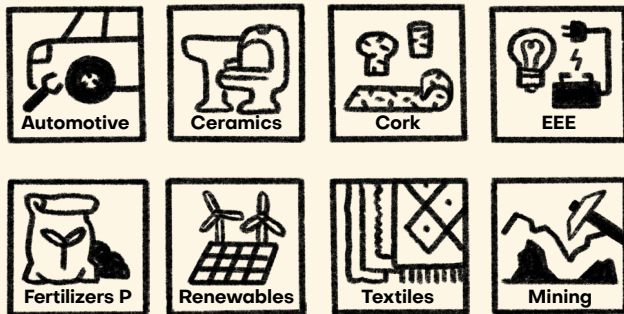


Uses of CRM+

The study started with an identification of the main CRM+ uses in 8 sectors of the Portuguese economy: Textiles and footwear; Ceramics; Cork; Mining; Chemicals and Fertilizers; Electrical and Electronic Equipment (EEE); Renewable energy and Automotive.



All CRMs in the European list are used in Portugal for the sectors considered. The sector with the greatest diversity in the use of CRM+ is the EEE sector (26 CRM+), followed by the chemical and automotive sectors (24 CRM+ each), and textiles (21 CRM+). Renewable energy and ceramics use 14 and 13 CRM+, respectively, while footwear uses 11 CRM+. Finally, both the cork and mining sectors use only 2 CRM+ each.

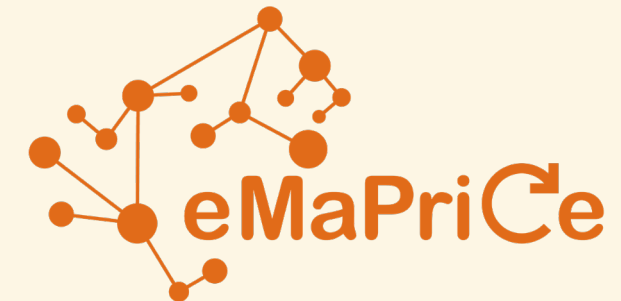
Some of the CRM+ uses are in textile treatments and coatings, in ceramics frits and glazes, thinners, fluxes, pigments in ceramics, ceramic pastes or metal alloys, flame retardants, part of semiconductors, capacitors, magnets, integrated circuits, circuit board, screen glass, etc.

What is the eMaPriCE project?

The project eMaPriCE aimed to identify opportunities to implement Circular Economy strategies, in order to prevent Critical Raw Materials from turning into waste, as well as options for replacing these with non-critical raw materials in the Portuguese economy.

The study had four major results:

- 1. Identify the main uses of the 30 Critical Raw Materials** and natural cork (CRM+) in Portugal.
- 2. Map the value chains for each CRM+ in eight relevant economic sectors**, seeking to analyze whether in Portugal we have a leading role in the end-of-life management of products with CRM+.
- 3. Quantification of CRM+ flows** for 21 representative products.
- 4. Identify opportunities to implement Circular Economy Strategies** in order to prevent CRM+ from becoming waste.



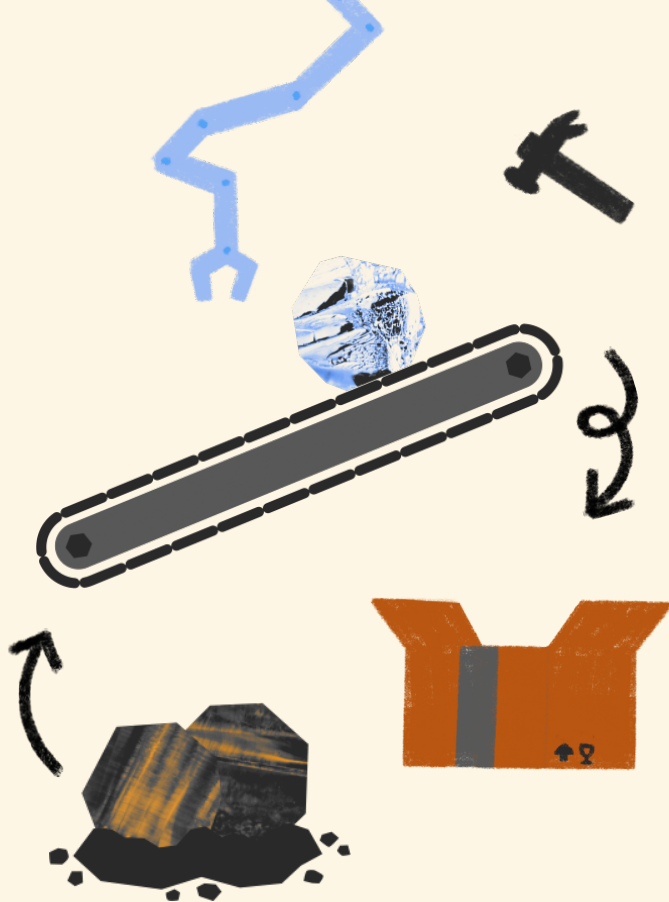
Study on Critical and Strategic Raw Materials and Circular Economy in Portugal



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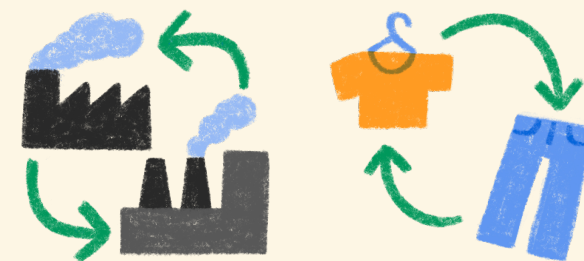
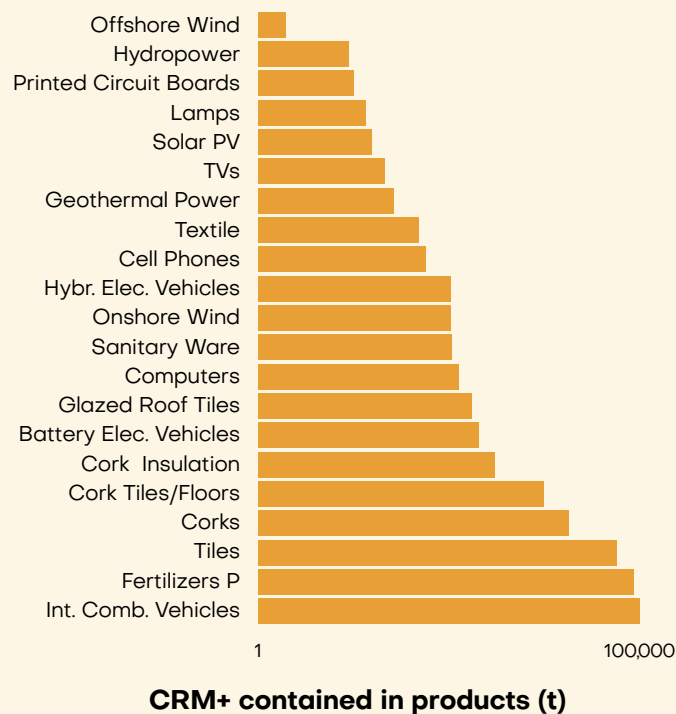
CRM+ Value chain

We analyzed and represented simplified value chains for each of the 31 CRM+ studied, seeking to identify the stages that take place in Portugal and/or in the EU, taking into account the following: Extraction; Processing of raw materials; Manufacture of intermediate and/or semi-finished products and/or components; Manufacture of final products; Use of final products and waste management containing CRM+. In Portugal, only three CRM+ are extracted: lithium (Li) and tungsten (W), as well as natural cork.

Flow quantification

It is estimated that in Portugal, in 2019, there were around 168 thousand t of CRM+ contained in the “stock” of the 21 products analyzed.

The most representative CRM+ are natural cork and phosphorus, followed by magnesium, natural rubber and borate. It is estimated that there were around 14 000 t of cobalt and 2 000 t of lithium contained in existing products in the country. Finally, there were also circa 1 483 t of rare earths and platinum group metals contained in the considered products (representing only 0.48% of all quantified CRM+). In 2019, more than 1 000 t CRM+ were contained in end-of-life product waste.



Circular Economy Strategies

We identified and analyzed Circularity strategies (EC) that prevent CRM+ from turning into waste and thus reduce their imports, increasing the country's self-sufficiency in these materials, such as:

- Maximize efficiency in manufacturing
- Industrial symbiosis
- Design for durability
- Repair, maintain, repurpose
- Shared use of products
- Performance purchase
- Re-use
- Refurbish
- Remanufacture
- Recycle

