



To secure raw materials, Europe turns to recycling

Extracting gold, silver and other commodities from discarded goods has industrial, geopolitical and environmental benefits for the EU.

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Dr John Bediako has criss-crossed the globe his whole life. He was born and raised in Ghana, earned a doctorate degree in South Korea and now works in Finland on a key challenge for Europe: reusing electronic waste, or e-waste.

‘It’s a hot topic,’ said Bediako, a researcher in the School of Engineering Sciences at Lappeenranta-Lahti University of Technology. ‘We could clean up the environment and, at the same time, fuel our economy. That fascinates me.’

Extraction challenge

The European high-tech economy runs on raw materials such as cobalt, platinum, palladium and gold, which are present in everything from mobile phones to solar panels.

Yet these materials are often mined in distant places from Europe and in ways that damage the environment.

For example, China supplies [97% of the EU’s magnesium](#), which is used in metal products that need to be strong but lightweight such as bicycles, ladders and laptops. China is also the source of the rare earths used in magnets – an essential component of electric cars and wind turbines.

One answer for Europe is to recycle critical raw materials as long as they can be extracted from the products being discarded. But that’s easier said than done.

Certain materials are present in such small quantities that it’s hard to remove them. Or often the treatment processes don’t allow for a full removal.

Scientists like Bediako are finding new ways to turn heaps of waste into literal goldmines.

Geopolitical goal

Besides bringing environmental benefits, success on this front would bolster the geopolitical position of the EU by making it less reliant on imported raw materials that also come from Russia, the Democratic Republic of Congo and other nations.

‘Europe lacks many precious metals,’ said Dr Elisabet Andres Garcia, project manager at TECNALIA, a private centre for applied research and technological development in San Sebastian, Spain. ‘The best way to prevent Europe’s progress from depending on external countries is to recycle.’

The 2022 Russian invasion of Ukraine prompted a spike in the price of palladium, a soft silver-white metal mined mainly in Russia and used in the production of cars, electronic components and even dental fillings.

To ensure it can retain access to these materials, the EU is focusing on its own production and on research.

In March 2023, the European Commission moved to boost domestic EU output of essential commodities through a draft law. Called the [Critical Raw Materials Act](#), the proposed legislation would set targets of at least 10% for the extraction, 40% for the processing and 15% for the recycling in Europe of these substances.

Gold retrievers

Parallel to this, the EU is building on previous research into e-waste extraction. One new project received EU funding to boost the recovery of precious metals including gold, platinum and silver.

Andres Garcia coordinates the project, which is called [PEACOC](#) and runs for four years until the end of April 2025.

It brings together 19 participants from nine countries: Austria, Belgium, France, Greece, Italy, the Netherlands, Spain, Turkey and the UK. The participants range from the research arm of Italian car brand Fiat to a Dutch maker of 3D printers for ceramics and metals called Admatec Europe.

‘We’re broadening the waste streams we can treat,’ said Andres Garcia. ‘We’re, for example, now recycling certain circuit boards from which we can get precious metals like gold.’

A circuit board from, say, a broken television might be ground down and run through chemical processes pioneered by PEACOC.

This processing eventually teases out precious metals from the waste – something that, until this point, was done only on a limited scale. The processes were developed in a previous EU-funded project called PLATIRUS and are now being designed for bigger operations.

DIY waste crushing

Bediako is focused on smaller, but no less important, volumes as head of another EU-funded research project. It’s called [IONIC BARRIER](#) and lasts for two years through January 2024.

In it, Bediako is trying to develop new chemical processes to extract critical materials from e-waste when only a small amount is present.

‘Sometimes the concentration of target metals is so low that existing methods aren’t able to capture them,’ he said. ‘With the technology I’m developing, we would be able to recover certain materials selectively even when they’re found in very low concentrations and in complex mixtures.’

Bediako is refining his process in the laboratory.

He manually crushes the e-waste, separates the plastic from the metal and then runs it through several steps: submerging the metal in a solution, leaching the resulting mixture and treating elements with absorbents.

At the end of the process, all that remain are gold, palladium and platinum.

Bediako compared the amounts of gold in discarded phones and in the earth to underscore the value of his research.

‘There’s about 350 grammes of gold per tonne of e-waste from phones,’ he said. ‘If you dig up ore from the ground, there’s only about five to 30 grammes of gold per tonne in there. It’s just common sense to improve our recycling abilities.’

Eyes on Athens

A key question is whether these processes can be done in economical and environmental ways.

In other words, researchers need to make their operations efficient enough to compete with mining without being environmentally harmful.

Under PEACOC, large-scale testing is scheduled to take place in 2025 in Athens, Greece at the facilities of a company called Monolithos that sorts and processes automotive catalytic converters. The goal is to learn whether the methods can be applied on a commercial scale.

‘We’re looking at several ways to use the metals we gain from recycling,’ said Andres Garcia. ‘They might be used in 3D printing, in the construction of new autocatalysts, but we’re just as well looking at the fabrication of jewellery.’

One thing is clear: Europe can no longer afford to let valuable resources go unused in the myriad piles of discarded goods that modern economies generate.

‘Our high-tech industries and energy transition need new critical raw materials,’ said Bediako. ‘The least we can do is not to let all of this waste go to waste.’

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