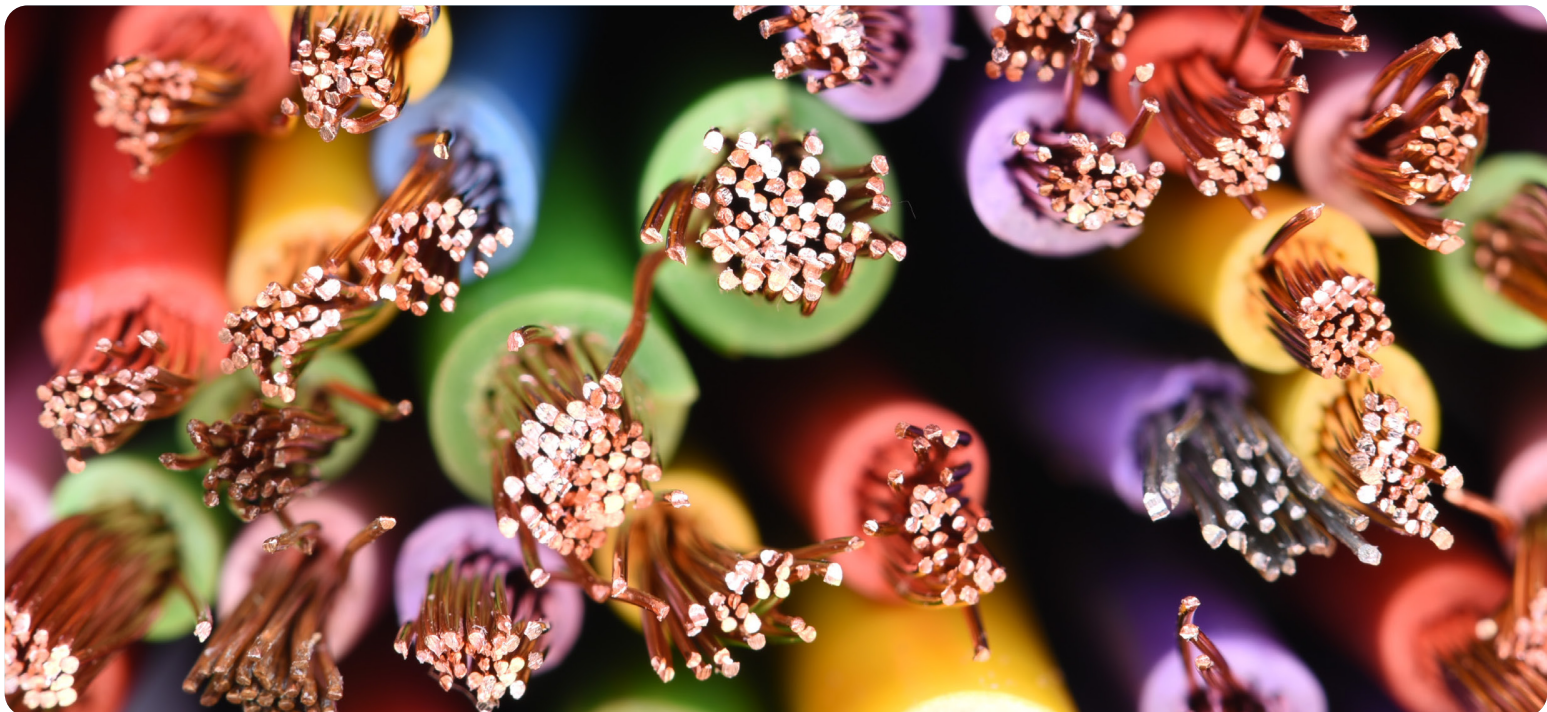




Research

Copper crunch: challenges of copper consumption

October 2024



Report from Material Focus, featuring Bloomberg Intelligence and Royal Society of Chemistry

The summary

Copper is vital to our everyday lives - from the tech we use, medical equipment, transport and our energy system. The demand for copper continues to grow and in May 2024 copper reached its peak price of \$11,000 per tonne for the first time. This briefing paper provides a summary of research that identifies the growing gap between the amount of copper produced and the rising demand for copper in the UK and internationally. The research identifies the significant role that recycling of copper could play in helping to fill this gap, particularly by recycling the copper held onto or thrown away by UK households. This research has been developed through a collaboration between Material Focus, Bloomberg Intelligence and the Royal Society of Chemistry.

Key findings

Research from Material Focus, the organisation leading the UK's Recycle Your Electricals campaign, reveals that the UK's **1.3 billion unused or binned electricals** could hold the answer to the nation's fast approaching gap in the supply of copper to meet growing demand¹. The research reveals the UK is a copper urban mine in the making; there are **823m unused or broken tech items** hiding in UK homes. These cables and other electricals, plus those that have already been thrown away, contain a staggering **£266m worth of copper**, enough to provide 30% of the copper needed in our green future¹.

Cables represent one of the UK's biggest e-waste challenges - and one of the biggest copper opportunities as UK householders are throwing away or holding onto on average 23 cables. Research by the [Critical Minerals Association](#) has identified that cables contain at least 20% of copper - which means that across all UK households, we could extract an incredible 3,251 tonnes of copper in cables.²

New analysis from Bloomberg Intelligence shows a growing gap between the amount of copper produced and demand for the raw product - globally there will be a **6.5 million tonnes gap by 2033**.

The same analysis identifies that better recycling of copper could potentially meet the additional demand.

Recycle your Electricals research also shows UK households contain **38,449 tonnes of copper** hidden inside unwanted and thrown away electricals - and according to Bloomberg Intelligence analysis, this is enough to fulfil the UK's annual demand for copper contained in tech.

The Royal Society of Chemistry has found that 347,000 tonnes of copper are needed to build wind turbines and solar panels by 2030. Recycle Your Electricals has identified that **30% of this copper could be produced from recycled copper that is currently thrown away**.

¹ Research conducted by Opinium for Material Focus between 23rd – 26th July 2024 amongst a nationally-representative sample of 4,000 UK adults.

² Copper tonnage and value research - analysis undertaken by Material Focus.

Why copper is important

Copper is considered one of the most important metals - it has unique qualities that make it essential in our everyday lives. It's one of the few metals that is anti-bacterial making it ideal in medical equipment. It's very malleable, and yet also strong, which means it can be formed into small wires without breaking. This versatility, alongside its high electrical and heat conductivity make it essential in electrical products. What makes copper a truly circular and sustainable material is that it can be recycled infinitely without reducing its quality - the same piece of copper can be used again and again. Copper has also a vital role in our energy future by providing a key material in the production of green energy and products such as solar, wind farms and electric vehicles.



6.5m

6.5 million tonne gap in copper by 2033

30%

Recycled copper could provide 30% of copper needed for the green future

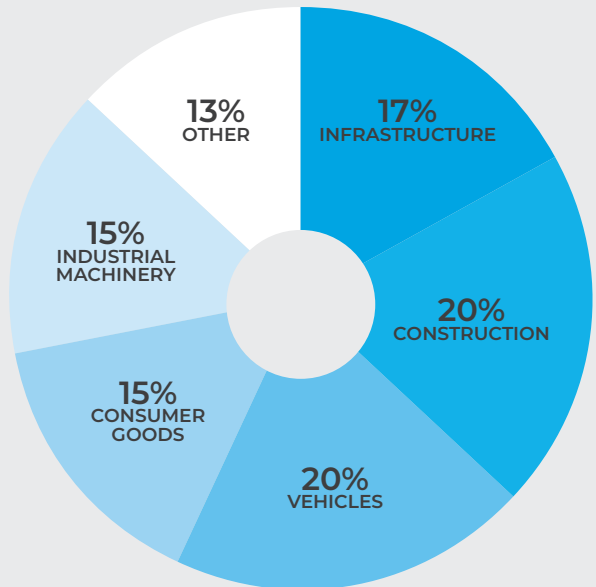
Bloomberg Intelligence: Analysis of copper demand and supply

1. UK consumption of copper

Most of the copper consumed in the UK today is imported into the country in the form of semi-processed or manufactured goods. In 2023, Bloomberg Intelligence estimates that **the UK “consumed” 250,000 – 280,000 tonnes of copper across a variety of end-uses spanning from infrastructure projects such as wind farms, passenger vehicles to electrical goods.** Copper consumption in passenger vehicles has grown rapidly as more electric vehicles (which use two to three times more copper than a regular gasoline car) gain market share, with around 17% of all vehicles sold in the UK being electric. We estimate about 50,000 – 60,000 tonnes was consumed in the automotive sector in 2023. Consumer durables such as washing machines, electrical goods and electronics accounted for about 35,000 – 45,000 tonnes of copper consumed, according to our estimates. Utilising the 23,000 tonnes of copper contained in old electrical items could supply a large proportion of the UK’s demand in new consumer durables – almost a perfect circular economy. If the additional 16,000 tonnes that ends up in landfill each year, that would be enough for a fifth of the UK’s annual demand.

The UK’s consumption of copper in primary manufacturing activities has declined over the past 20 years to the extent that only around

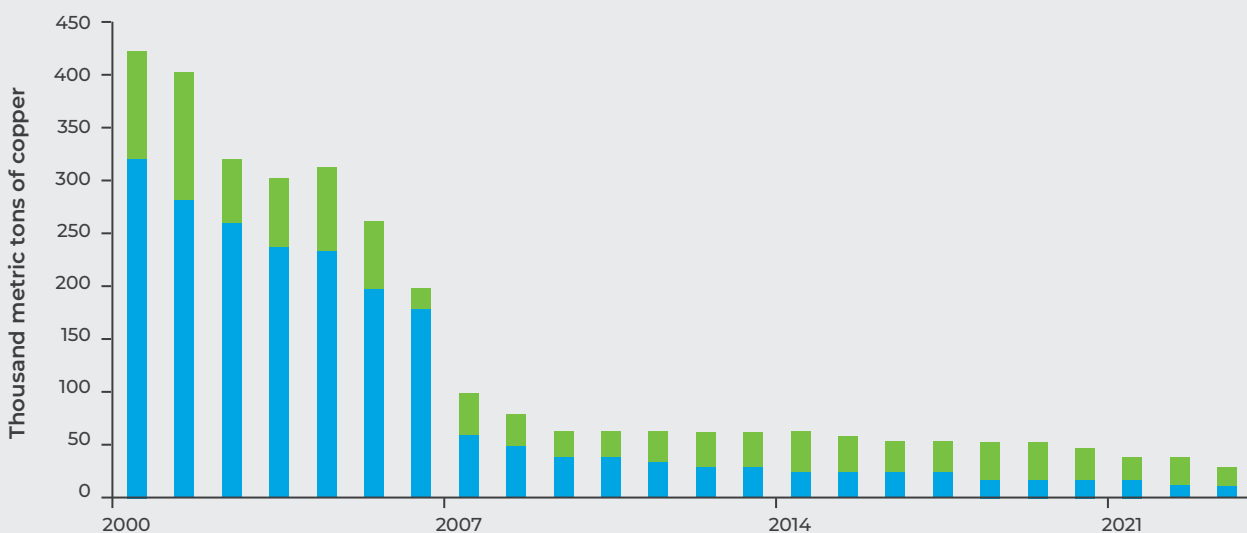
UK’s copper demand by end-sector



Source: International Wrought Copper Council, Wood Mackenzie, Bloomberg Intelligence

30,000 tonnes of metal was consumed in 2023, down from over 400,000 tonnes in 2000. Half of the copper used in manufacturing semi-fabricated goods comes directly from recycled materials, which is higher than the global average of around 30%. While the UK does a good job of recycling already, the copper in redundant electrical items could supply all of the UK manufacturing needs for an entire year.

UK’s copper consumption in primary manufacturing



Source: International Copper Study Group, Wood Mackenzie, Bloomberg Intelligence

LME copper price



Source: Bloomberg

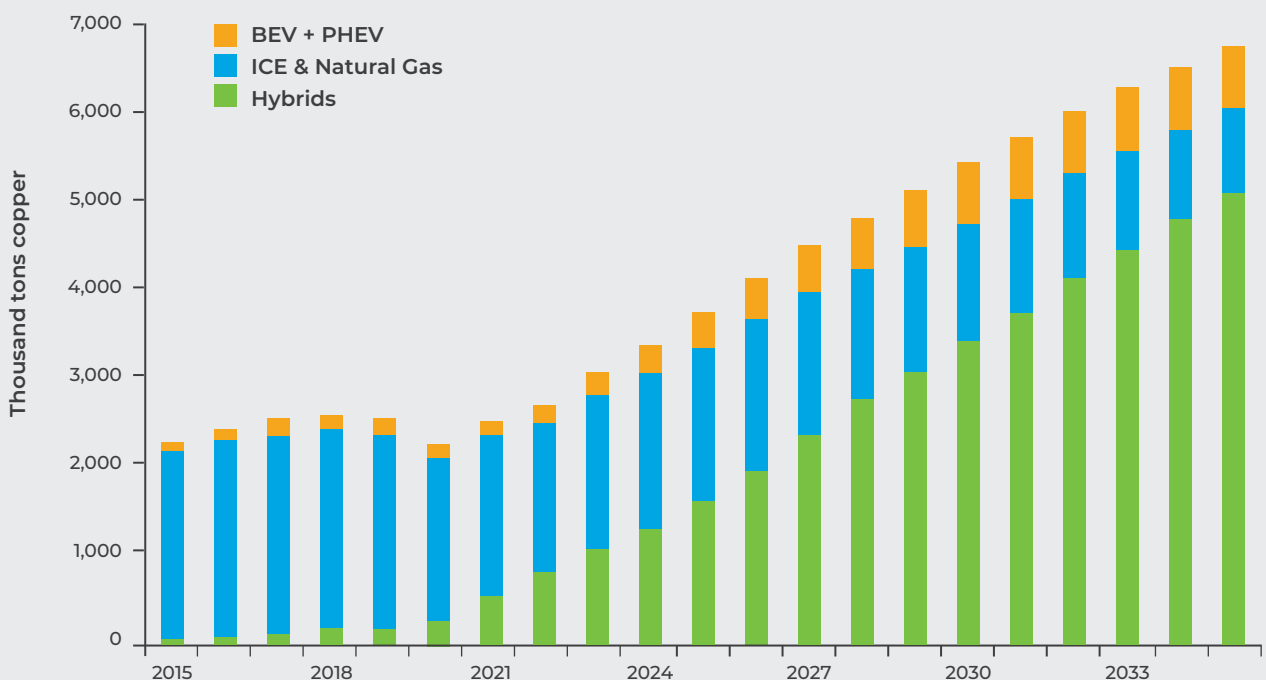
2. The Value of Copper in UK Homes

The copper price hit a record of \$11,300 a tonne in October 2021 and has been above \$10,000 a tonne on several occasions since then, highlighting the metal's increasing scarcity. At a current price of \$9,100 a tonne, the copper contained in **the UK's stock of redundant electrical items is worth nearly £158 million, while the UK throws away about £108 million worth of copper each year.**

In part, copper's price has been driven by the strong inflation the world has experienced in the recovery

from the global pandemic, but growing demand along with tighter supply could see the price stay elevated and potentially increase further over the longer term. The drive to decarbonise is going to require significantly more copper. The global build out of renewable power generation in the form of wind and solar farms, and the switch from gasoline cars to electric could keep copper demand growing at 2.5 to 3% a year, which would require an additional global 7-7.5 million tonnes over the next 10 years. The growing fleet of electric vehicles could account for over 3 million tonnes globally.

Copper demand growth in the global automotive sector



Source: International Copper Association, International Wrought Copper Council, BloombergNEF, Bloomberg Intelligence

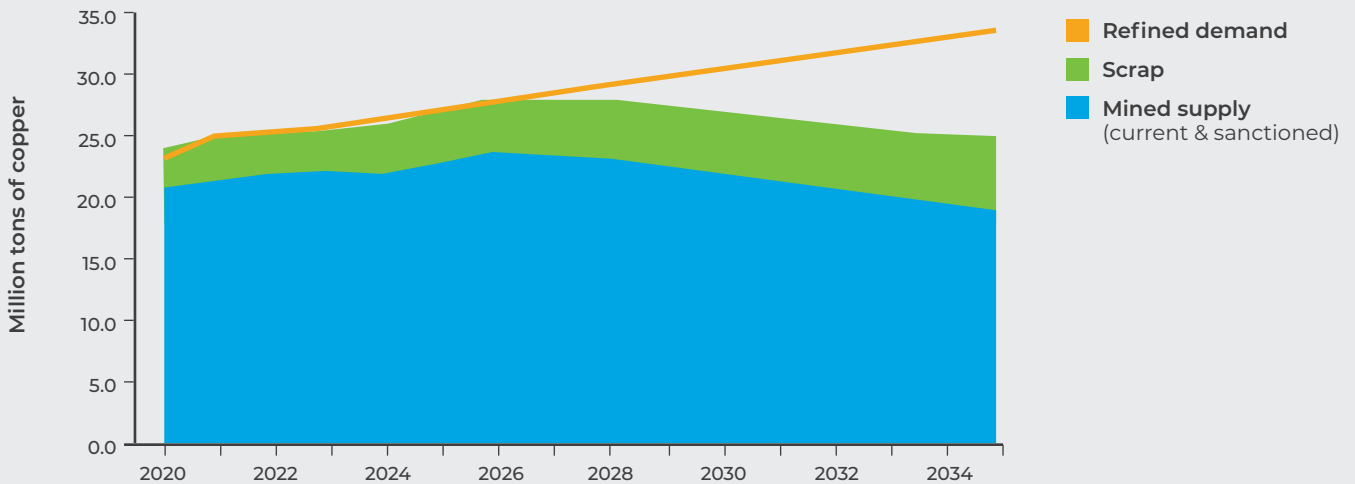
3. Copper's potential supply gap

Supplying the world's copper requirements over the next 10 years is going to be challenging. All the shallow, easy to extract copper deposits have been mined out, with the mining industry forced to target deposits with lower quality ore in locations that lack infrastructure. Securing social and environmental approval to build a new mine is becoming harder, and it can take up to 15 years from discovery to first metal. Many communities simply don't want a mine being built in their backyard. At the current build rate, the copper market could face severe shortages in five to ten years and without new mines being commissioned, **the gap between supply and demand could grow to as much as 6.5 million tonnes by 2033 globally**, according to our calculations.

While some new mines will likely be developed, better recycling practices and efficiencies will be needed to close this gap. Scrap in all its forms from high quality which can be used directly in manufacturing to scrap reclaimed from old

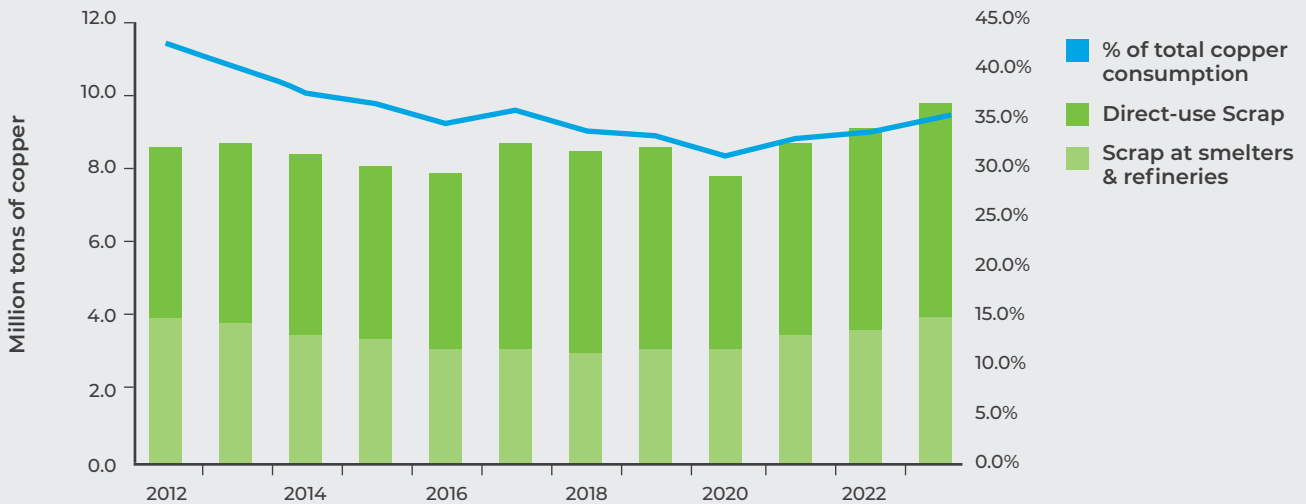
cars and washing machines that needs to be re-processed in a smelter meet just under 30% of overall global demand. Increasing the proportion of recycled copper to 50% from current levels of 30% would be a challenge for global supply chains but could contribute significantly to meeting the additional demand. act copper deposits have been mined out, with the mining industry forced to target deposits with lower quality ore in locations that lack infrastructure. Securing social and environmental approval to build a new mine is becoming harder, and it can take up to 15 years from discovery to first metal. Many communities simply don't want a mine being built in their backyard. At the current build rate, the copper market could face severe shortages in five to ten years and without new mines being commissioned, the gap between supply and demand could grow to as much as **6.5 million tonnes** by 2033 globally, according to our calculations.

Copper's potential supply gap



Source: Wood Mackenzie, ICA, IWCC, ICSG, BloombergNEF, Bloomberg Intelligence

Recycling needs to grow to meet future demand needs



Source: International Wrought Copper Council, Wood Mackenzie, Bloomberg Intelligence

Analysis of copper: demand, environmental aspects, recycling and a circular economy

Copper demand

Copper is vital in all the key technologies essential for the clean energy transition. Wind turbines, solar panels, electric vehicles and the electricity networks that will support electrification and the move away from fossil fuels all require large quantities of copper. Copper is also very important in construction, industrial machinery and other sectors such as consumer electronics. Global demand for copper is predicted to grow substantially in the immediate future – from 26 million metric tonnes (Mt) in 2023 to up to 36Mt in some scenarios^[i] and this growth in demand will continue for many years to come.

For the UK to meet its targets for wind energy by 2030 will require 200,000 tonnes of copper.^[ii]

That's the same as the curb weight of 16,064 London buses.^[iii]

Achieving the Government's target for UK solar photovoltaic capacity in 2030 will require another 147,000 tonnes of copper.^[iv]

Since copper is in such high demand, there is growing concern about supply matching demand. Some analysis predicts supply shortages as early as 2030, current project pipelines of mined copper will reach 25 million metric tonnes (Mt) in 2026 and will decline from then on. Some estimates suggest there will be at least a 31% shortfall in mined copper against expected demand by 2035.^[v]

Environmental aspects of copper extraction

Unlike some materials that are also essential for the clean energy transition, copper supply chains are relatively less geographically concentrated. However, half of the world's copper mines are located in areas of high water stress^[vi] which is already creating environmental and social pressures. Climate change will likely exacerbate the water stress these areas are experiencing, posing risks to supply. Copper ore quality is declining in

many mine sites which changes the economic viability of the mines, and also leads to increased waste which in turn creates environmental and social problems. Currently, greenhouse gas emissions from copper production account for only about 0.3% of total emissions^[vi] however, the combination of growing demand and declining ore grades has the potential to substantially increase this percentage^[vi] to up to 2.7% in 2050. This is problematic given the need to reach net zero emissions.

Therefore, increasing the amount of recycled copper available, material substitution, and reducing material demand will all become increasingly important in helping to match supply and demand, as well as reducing environmental and social impacts.

Copper recycling and the urban mine

Copper can be recycled repeatedly without any loss in quality, so increasing the amount and availability of recycled copper is a key aspect of diversifying supply chains. Some waste streams are already quite well recycled, e.g. manufacturing waste, but others are not. Currently, 17% of copper demand is met via secondary supply globally^[i] but this will need to grow substantially to meet growing demand. Understanding the global stock of copper or "urban mine" will be important in helping to ensure this growth. For example, end of life electric vehicle batteries will likely be an important and growing source of copper by 2030^[ii]. Improving data collection, including the mapping and tracking of material streams, will be essential for the UK to understand the scale and potential of the urban mine particularly in relatively poorly tracked waste streams such as consumer electronics. Investment in recycling infrastructure to increase the amount of copper containing waste that is collected and recycled will also be important, again particularly in poorly recycled waste streams such as e-waste.

Investment in recycling technologies will be crucial

Currently, pyrometallurgical techniques are generally used to recycle copper. These processes tend to have a high energy demand, and high greenhouse gas emissions. The recycling of post-consumer electronics is challenging, partly because it is difficult to sort and separate copper and its alloys economically. New recycling technologies e.g. bioleaching and hydrometallurgical approaches will be important to extract more copper from low grade ores or materials currently considered as waste. Alongside these, advanced separation techniques will be important in upgrading ore quality. Many of these vital technologies are not yet deployed at scale hence the need for investment.

In most contexts, recycling copper will have lower greenhouse gas emissions compared to primary extraction and be less water intensive. This depends on a number of factors including:

- The extraction and recovery technologies and processes used,
- The energy mix used in extraction and recycling
- The quality of the scrap and primary ore.

Life cycle analysis will be important to avoid 'burden shifting' environmental impacts from one part of the value chain to another and vital for comparing trade-offs with new recycling technologies and primary vs secondary extraction.

Demand reduction & circular economy

Designing products to be more efficient in their use of copper will be one aspect in helping to reduce overall copper demand. This means using less copper for the same functionality and performance. In a circular economy, materials are kept circulating for as long as possible at their highest value. Repair, re-use and re-manufacturing are all crucial in achieving a circular economy but there will need to be investment in infrastructure to support the re-use, repair and re-manufacturing of products according to the waste hierarchy. Substituting copper for other materials will also help balance supply and demand. Aluminium is generally viewed as the main substitute for copper; however, it isn't an appropriate material choice in all use cases, isn't such a good conductor and aluminium processing is almost 5x as carbon intensive as copper processing^[i] so the energy demands, and environmental impacts of this substitution need to be considered carefully. New alternatives for copper e.g. carbon nanotubes will be important in the future. Therefore, there needs to be support for world-class research into sustainable materials, including those limiting emissions along entire material and product lifecycles.

Please contact policy@rsc.org to discuss any of the information contained in this document further.

Material Focus research methodology

Research was conducted by Opinium for Material Focus between 23rd – 26th July 2024 amongst a nationally-representative sample of 4,000 UK adults. The research analysed how many electricals UK households hold onto and throw away, using a standard sample of electricals items held in UK households of 20 items including tech and household items. Research was then conducted into the amount of copper contained inside these items utilising Eunomia analysis and desktop research.

[i] **Global Critical Minerals Outlook 2024.** International Energy Agency, 2024.

[ii] *RSC and Gate C analysis. This estimate is based on Labour's mission to double onshore wind and quadruple offshore wind by 2030; 2030 target GW are calculated from 2022 turbine capacity in UK*

[iii] *New Routemaster curb weight is 12.45 metric tonnes*

[iv] *RSC analysis. This estimate is based on our current capacity of 15.8 GW, a 2030 of 47.7 GW, and a material requirement of 4,600 tonnes of copper per GW) an increase of 31.9 GW Gov target to achieve 47.4GW by 2030, 70GW by 2035. **Planning for Solar Farms**, UK House of Commons, 2024*

[v] **Global Resources Outlook 2024**, International Resource Panel, 2024.

[vi] **Global copper cycles and greenhouse gas emissions in a 1.5oC world.** Watari et al., 2022.

Material Focus is an independent, not-for-profit organisation on a mission to save valuable, critical and finite materials inside electricals from going to waste. We do this through

Insights

We identify, produce and share insights to improve the UK e-waste system and inform policy decisions.

Investments

We identify and fund projects that make it easier to reuse and recycle; or that encourage circular design.

Inspiration

We inspire, educate and encourage the UK public to fix, donate, sell and recycle their unwanted electricals through our Recycle Your Electricals campaign.