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Report

Available Recycled Aluminum and Copper in the United States – Copper Highlights

Prepared for the Recycled Materials Association

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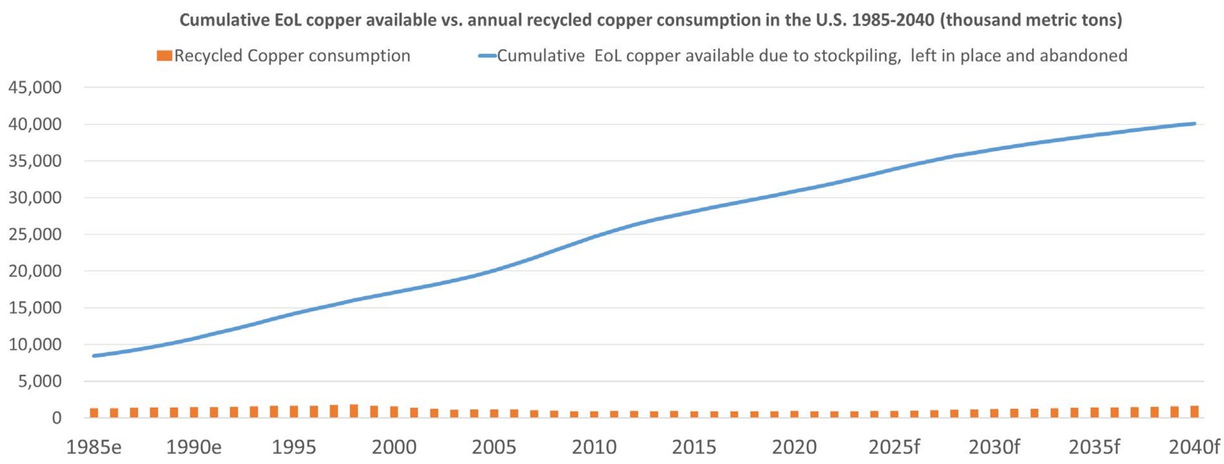
EXECUTIVE SUMMARY - Copper

New research performed by MM Markets indicates that there is no shortage of available End of Life (EoL) copper material in the United States.

The investigation examined and modelled current and projected levels of supply and demand of this recycled material over the period 1920 through 2040, using the material use period from 1940-2040. Available supply is defined as EoL copper left in place, stockpiled, and/or abandoned, therefore, not recycled, landfilled or lost, and is also referred to as the “reservoir” of available supply.

Based on primary and secondary research conducted by MM Markets, the report findings indicate that available US end-of-life recycled copper tonnage significantly exceeds annual US recycled copper consumption. Available EoL reservoirs will continue to grow faster than US recycled consumption. This ensures adequate material supply to meet future recycling needs.

Copper



On Copper (1920-2040):

- Available US end-of-life recycled copper tonnage significantly exceeds annual US recycled copper consumption.
- In 2025, available US EoL copper tonnage is estimated to be 35 times larger than consumption.
- The single largest identifiable contributor is electrical copper left in place (including wiring, cables, and other infrastructure), stockpiled, or abandoned.
- This estimate is conservative because it doesn’t account for copper in other non-recycled end-use categories.
- The tonnage of US EoL copper recovered is expected to increase in future, driven by national electrification and sustainability goals.

Copper	Kte 2025	Ktf 2040
EoL Copper Available	33,889	40,085
Recycled Copper Consumption	970	1,624

Note: Kte – Kilo tonne estimate. Ktf – Kilo tonne forecast. Source: USGS/MM Markets

Available US Reservoir
Available EoL reservoirs will continue to grow faster than US recycled consumption. This ensures adequate material supply to meet future recycling needs.

Regulatory Issues and International Trade

- Given ongoing trade regulatory/tariff activity, there is no justification for trade restrictions on exports of copper recycled materials out of the US. The need to retain recycled tonnage in the country to meet domestic demand is not supported. With substantial amounts of copper EoL material available now and into the future, the market—if allowed to operate freely—can continue meeting demand needs.

Background Documentation/Methodology

- The work methodology covered secondary research to screen existing statistics, and primary research to survey key organizations in the value chain. Analysis and reporting merged results of the secondary and primary research, and a base model was originated. This report is supported by a dataset, modelling, slide deck and technical appendix.

Legal Disclaimer

No Warranty or Liability: The calculations, information and forecasts are provided “as is” without warranties of any kind, express or implied, including accuracy, completeness, or fitness for a particular purpose. The author(s) assume no responsibility for any losses, damages, or other consequences arising directly or indirectly from the use of these data and information.

The historical data, calculations, and projections provided herein are based on publicly available sources, including but not limited to U.S. Geological Survey (USGS) publications, trade statistics, industry reports, and other third-party datasets. Where explicit figures were unavailable, data have been interpolated or extrapolated using statistical methods (e.g., linear regression, moving averages) and assumption-driven modelling.

Key limitations and caveats:

- Historical Data Quality – While the underlying sources are considered credible, historical statistics may contain inconsistencies due to methodological changes, revisions, or incomplete records.
- Forecast Methodology – Projections for 2025–2050 are estimates based on the parameters, not predictions. They rely on assumptions regarding economic growth, recycling rates, technology adoption, trade patterns, and policy developments.
- Parameters and Uncertainty – Where no explicit forecast data existed, assumptions were applied, including trend continuity, stable market drivers, and absence of major geopolitical or macroeconomic shocks. These assumptions may not hold in real-world conditions.
- Exclusion of Extreme Events – Forecasts do not incorporate the impact of rare but high-impact disruptions such as global pandemics, commodity price crashes, wars, trade embargoes, or severe supply chain breakdowns.
- Policy and Regulatory Risk – Changes in environmental regulation, trade tariffs, decarbonisation mandates, or recycling incentives could significantly alter consumption and trade flows beyond what the model projects.
- Technological Shifts – Potential breakthroughs in materials science, product design, or recycling technologies could reduce or increase copper/aluminium demand in ways that differ substantially from the historical trend.
- Use of the Data – The results are provided for informational and analytical purposes only and should not be relied upon for investment, commercial, or operational decision-making without further validation and context-specific due diligence.
- Recommendation: Users should treat these figures as indicative estimates, supplement them with updated market intelligence, and test multiple scenarios—particularly when informing strategic or financial decisions.

TECHNICAL APPENDIX

Purpose

The report's purpose was to provide detailed information on the US markets for EoL available recycled copper and aluminum, including current levels of demand and availability, in addition to projected availability, and indicate the available material tonnage reservoir, now and in the future. The report will be used to address concerns on potential shortages of recycled material in the US and support the association's efforts to promote the free and fair trade of recycled copper and aluminum.

Supporting Materials

A slide deck and dataset accompany this report.

Methodology

- Secondary research to screen existing statistics. Searching existing academic studies and projects on the topic.
- Primary research surveyed key organizations in the value chain. MM Markets was given important access to ReMA membership.
- Analysis and reporting merged results of the secondary and primary research.
- A base model was originated to calculate vital figures from key sources and set parameters.
- A slide deck, dataset, executive summary, technical appendix and meetings formed the output materials.
- See methodology slides and dataset parameters for further detail.

Acronyms, Definitions
(Not exhaustive)

1. Abandoned - A metal shape or product which has been left behind and is no longer used. The metal has not entered the recycling chain and has not been landfilled
2. Available EoL – available end-of-life material left in place, stockpiled or abandoned
3. Construction - Buildings, tubes, building wiring, telecommunications, general wiring
4. Consumer Products (appliances, tools)
5. Material in use: material consumed be different
6. EoL recycled copper/aluminium: US apparent copper/aluminium consumption (including copper/aluminium exported and imported as metal or semis), recovered after the life time of the sector specific applications.
7. Cumulative - Increasing by successive additions
8. DoE - Department of Energy
9. Electrical and Electronic Products – Including utilities easily accessible electrical equipment switchgear cabinets, rack-mounted gear, modular transformers, embedded/larger infrastructure duct banks, underground feeders, cable in conduit, embedded busways, power cable
10. EoL – End of Life. Materials and products reaching end of use, transitioning to a resource for future use through recycling or reuse
11. EPA – Environmental Protection Agency
12. ICSG – International Copper Study Group

13. Industrial Machinery - High value machinery motors, transformers, process lines, large, embedded machinery, mining equipment, turbines, ship-mounted systems). In the context of industrial construction machinery building plant
14. IAI - International Aluminum Institute
15. Kte – Kilo tonne estimate
16. Ktf – Kilo tonne forecast
17. Left in place - A metal shape or product which has not been moved. The metal has not entered the recycling flow
18. Other - e.g., coins, military, art
19. Post consumer – Aluminum and copper originating from flows such as households and businesses after the consumer has used the product for its intended purpose
20. Prompt - Residuals of industrial processes, the remainder from production of products such as sheet metal, automobiles, and electronics, power cables etc. Immediately reused in-house, never reaching the marketplace
21. Stockpiled - Gathering in a supply of metal shapes or product in preparation for possible future use/recycling. The product is not in use, has not been landfilled, and has not entered the recycling stream
22. Transportation (cars, trains, aircraft)
23. UNEP - United Nations Environment Programme
24. US recycled copper/aluminum provision = recycled material produced and imported
25. US recycled copper/aluminum requirements = consumption and exports
26. USGS – United States Geological Survey

References

COPPER

Sources for EoL Copper left in place, abandoned or stockpiled	
Construction (buildings, pipes, wiring)	EPA – Sustainable Management of Construction and Demolition Materials notes that metals from C&D are recovered when accessible, but wiring and piping in concrete, walls, or underground is often not retrieved.: https://www.epa.gov/smm/sustainable-management-construction-and-demolition-materials National Demolition Association (NDA) – NDA Demolition Safety Manuals and guidance indicate metals are recovered when safe and accessible, but embedded runs in concrete or inaccessible voids are frequently left to avoid cost/time overruns. Wallsten, B. (2013) – On the hibernation logic behind urban infrastructure mines explains why copper in embedded building systems and underground ducts often remains unrecovered, focusing on economic and logistical barriers. Resources, Conservation and Recycling, 73, 229–240. Hulthén, E., et al. (2013) – Underground infrastructure as urban mines – Metal recovery from hibernating stocks: Case study shows large amounts of copper left in situ in older buildings' embedded wiring and piping. Journal of Cleaner Production, 55, 103–111.
Electrical & Electronic Infrastructure and products	Krook et al., 2011 (J. Cleaner Production): quantifies hibernating copper in local power grids; shows buried cables are often uneconomic to recover even at high Cu prices—i.e., left in situ. Wallsten, 2013 (RCR): explains the "hibernation logic" of subsurface infrastructure mines—cables/pipes routinely abandoned underground due to economics/logistics. NEC (2002 onward) abandoned-cable provisions – Code articles (e.g., 725.25 / 800.25) require removal of abandoned communications/low-voltage cables (esp. in plenums), implying the legacy stock of abandoned cabling that earlier went unrecovered/left in place; compliance is uneven. carlonsales.comcablinginstall.comICC Digital Codes DoD / Army UFGS 33 71 02 (Underground Electrical Distribution): explicit option to "abandon in place those no longer used ducts and cables" if they don't interfere—clear U.S. evidence that underground electrical assets are often left. City/State code adoptions reflecting NEC 725.25: e.g., NYC codified removal of accessible abandoned Class 2/3/PLTC cables—again evidencing the problem space and policy

	response. EPRI (transformer/substation LCM & decommissioning guides): practical utility guidance covering end-of-life removal & recycling of transformers, ground grids, wiring—useful to support high recovery where accessible; complements the infrastructure literature by showing where LIP is not expected (inside substations/equipment). DOE/NREL & decommissioning planning docs (power plants/PV): show standard practice to remove equipment (transformers, wiring) at decommissioning, but also acknowledge site-specific choices and, in broader DOE material, “in-place decommissioning” as a legitimate pathway in some contexts. CIGRÉ (cable decommissioning): international utility body documenting decommissioning phase issues; work programs and TBs acknowledge that underground/submarine cables may be decommissioned in-place depending on costs/impacts.
Industrial Machinery	Okon Recycling (2025), "Industrial Equipment Disposal: How to Responsibly…" Okon Recycling+3Okon Recycling+3Recycling Today+3 Okon Recycling (2025), "Exploring Asset Recovery for Industrial Machinery" Okon Recycling Wang, T. et al. (2021), “Copper Recycling Flow Model for the United States Economy” sciencedirect.com+4pmc.ncbi.nlm.nih.gov+4pubs.acs.org+4 Material flow models (e.g., Wang et al., 2021) indicate wide variability in EoL copper recycling rates by application—26–82% globally, averaging ~40%. This implies that for industrial machinery (lower-volume and harder to recover), a higher portion of EoL copper is likely Recycling Today (circa 2001), “Copper—From Mining to End Markets” Recycling Today+2researchgate.net+2 A historical industry note: In 1997, gives context to industrial machinery’s role in copper flows.
Transportation	Goonan, T.G., 2010, Copper Recycling in the United States in 2004: U.S. Geological Survey Circular 1196–X. https://pubs.usgs.gov/circ/circ1196x Jody, B.J., Daniels, E.J., et al., 2010, Recycling of Automotive Shredder Residue. Argonne National Laboratory, ANL/ESD/10-8. https://www.anl.gov/ Auto Shredder Residue (ASR) Studies Quantify post-shred copper losses. Example finding: copper losses to ASR can be 3–20% of the copper content of a vehicle depending on separation technology. Automotive Recyclers Association, 2020, Industry Facts and Statistics. https://www.a-r-a.org/ -94% of vehicles are processed; abandoned ELVs (junked but not recovered) make up the small “left in place” hibernating stock for transportation equipment. Stodolsky, F., Vyas, A., Cuenca, R., 1995, End-of-Life Vehicle Recycling: State of the Art of Resource Recovery from Shredder Residue. University of Michigan Transportation Research Institute / USCAR: Uses OEM and dismantler data to show that a small but measurable fraction of ELVs remain abandoned in situ (driveway, field, remote property) for years—this is the direct “left in place” analog for vehicles. One benchmark: late-1990s estimates put abandoned vehicles at ~6% of ELV generation in the U.S. U.S. Environmental Protection Agency, 2017, End-of-Life Vehicle Management & Automobile Shredder Residue. https://www.epa.gov/smm/sustainable-management-materials-automotive U.S. reporting aggregates all unrecovered flows—landfill, dissipative, and left-in-place—without isolating electrical systems.
Consumer Products (appliances, tools)	EPA / E-Waste Management Statistics: E-waste recycling in the U.S. is very low: Only 13.6% to 26.6% of e-waste was recycled in 2010. The rest likely ended up in landfills, informal recycling, or stockpiled—representing copper that was not recovered, effectively “left in place.” ScienceDirect+7SSRN+7Wiley Online Library+7Wikipedianswai.org C&EN, 2024) indicates the copper recycling rate from e-waste was about 60% globally, which also implies around 40% remains unrecovered and likely “left behind.” Chemical & Engineering News International Copper Alliance (ICA) – Broad Recycling Rates nswai.org+15International Copper Association+15PMC+15 U.S. Electronics Waste Facts A 2024 news piece states that only 22% of e-waste was formally collected and recycled in the U.S.—implying around 78% of electronic devices (hence their copper) are not formally recovered, translating into copper left in place within landfills or informal channels. Vox A material flow model for the U.S. (Wang et al., 2021) finds that 26–82% of EoL recyclable copper is recycled, averaging ~40% globally. This wide range underscores the variability across product types, but for small consumer products, likely lower recovery rates, so a large share is unrecovered/ left in place. American Chemical Society Publications+3PMC+3Wiley Online Library+3

Other (e.g., coins, military, art)	Coins: U.S. Mint / Federal Register: Since 2007, it's regulated (via 31 CFR Part 82) that melting or exporting U.S. pennies (1¢) and nickels (5¢) is prohibited except in very limited cases. This policy greatly restricts copper recovery from coins, meaning the bulk of copper in circulation remains "left in place" indefinitely. moderncoinmart.comNumismatic News+1 Numismatic News (2025): Confirms the legal restrictions make melting/exporting pennies nearly infeasible and notes that many people hoard pre-1982 copper pennies, reinforcing the idea that coins remain embedded in private or informal stockpiles. Numismatic News Conclusion Practically ≥95% of copper in coins remains in use, in collections, or in circulation—not recovered as recycled material—thus supporting a very high "left in place" rate for coins. Military (Small Arms Ranges / Ammunition) GNEST Journal (Hardison Jr., 2004): Documents that spent cartridge bullets (which have copper jackets or casings) accumulate in range soils over decades. These residues are environmental legacies—effectively copper left in place. Getty+5journal.gnest.org+5Princeton University+5 Frontiers in Environmental Science (2024): Reviews remediation at decommissioned firing ranges, emphasizing that contaminated soils—including copper debris—remain on site unless explicit cleanup occurs, showing enduring "left in place" copper. frontiersin.org+1 Conclusion A significant portion of copper from military ammunition accumulates in situ at ranges and is only partially reclaimed. Art / Monuments Nature article on bronze sculptures (2024): Examines outdoor bronze sculptures (typically 80–90% copper alloys) left in situ for decades; their volume, weight, and preservation implies that at EoL, most are not scrapped or recovered, but rather remain embedded as cultural heritage. nature.com+2en.wikipedia.org+2 MDPI Metals (2023): Studies corrosion patinas on outdoor copper/bronze sculptures, indicating their long-term outdoor durability and presence—again demonstrating that they remain in place and are not recycled. mdpi.com Conclusion: Art pieces and monuments containing copper typically stay in place well beyond their expected lifespans and are rarely dismantled for metal recycling – strongly indicating 90–100% of that copper remains left in place.

Not exhaustive.

1. **USGS Circular 1196-X (2010)** Indicates 60% of old scrap copper is unrecovered (i.e., 40% recovery avg.) in 2004. Implies that some sectors are well above that (transport, B&C), others well below (electronics). https://pubs.usgs.gov/circ/circ1196x/pdf/circ1196X.pdf

2. **UNEP Recycling Rates of Metals Report (2011)** Global EoL recycling rate for copper: 50%. Electronics/E&E: 30–40%. Construction: 60–70% depending on recovery of buried cable. https://www.resourcepanel.org/reports/recycling-rates-metals

3. **Wang et al. (2021), PMC8154355 Copper recycling in the U.S.** ranges 26–82% depending on sector. Transport and B&C at the higher end (~70–80%), E&E and consumer electronics lower. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8154355

4. **Automotive (ELV) Studies – Argonne & USCAR Copper recovery in vehicles**: 75–80%. Losses occur primarily in shredder residue (ASR). https://deepblue.lib.umich.edu/bitstream/handle/2027.42/192065/CSS01-01.pdf

5. International Copper Study Group (ICSG) **Copper Factbook 2020** – breakdown of global copper end-uses (construction, electronics, transport dominate). U.S. Geological Survey (USGS) & Copper Development Association Product Type Average Copper Lifespan

6. USGS, UNEP, and ICA, U.S. Department of Energy (DOE) **appliance durability reports**

7. Statistical studies from **Müller, Glöser, and Eckelman et al.**

8. Lifecycle data from EPA. Consumer Reports durability databases

9. Fraunhofer ISI/MM Markets https://internationalcopper.org/wp-content/uploads/2023/01/NA_2020-2022-11-07-768x587.png and https://pubs.acs.org/doi/10.1021/es400069b