



Where I work Gianluca Torta

Photographed for *Nature* by
Elisabetta Zavoli.

I was the kind of child who liked to explore chemistry, not take motors apart. Now I do both. I earned my undergraduate and master's degrees in industrial chemistry at the University of Bologna, Italy. Pure chemistry was too abstract for me; I wanted something I could apply to real life.

I now study how to recycle metals from industrial and municipal waste – anything from cars to computers. Rare-earth metals, such as neodymium, praseodymium and dysprosium, are in short supply, yet are crucial for manufacturing electric motors for cars, bikes and scooters. Currently, electric motors are typically 'shredded' and the rare-earth elements – which could be reused in new motors – end up in landfill or are lost during iron production.

But it's a huge challenge to get hold of these parts. Last October, I went to a meeting of recycling companies to build up my network. Several businesses have sent me electric motors – almost 1,000 kilograms in total. In this photo, I'm trying to find even more at a scrap dealer in Marotta, Italy.

Electric vehicles rely on the spinning of

powerful magnets to create motion. The magnets make up just 2–7% of the weight of most motors, but hold the real economic value, because they contain the rare-earth elements. I extract the magnets from the motor with a blowtorch, working outside and wearing a blacksmith-type apron and goggles. In the lab, I use acid to dissolve the magnets and create a solution that contains all the rare-earth metals. I analyse the mixture to identify the concentrations of each element.

My goal is to find the most efficient way to recycle these metals – either by dismantling just the magnets or by mechanically separating the entire metal fraction and then isolating the rare-earth elements. Recycling these metals is challenging, but provides an opportunity to reduce the environmental damage of further extraction and to help European countries to depend less on other nations for these metals.

Gianluca Torta is a PhD student at the University of Bologna in Italy, researching how to recover rare-earth metals efficiently from industrial waste. **Interview by Virginia Gewin.**