a structural test
Taxes	Tax rate on labour × labour cost; corporate income tax IRES (24%) × taxable share of operating surplus net of other taxes on production; net taxes on production and on products used from FIGARO coefficients, net of other subsidies (IRAP is an other tax on production in the Italian national accounts)

Model package. The CU-IT package archived by IGMNiR contains the model modules M1–M6 and M2b (Python), all input data with extraction dates and dataset codes, the parameter file with sources and ranges (Annex B), scenario definitions, automated consistency checks and the run log. Machine-readable files accompany each run: results by segment, first-round demand vectors, the copper balance and dynamic-model series, route footprints, parameters with reliability classes and the correlation matrix, Monte Carlo summaries and a SHA-256 manifest. A replication script recomputes direct and Type I value added and employment from these files (largest difference 0.002); a quality-control script checks the key numbers in both language versions. Run ID: CUIT-1.0-e47162ffa3.

TABLE 50 Input data files of the model package

File	Content	Size, KB	SHA-256 (first 16 characters)
comext_it_other_sec.csv	Comext, other secondary materials	4	b876ad0bc95b0a0f
comext_it_partners.csv	Comext, copper trade by partner	170	7218da9e1bdc8c37
comext_it_world.csv	Comext, copper trade with the world	40	692f6c81fb6751a1
figaro_it_2023.csv	FIGARO 2023, use by Italy (naio_10_fcp_ip4)	9,460	bd0f54805760c776
figaro_it_2024.csv	FIGARO 2024, use by Italy (naio_10_fcp_ip4)	9,460	f5eb1482053e7a61
istat_it_2022.csv	Same table, 2022, converted to the FIGARO layout (validation)	367	e9dd1fcd4d6fd1ed
istat_siot_it.csv	Symmetric input-output table of Italy, ISTAT (naio_10_cp1700), 2021–2022	1,606	00947ec628eb464c
it_facilities.csv	Installations (Annex C)	2	bb4c78c96a9227fc
nama_emp.csv	Employment by industry (nama_10_a64_e)	10	6fc178f084d47fda
nama_gva.csv	Output and value added by industry (nama_10_a64)	29	43380d4346d05584
prodcom_it.csv	PRODCOM, copper products (DS-059358)	14	ae022bc1fa3bf23a
sbs_it.csv	Structural business statistics, Italy (sbs_ovw_act)	17	3f571eaef54b1ab8

Source: IGMNiR CU-IT v1.0, package file 09 (full hashes of code, data and results). Eurostat data as available on 31 October 2026.

Replication. The package runs with Python 3 (numpy, pandas, scipy, matplotlib, pypdf), Node.js with the docx library and LibreOffice. The command bash build_all.sh recomputes the model, the Monte Carlo runs, the figures and the EN and PL reports; bash build_all.sh --no-mc reuses the stored Monte Carlo results. The run identifier in results/run_id.txt (CUIT-1.0-e47162ffa3) is a hash of the parameters, the code and the input data and must be identical after replication; file 09_manifest_sha256.csv lists the SHA-256 hashes of all files, and the replication script recomputes the headline results from the stored parameters (largest difference 0.002). Eurostat data are reused under the Eurostat copyright notice. Data with restricted use are not redistributed: the paid statistical publication of Assomet (only the summary figures quoted in the report are used), company reports (quoted values only) and commercial market studies (not used numerically). The package is archived by IGMNiR and available on request.

B Parameters and uncertainty ranges

Each uncertain parameter is described by a triangular distribution (low, central, high) within one dataset family; alternative datasets, boundaries, split keys and footprints are treated as structural cases (Chapters 5, 7 and 9). Reliability classes: A – official statistics, scientific literature or company financial statements; B – industry or company data; C – IGMNiR assumption or derived value.

TABLE 51 CU-IT parameters

Parameter	Central	Low	High	Class	Basis and source
Copper value share, 46.77	0.180	0.120	0.240	A/C	NF share of 46.77 value (≈0.40) x copper share of NF scrap value handled in Italy (≈0.45; Comext CN 7404 imports and exports EUR 2.1 bn in 2024)
Copper employment share, 46.77	0.110	0.070	0.150	C	NF employment share of 46.77 (≈0.28) x copper share of NF scrap tonnage handled (≈0.4)
Copper value share, 38.3	0.050	0.030	0.080	C	copper share of value of NACE 38.3 in Italy (materials recovery of all waste streams): cable granulation, WEEE and ELV dismantling
Copper employment share, 38.3	0.045	0.025	0.070	C	copper share of 38.3 employment
Metal share of copper production output	0.720	0.640	0.800	A/C	metal share of output value of copper production (cathode, scrap, zinc for brass): KME SE 2024 revenue EUR 1,540.8 m vs revenue net of metal ≈EUR 499 m (0.68); higher for wire rod (cathode ≈95% of rod value)
Copper-alloy share of 24.54	0.380	0.280	0.500	B/C	copper-alloy share of the value of NACE 24.54 (casting of other non-ferrous metals; rest mainly aluminium and zinc die-castings): copper-alloy castings 48.8 kt in 2024 (Assofond) are 22.5% of the PRODCOM tonnage of 24.54 (216.6 kt), at a higher value per tonne
Metal share of copper-alloy castings	0.550	0.450	0.650	C	metal share of output value of copper-alloy castings
Copper share of 27.32	0.750	0.600	0.900	C	copper-conductor share of activity of NACE 27.32 (wires and cables; rest aluminium conductors and optical fibre)
Copper share of cable output value	0.650	0.580	0.720	A/C	copper share of output value of wires and cables: mass balance of PRODCOM 27.32 (2024) – winding wire 205 kt at ≈0.96 Cu, cables up to 1 kV 477 kt at ≈0.5, cables above 1 kV 296 kt at ≈0.2 – gives ≈485–515 kt of copper, consistent with ≈499 kt of wire rod and wire available (production plus net imports); m5 x cu_cable x output / LME = ≈464 kt

Parameter	Central	Low	High	Class	Basis and source
Bridge term: refined use not entering semis, kt	10.0	−30.0	70.0	C	difference between apparent use of refined copper and refined copper actually entering semis and castings (stock changes, other uses not covered), kt Cu; enters the bridge for direct melting S_dm = copper in semis + copper in castings - (apparent refined use - other uses) + d_ref. Central +10: average of the bridge 2022-2024 (≈305 kt) instead of the single year 2024 (≈295 kt); low end: year-to-year range of the bridge; high end: plant input data (Almag 93.1% recycled input, KME Italy purchased scrap 68% of external metal input, Serravalle tube billet 54% scrap) and Assomet scrap-based output net of zinc indicate ≈330-390 kt
Copper content of bars, rods and profiles	0.620	0.590	0.670	C	average copper content of bars, rods and profiles: free-cutting brasses CW614N/CW617N 57-59% Cu (EN 12164/12165), with some copper bars
Copper recovery, secondary refining	0.950	0.920	0.970	C	copper recovered per t of copper in secondary feed of refining
Copper content of scrap (CN 7404)	0.770	0.700	0.850	A/C	copper content of imported scrap CN 7404: unit value EUR 6,206/t = 0.73 of LME; brass-rich mix priced close to full copper content (payable ratio ≈0.95); exports have a content 0.02 lower (unit value EUR 6,028/t)
New scrap per t of copper in semis	0.170	0.130	0.210	C	new (fabrication) scrap arising in Italy per t of copper in semis: turning swarf of brass rods machined in Italy (≈85 kt Cu), strip punching (≈22 kt), wire drawing and cable making (≈13 kt), tubes, copper bars and castings (≈15 kt); ≈135 kt in total
Per-capita inflow vs EU-28 2014	1.10	0.90	1.50	C	Italian per-capita inflow of copper into use relative to EU-28 2014 (5.91 kg/cap, JRC Passarini et al. 2018); copper entering fabrication ≈775-815 kt (semis and castings ≈820 kt plus net imports of semis ≈70 kt less new scrap) minus copper in net exports of products (valves, fittings, machinery, appliances), not quantified
Per-capita inflow 1960 vs 2014	0.300	0.200	0.450	C	per-capita inflow in 1960 relative to 2014: refined copper use 1965 192 kt and 1968 226 kt (US Bureau of Mines, Minerals Yearbook 1968) against refined net imports 617 kt in 2014
Inflow growth 2025–2035, per year	0.005	0.000	0.020	C	annual growth of per-capita inflow 2025-2035 (electrification, grids)
Scaling of product lifetimes	1.00	0.80	1.20	A/C	scaling of mean product lifetimes (JRC: building 40, electrical 25, machinery 18, transport 16, consumer 8 years; SD 0.3 x mean)
Scaling of collection and recovery	1.10	0.95	1.20	A/C	scaling of end-of-life collection and recovery rates by waste stream (Glöser et al. 2013, global 2010) to European levels: EU end-of-life recycling rate about 60% (Ciacci et al. 2017; Soulier et al. 2018)

Parameter	Central	Low	High	Class	Basis and source
Propensity to consume	0.900	0.860	0.940	C	average propensity to consume out of net labour income; household saving ratio Italy ≈9%
Tax rate on labour	0.439	0.420	0.460	A	tax rate on labour income incl. social contributions: implicit tax rate on labour, Italy 2024, 43.86% (DG TAXUD, Data on Taxation Trends 2026)
Scaling of employment coefficients	1.00	0.90	1.10	C	uncertainty of FIGARO employment coefficients
Taxable share of operating surplus	0.400	0.250	0.550	C	operating surplus net of production taxes, depreciation, interest and losses; many small enterprises
Footprint of primary copper, t CO_2e/t	3.64	2.80	3.96	B/A	primary copper cathode, global average, cradle-to-gate: ICA (2023 data, as reported in the Aurubis Environmental Footprint Declaration 2026) 3.64 t CO2e/t; ICA Copper Environmental Profile 2023 (2019 data) 3.965; Nuss and Eckelman 2014 2.8
Direct melting, whole site, t CO_2e/t Cu	0.300	0.200	0.450	B/C	scrap collection and preparation plus melting and casting of directly melted scrap, t CO2e/t Cu (whole-site values per t Cu, therefore an upper estimate of the increment over melting cathode): brass mill ≈0.48 MWh/t gross (≈0.80 MWh/t Cu) site electricity and 0.81 GJ/t gross gas (Almag 2024, data for 2023: Scope 1+2 0.17 t/t gross), scrap preparation residual
Secondary refining in Italy, t CO_2e/t	1.50	1.00	2.20	C	secondary refining of scrap to refined copper and anodes in Italy (small furnaces), t CO2e/t Cu
Italian grid factor, t CO_2/MWh	0.193	0.180	0.210	A	Italian electricity, CO2 per MWh: ISPRA Rapporti 430/2026, consumption basis 192.6 g/kWh (2024); production basis 209.4
Primary energy, primary copper, GJ/t	53.7	42.1	68.6	A	primary energy (cumulative energy demand), primary copper, GJ/t: Nuss and Eckelman 2014, 53.7 (42.1-68.6)
Primary energy, direct melting, GJ/t	5.00	3.00	8.00	C	additional primary energy of direct melting relative to cathode, GJ/t
Primary energy, secondary refined copper, GJ/t	22.0	17.0	28.1	A/C	primary energy, secondary refined copper, GJ/t; Nuss and Eckelman 2014 secondary 28.1
Tailings per t, t	93.5	84.0	103.0	B/C	t of flotation tailings per t of primary cathode: ICA global 93.5, +/-10%
SO_2 per t, kg	31.2	15.0	35.0	B	kg SO2 emitted per t of primary cathode, ICA global life-cycle inventory
Blue water per t, m^3	57.3	40.0	75.0	B	blue water consumption of primary copper, m3 per t (ICA 2023 LCA)
EU ETS price, EUR/t	64.8	60.0	74.0	A	EU ETS average 2024 (EEA)
Shadow cost of carbon, EUR/t	208	164	314	A	EIB shadow cost of carbon 2025, EUR 165/t (130-250) in 2016 prices, rebased to 2024 prices with the euro-area HICP (126.07/100.23)

Correlated groups (Gaussian copula parameter): copper shares of scrap trade and recovery (ρ = 0.8); primary footprint and primary energy (0.7); metal shares of copper production, castings and cables (0.7); lifetimes and per-capita inflow (−0.3). Copper from direct melting and the split key of NACE 24.44 are recomputed in each draw from the copper bridge. Fixed inputs (copper price EUR 8,446/t; copper contents of tubes and castings; PRODCOM volumes; apparent refined use 548.3 kt; net imports and population; scenario capacities) are listed in the model package.

C Installations of the copper value chain

TABLE 52 Main copper installations in Italy

No.	Installation and activity	Town	Segment
1	Aurubis Italia – wire rod from cathode (shaft furnace)	Avellino (Pianodardine)	I3
2	KME Italy – copper and copper-alloy semis	Fornaci di Barga (LU)	I3
3	Serravalle Copper Tubes (KME) – copper tubes	Serravalle Scrivia (AL)	I3
4	AML – copper strip	Quargnento (AL)	I3
5	Brass rod mills of the Brescia district (Almag, Eredi Gnutti Metalli, Metallurgica San Marco)	Brescia area	I2
6	Copper Italia (Italchimici) – oxygen-free copper wire	Lumezzane (BS)	I2
7	Prysmian – cable plant	Arco Felice, Pozzuoli (NA)	I5
8	Prysmian – cable plant	Pignataro Maggiore (CE)	I5
9	Prysmian – submarine and power cables	Giovinazzo (BA)	I5
10	Prysmian – cable plant	Livorno	I5
11	Prysmian – cable plant	Merlino (LO)	I5
12	Prysmian – cable plant	Quattordio (AL)	I5
13	La Triveneta Cavi (Nexans) – cables and wire drawing	Montecchio Maggiore (VI)	I5
14	Tratos – cables	Pieve Santo Stefano (AR)	I5
15	Portovesme CRM Hub (Glencore) – CRMA strategic project (Li, Mn; copper recovery per press reports)	Portoscuso (SU)	outside model
16	Recover-It (Circular Materials) – CRMA strategic project	Veneto	outside model
17	9PV-up (9-Tech) – CRMA strategic project, PV panel recycling	Meolo (VE)	outside model

Locations at town level. The list covers major installations identified in company reports, websites and EU documents (2024–2026); it is not exhaustive for semis producers, foundries, cable makers and recyclers. Producers of semis often use both cathode and scrap; the segment shown is the predominant input. CRMA strategic projects are listed for information and are outside the 2024 model.

D Glossary

- **Potentially avoided burden** – environmental credit for displacing primary production with secondary material, conditional on the substitution assumed.
- **Coverage ratio** – domestic supply or output relative to use; not a measure of self-sufficiency.
- **Direct melting** – melting of clean copper and copper-alloy scrap by semis producers and foundries without refining to cathode; in Italy mainly in the brass rod mills.
- **Toll processing (conto lavorazione)** – processing of metal owned by the customer for a conversion fee; the metal value is then not part of the processor's output.
- **Dynamic material-flow model** – model that tracks copper entering use by year and end use and its release at end of life after a distributed product lifetime.
- **Compensation of indirect emission costs** – state aid compensating part of the emission costs passed through in electricity prices (Directive 2003/87/EC, Article 10a(6); in Italy D.Lgs. 47/2020, Article 29); in national accounts an other subsidy on production.
- **Energy-intensive users (energivori)** – Italian category of undertakings with high electricity use that benefit from reduced system charges (DL 131/2023 from 2024).
- **DL, D.Lgs., DM, DPCM** – decree-law (converted into law by Parliament), legislative decree, ministerial decree, decree of the President of the Council of Ministers.
- **IRES / IRAP** – Italian corporate income tax (24%) / regional tax on productive activities (3.9% standard rate).
- **End-of-life recycling rate** – share of copper in end-of-life products that is recovered as secondary copper.
- **GVA** – gross value added: output minus intermediate consumption; from structural business statistics at factor cost.
- **Gross contribution / net effect** – activity associated with the chain at fixed coefficients / change that would result from a policy or shock after resources are reallocated; the report shows gross contributions only.
- **HHI** – Herfindahl–Hirschman index of concentration (0–10,000).
- **New and old scrap** – scrap from fabrication of semis and products (e.g. turning swarf of brass rod) / scrap from products at the end of their life.
- **Observation / estimate / model result (O/E/M)** – status of a figure: published data / data combined with allocations or calibrated parameters / result depending on counterfactual or dynamic assumptions.
- **Type I / Type II effects** – direct plus supply-chain effects / plus effects induced by household spending.

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CU-IT is a transparent, reproducible model linking official Italian and EU statistics, company financial and environmental reports, published product footprints, a dynamic model of copper in use and the process metallurgy of copper. It estimates the gross economic and fiscal contribution of the copper industry in Italy – collection and trade of scrap, scrap-based and cathode-based copper production, copper-alloy castings and cables – the emissions and other burdens potentially avoided by secondary copper, and the industry's importance for the security of supply.

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