The European House Ambrosetti

The evolving scenarios of critical raw materials and the recycling of technology products as a strategic lever to reduce supply risks for Italy

Executive Summary of the Study
June 2022

Carried out for:

erion

The 5 Key Messages of the Study

1. Critical raw materials are characterised by high economic importance and high supply risk. In 2020, the European Union launched an action plan to address dependence on third-country supplies.

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2. Critical raw materials are relevant to multiple industrial ecosystems: in Italy, about EUR 564 billion enter industrial production (equal to about one-third of the 2021 Italian GDP).

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3. The reference scenario of critical raw materials sees a concentration of production where China is today the world's main supplier for 66 percent of critical raw materials.

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4. A contribution to the strengthening of independence from third countries comes from technological products which, if properly recovered and recycled, make it possible to reduce dependence on critical raw materials, enabling economic, social and environmental benefits.

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5. In order for the recycling of technological products to become a strategic lever to reduce supply risks for Italy, it is necessary to act on 3 levels: regulations, volumes and plants equipment, with the ultimate goal of developing local supply chains.

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1. Critical raw materials are characterised by high economic importance and high supply risk. In 2020, the European Union launched an action plan to address dependence on third-country supplies.

Critical raw materials represent materials of strategic economic importance characterised by high supply risk. Specifically, a raw material is considered critical when, at the same time, it presents a supply risk greater than 1.0 (on an index from 0 to 6) and an economic importance greater than 2.8 (on an index from 0 to 9).

The list of critical raw materials is being **continuously updated** by the European Commission. An initial census was completed in 2011 and included 14 critical raw materials, while the most recent version (dated 2020) includes 30 of them, among which **heavy and light rare earths show the highest supply risk**. Not only that, but from 2017 to 2020 the supply risk of rare earths increased by almost 1 point, highlighting the importance of monitoring the future evolution of critical raw materials.

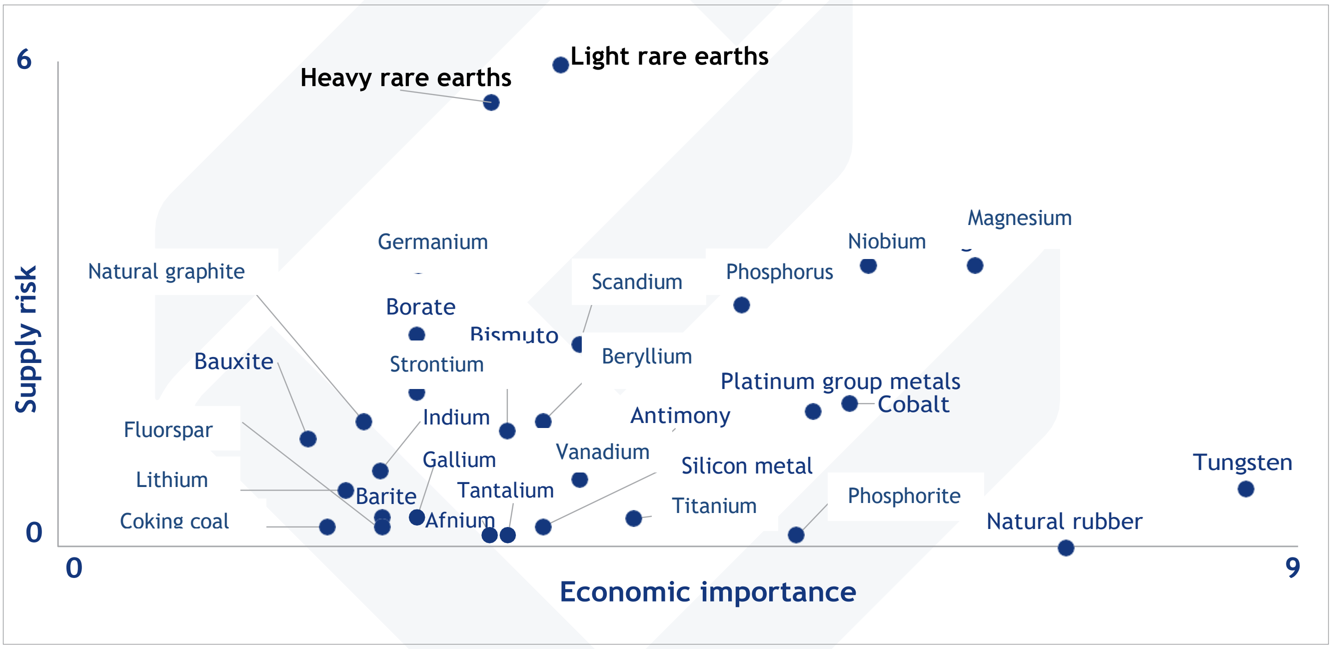
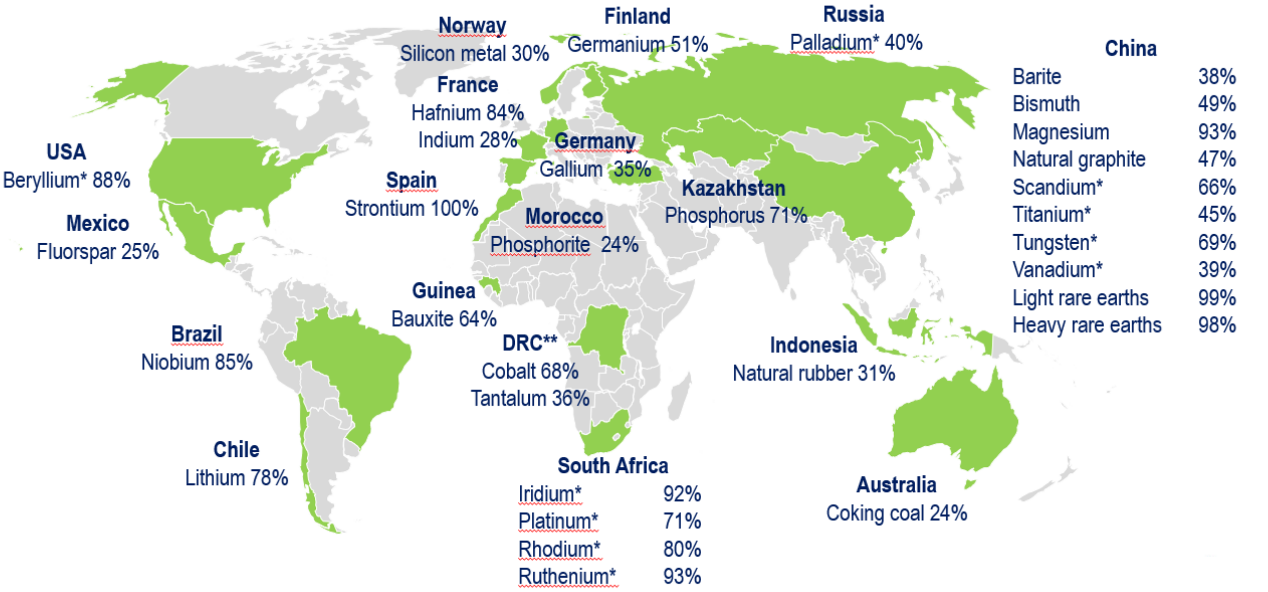


Figure I. Economic importance (x-axis, scale 0 to 9) and supply risk** of critical raw materials (y-axis, scale 0 to 6), 2020. (*) calculated based on the importance of a given material in the EU for end-use applications and on the performance of any substitutes in these applications. (**) calculated based on factors measuring the risk of supply disruptions for a given material (e.g., supply concentration, import dependence, governance performance, trade restrictions and agreements, existence and criticality of substitutes). Source: The European House - Ambrosetti processing of European Commission 2022 data*

Although domestic production of some critical raw materials, particularly hafnium, exists in the European Union, in most cases the **EU depends on imports from third countries**. In particular, China supplies the EU with about 98 percent of rare earths, Turkey with 98 percent of borate, South Africa with 71 percent of platinum, and an even higher percentage for materials in the platinum group: iridium, rhodium, ruthenium. Lithium is 78 percent of the total supplied by Chile, while the supply of some critical raw materials with hafnium and strontium depend on individual European companies.



To address this situation and strengthen its strategic autonomy, in 2020 the European Commission launched an **Action Plan for Critical Raw Materials**. The plan contains 10 lines of action, aimed at fostering the transition to a green and digital economy and strengthening Europe's resilience and autonomy with respect to key transition technologies. More broadly, the Action Plan is based on **3 strategic axes**:

- **reduce dependence on critical raw materials through circular use of resources**, sustainable products, and innovation, including the launch of specific research and innovation projects;
- **strengthen the domestic supply** of critical raw materials in the European Union;
- **diversify supply from third countries** and remove international trade distortions.

2. Critical raw materials are relevant to multiple industrial ecosystems: in Italy, about EUR 564 billion enter industrial production (equal to about one-third of the 2021 Italian GDP).

Critical raw materials are now **essential prerequisites for the development of strategic sectors** such as renewable energy, electric mobility, defence and aerospace, and digital technologies. In particular, as many as **26 out of 30 critical raw materials are essential for the aerospace industry** (87 percent of the total), **24** for the energy-intensive industry (80 percent of the total), **21** for electronics and automotive industries (70 percent of the total), and **18** for the renewable energy sector (60 percent of the total). In this context, **rare earths are present in major industrial ecosystems and show at the same time the highest supply risk.**

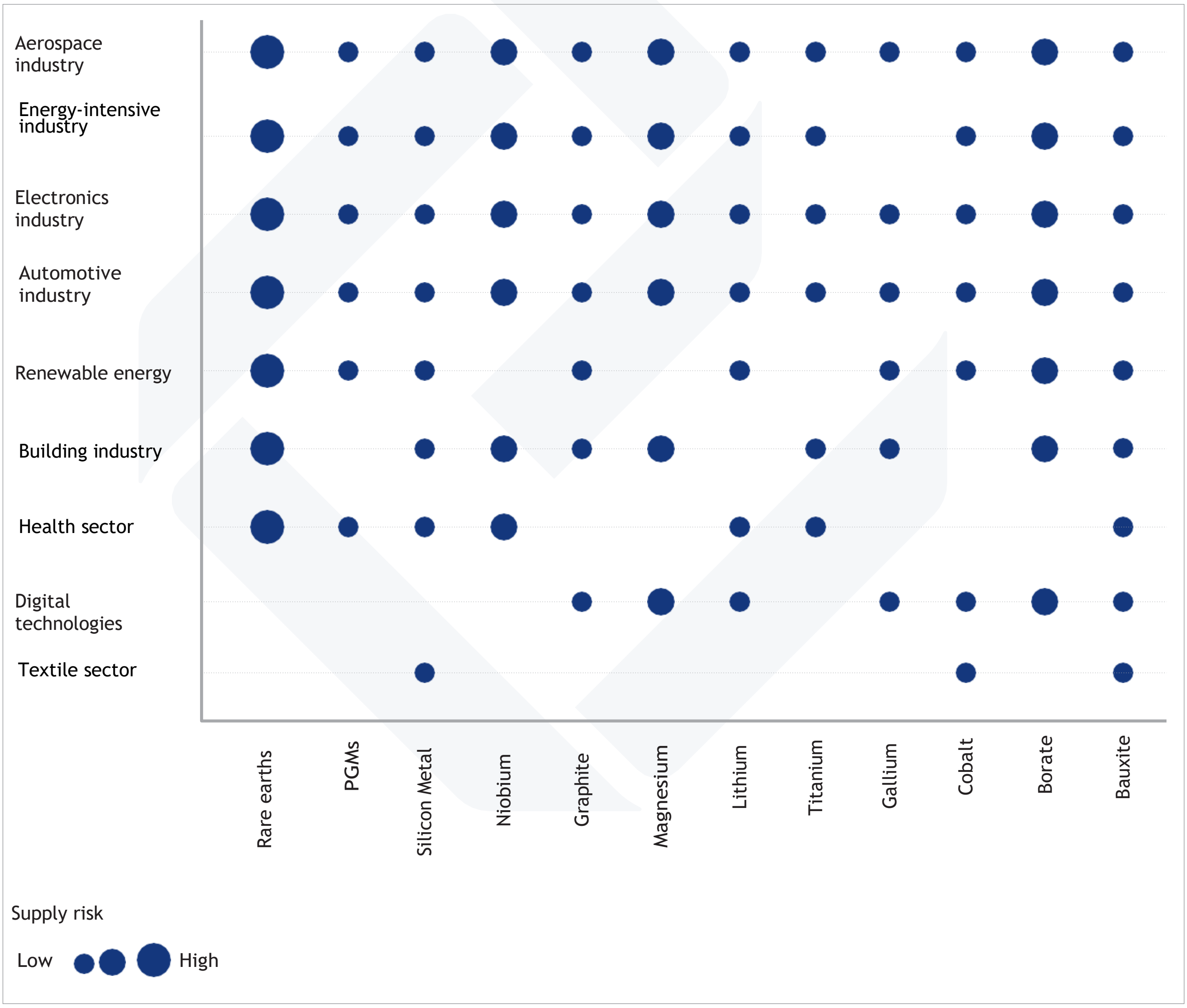


Figure III. Graphic showing the critical raw materials most involved in key industrial ecosystems in 2022. NOTE: PGMs refers to platinum group metals. Source: The European House - Ambrosetti processing of European Commission 2022 data.

To reconstruct the value of industrial production attributable to critical raw materials, The European House - Ambrosetti **surveyed for the first time all the sectors involved** with a bottom-up approach, analysing all the technologies and products in which critical raw materials are involved. Starting from these technologies, it was possible to derive the reference sectors within Italian industrial production and identify a short-list of industrial productions whose value strongly depends on critical raw materials (15 main industrial activities). On this basis, it was possible to quantify the relevance and strategic nature played by critical raw materials and analyse the value of industrial production through the PRODCOM database. The data shows that in 2021 about **EUR 564 billion** are generated by critical raw materials, which, although still limited in quantity, are therefore **essential for almost a third of the country's GDP**.

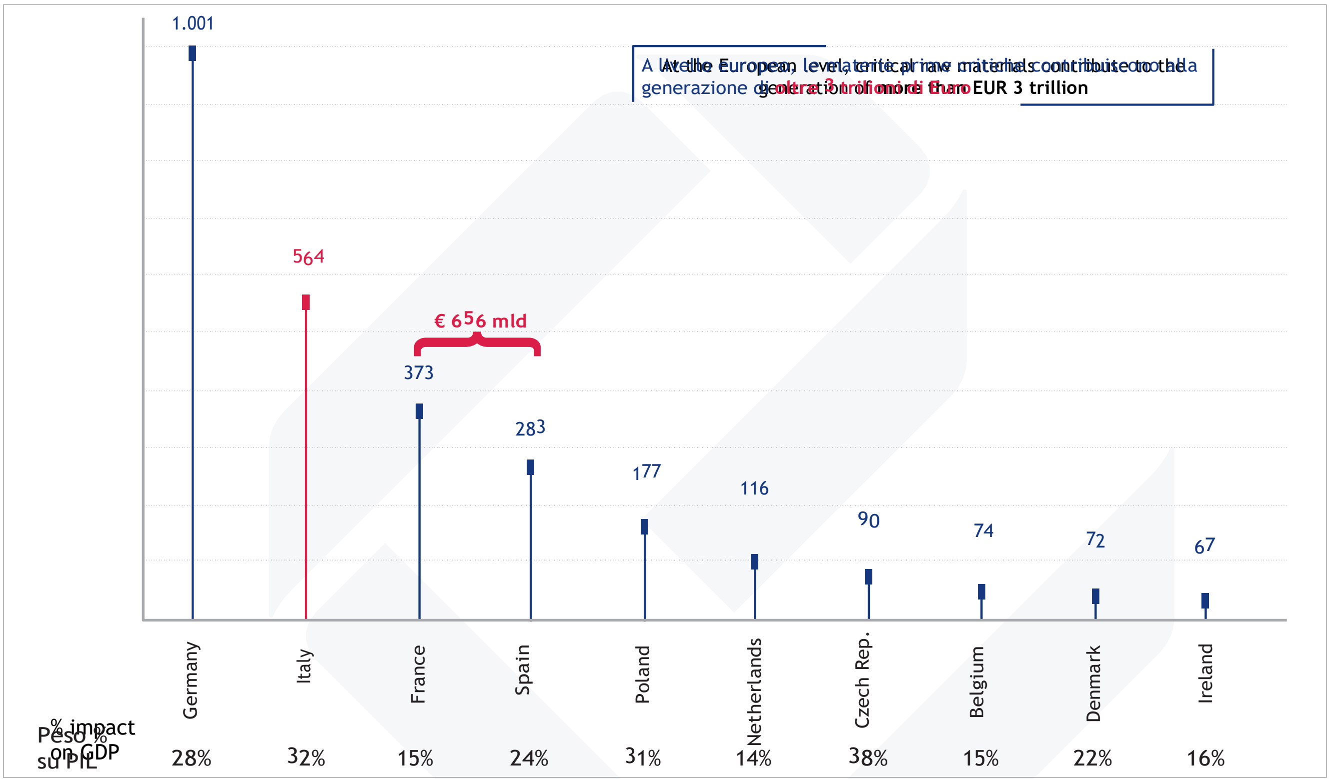
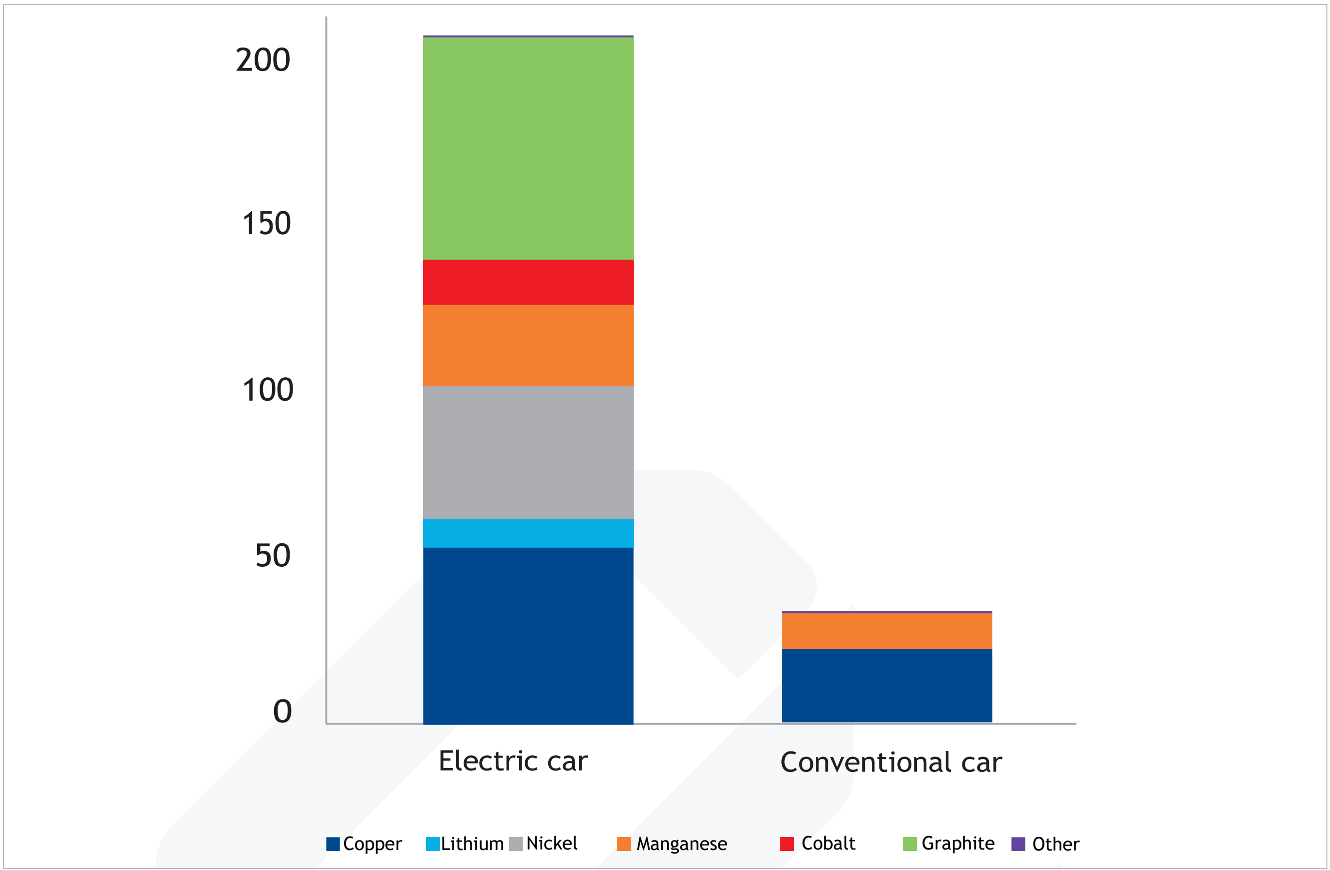


Figure IV. Top 10 countries by contribution of critical raw materials to industrial production (billion of Euros and % impact on GDP). Note that by its nature the PRODCOM database also includes semi-finished products that become part of industrial production. Source: The European House - Ambrosetti processing of European Commission 2022 data.

In this context, a role of primary importance is played by **rare earths**. In fact, although the quantity imported in Italy as of 2021 is 605 tons, they contribute to the generation of nearly **EUR 50 billion**. The central importance of critical raw materials also emerges from the current impact of the Russian-Ukrainian conflict. The critical raw materials with Italy's exposure to Russia (Palladium 35 percent, Rhodium 33 percent, Platinum 28 percent, and primary Aluminium 11 percent) are part of the industrial production of **nearly EUR 107 billion**.

Lastly, it is important to emphasise that critical raw materials, in addition to being fundamental for many industrial activities, are particularly significant for industrial production with strong potential for future growth, starting with technologies for the **ecological transition**. Critical raw materials are, in fact, used in **wind turbines**, **photovoltaic panels**, and **batteries**.



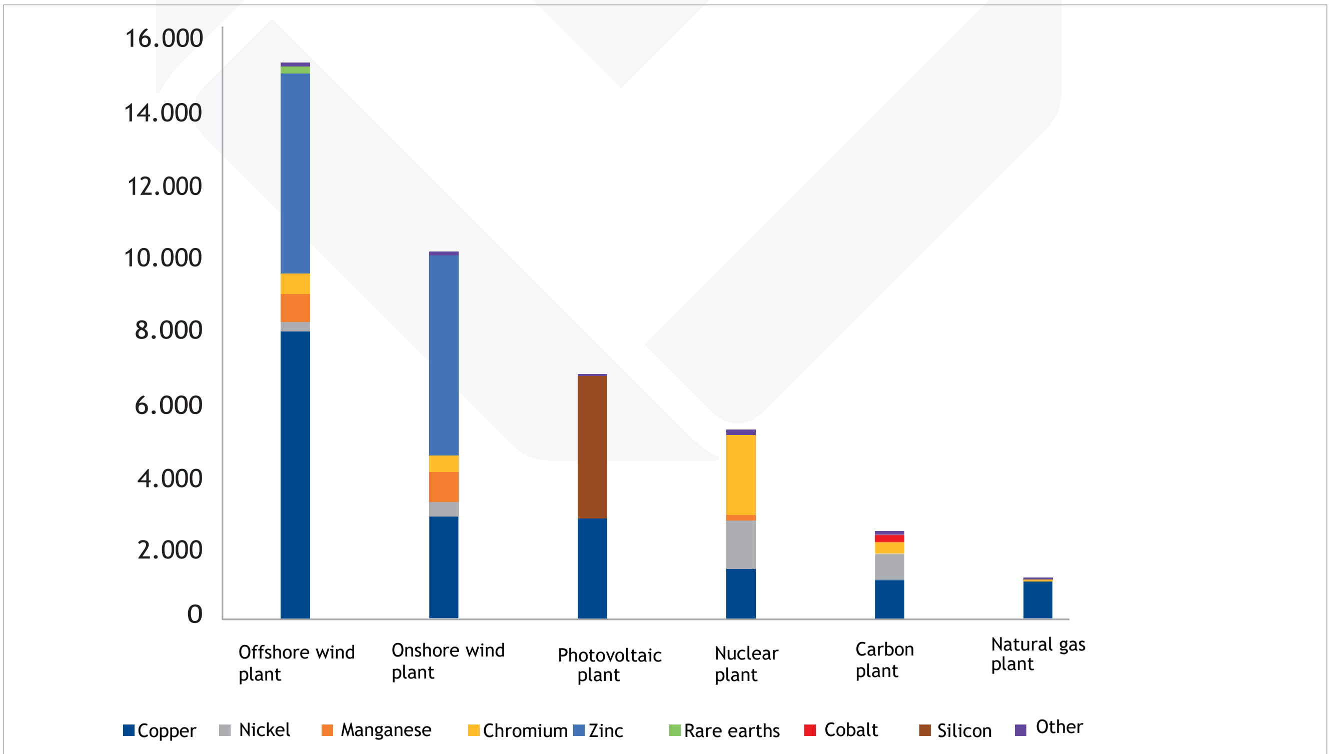


Figure V*. Minerals used in electric cars compared to conventional cars (graph above: kg/vehicle) and minerals used in green technologies compared to conventional sources (graph below: kg/MW) in 2022. Source: The European House - Ambrosetti processing of European Commission 2022 data.*

3. The reference scenario of critical raw materials sees a concentration of production where China is today the world's main supplier for 66 percent of critical raw materials.

China is now the leading supplier of critical raw materials, leveraging the exploitation of domestic deposits and the global positioning of its mining companies. China is, in fact, the **world's leading supplier** for 66 percent of critical raw materials, almost 4 times the share held by South Africa (9 percent), the Democratic Republic of Congo (5 percent) and the USA (3 percent), which together reach 17 percent. In support of this positioning, suffice it to say that one-third of all new rare earths deposits are located in the Chinese subsoil, enabling Beijing to position itself **at the top of the supply chain for rare earths and critical raw materials.**

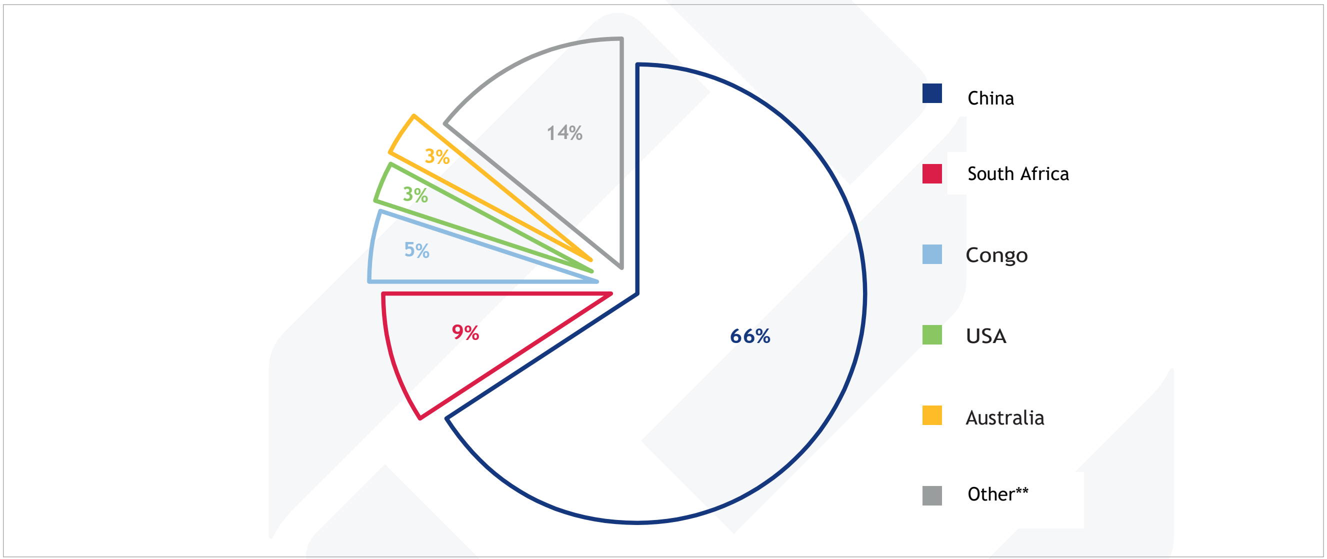


Figure VI. Top global suppliers of critical raw materials (percentage values), 2020. (**) Chile (2 percent), Brazil (2 percent), Turkey (2 percent), France (2 percent), Russia (2 percent), Spain (2 percent) and Thailand (2 percent). Source: The European House - Ambrosetti processing of European Commission 2022 data.

At the European level, the issue of concentration of critical raw materials emerges in equal measure: China is in fact the **main supplier of critical raw materials in Europe (44 percent of the total).** In the case of rare earths, moreover, China is also the main exporter to the European Union with **98 percent** of the supply. Besides rare earths (whose world production accounts for 86 percent of the total), China has a widespread and significant presence on several critical raw materials, including in particular:

- **Zinc**, with worldwide production accounting for 33 percent of the total;
- **Bauxite**, with worldwide production accounting for 22 percent of the total;
- **Gallium**, with worldwide production accounting for 97 percent of the total;
- **Indium**, with worldwide production accounting for 58 percent of the total;
- **Germanium**, with worldwide production accounting for 78 percent of the total.

The prolongation of Chinese government-supported health restrictive measures could, therefore, have **significant impacts on the supply chains of critical raw materials with production** (Dysprosium, Germanium, Neodymium, Indium, Terbium) **and refining** (Zinc, Cobalt, Lithium) concentrated in China. Risks range from direct price increases and global supply-demand imbalance (prices variations from 10 to 35 percent in have also been observed in the course of a few months) to production disruption in several industrial supply chains due to logistical delays.

4. A contribution to the strengthening of independence from third countries comes from technological products which, if properly recovered and recycled, make it possible to reduce dependence on critical raw materials, enabling economic, social and environmental benefits.

Due to the concentration of production in third countries, the European Union, in addition to investing significantly in domestic production, can achieve a significant contribution from **recycling**. In particular, one of the solutions to the issue of potential problems in the sourcing of critical raw materials is certainly the practice of **recycling technological products**, which are largely dependent on these materials.

Globally, the amount of e-waste is increasing at a rate of nearly 2 million tons per year. In 2020 there were about 55.5 million tons of e-waste and **at this rate it will reach nearly 75 million tons by 2030**. In this context**, Europe is the continent that generates the largest amount of e-waste with 16.2 kg per capita** (vs. 13.3 of the Americas, 2.5 of Africa, 16.1 of Oceania and 5.6 of Asia). Focusing attention at the Italian level, in our country **e-waste recycled correctly** is **39.4 percent**, thus showing a gap to be filled compared to the stated European target of 65 percent. The same is true for the collection rate of batteries and accumulators, for which Italy always ranks among the last with 43.9 percent (ahead of only Cyprus, Slovenia, Greece, Portugal, Estonia and Malta).

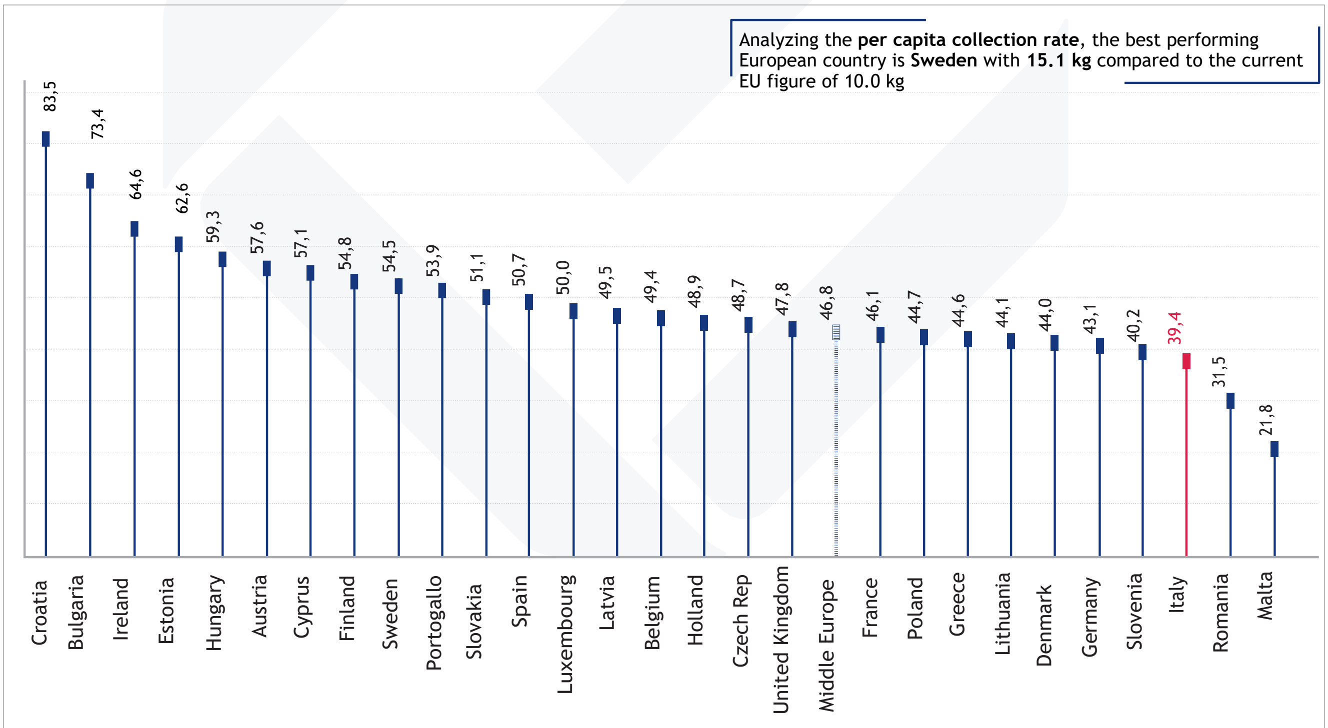


Figure VII. Collection rate of e-waste in the EU (percentage value on total waste placed on the market in the previous 3 years), latest annual data available. NOTE: the results of Croatia and Bulgaria correspond to official statements by their respective Governments and there are no further public reports or underlying information available to assess their truthfulness. Source: The European House - Ambrosetti processing of European Commission 2022 data.

These data highlight even more **the potential in Italy deriving from adequate recycling of technological products**. In the light of these considerations and to better quantify the benefits that can be obtained, impacts were estimated in terms of **recovery of critical raw materials**, **environmental and social benefits**, and **economic benefits**.

With reference to the first dimension, namely the recovery of critical raw materials, The European House - Ambrosetti estimated that **if the collection rates of the best European performers were reached, almost 7.6 thousand tons of critical raw materials could be recovered**. Conversely, if we maintain the current collection rate, a gap of technological waste to be recovered would be created equal to about 280 thousand tons, which would result in a **loss of 15.6 thousand tons of critical raw materials**.

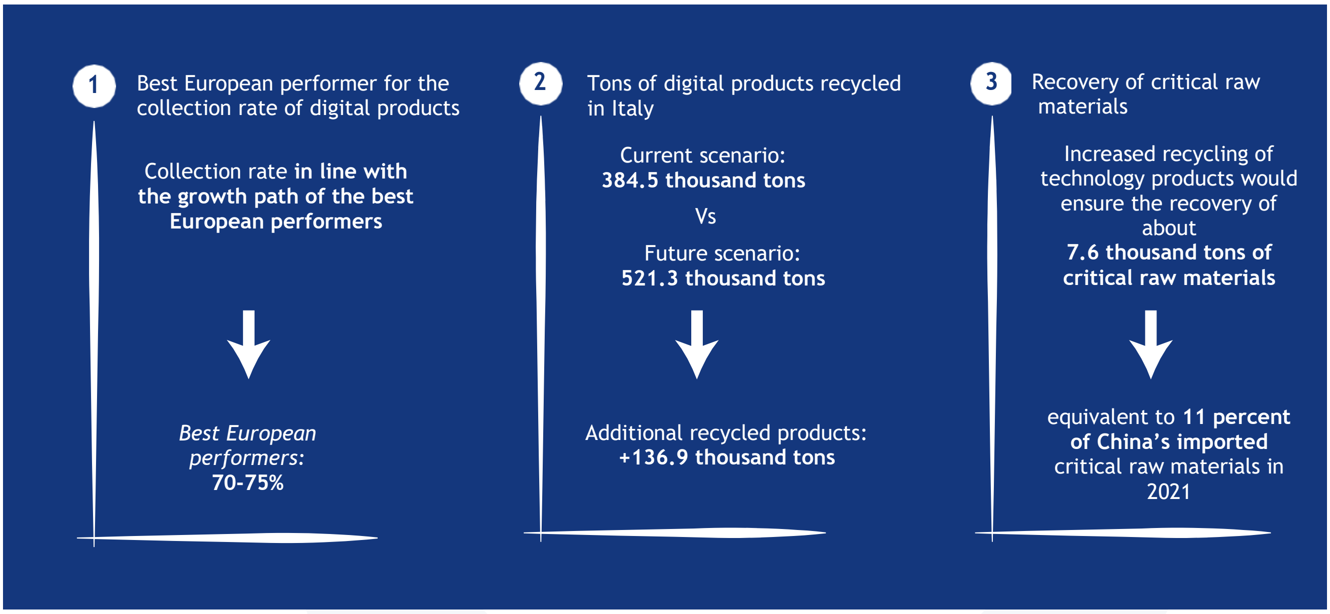


Figure VIII. Recovery of critical raw materials in Italy assuming alignment with best European performers. Source: The European House - Ambrosetti processing of European Commission 2022 data.

Regarding the second dimension, namely the **environmental and social benefits**, a considerable increase in the collection rate for Italy would be equivalent to a transformation of the (disposal) cost into a (valuable) resource, due to the extraction of critical raw materials that would have otherwise to be imported. Building on these considerations, The European House - Ambrosetti has estimated that increasing the rate of recycling of technological waste would generate environmental benefits that, in the best case scenario, would result in a **reduction of nearly 1 million tons of CO_2**. These environmental benefits would translate into social benefits for the community and, assuming a cost per ton of EUR 195, the reduction in emissions would generate a gain of **nearly EUR 208 million**.

Finally, with regard to the third dimension, namely the **economic benefits**, The European House - Ambrosetti has estimated that, as a result of increased recycling of technological waste and greater availability of critical raw materials, the **cost of imports would be reduced**, generating an economic benefit of **nearly EUR 14 million**

5. In order for the recycling of technological products to become a strategic lever to reduce supply risks for Italy, it is necessary to act on 3 levels: regulations, volumes and plants equipment, with the ultimate goal of developing local supply chains.

The recycling of technological products – even if it does not enable volumes that make it possible to do without mining activities – **can help reduce the dependence of the country's critical raw material supplies** by enhancing a circular economy paradigm. Aligning the elements of **regulations**, **volumes** and **plants equipment** – with effective communication to citizens – would also contribute to the development of **local supply chains**. In particular, with reference to **regulations**, it is necessary to adjust the rules for the collection of technological products (expanding the possibility of collecting small WEEE and batteries also to distributors not belonging to the product categories of electronic equipment and batteries) and to simplify and digitalise the registration to the Register of environmental managers.

With regard to **volumes**, it is necessary to support the growth of collection mechanisms for WEEE, develop ecopoints for collection throughout the territory, where citizens know that they can dispose of their waste from technological products, and create control mechanisms for the so-called "parallel streams" through a communication activity to citizens, but also the expansion of collection centres and subsidies to logistics operators who must be able to collect materials on behalf of distributors more frequently.

Finally, with reference to **plants equipment**, the need emerges – first and foremost – to simplify authorisation procedures. In fact, the actual average duration of the construction of waste treatment plants stands at **4.3 years**, 2.7 of which are taken up by planning and authorisation times. Bringing down these times requires the adoption of models to foster "consensus management" in the territory (e.g., public debate, synchronous conference of services, etc.) in order to guarantee fixed timescales. In addition, it is also necessary to further expand the network of existing collection centres, which is unevenly distributed across the country and consists of collection points regulated in a highly differentiated manner.

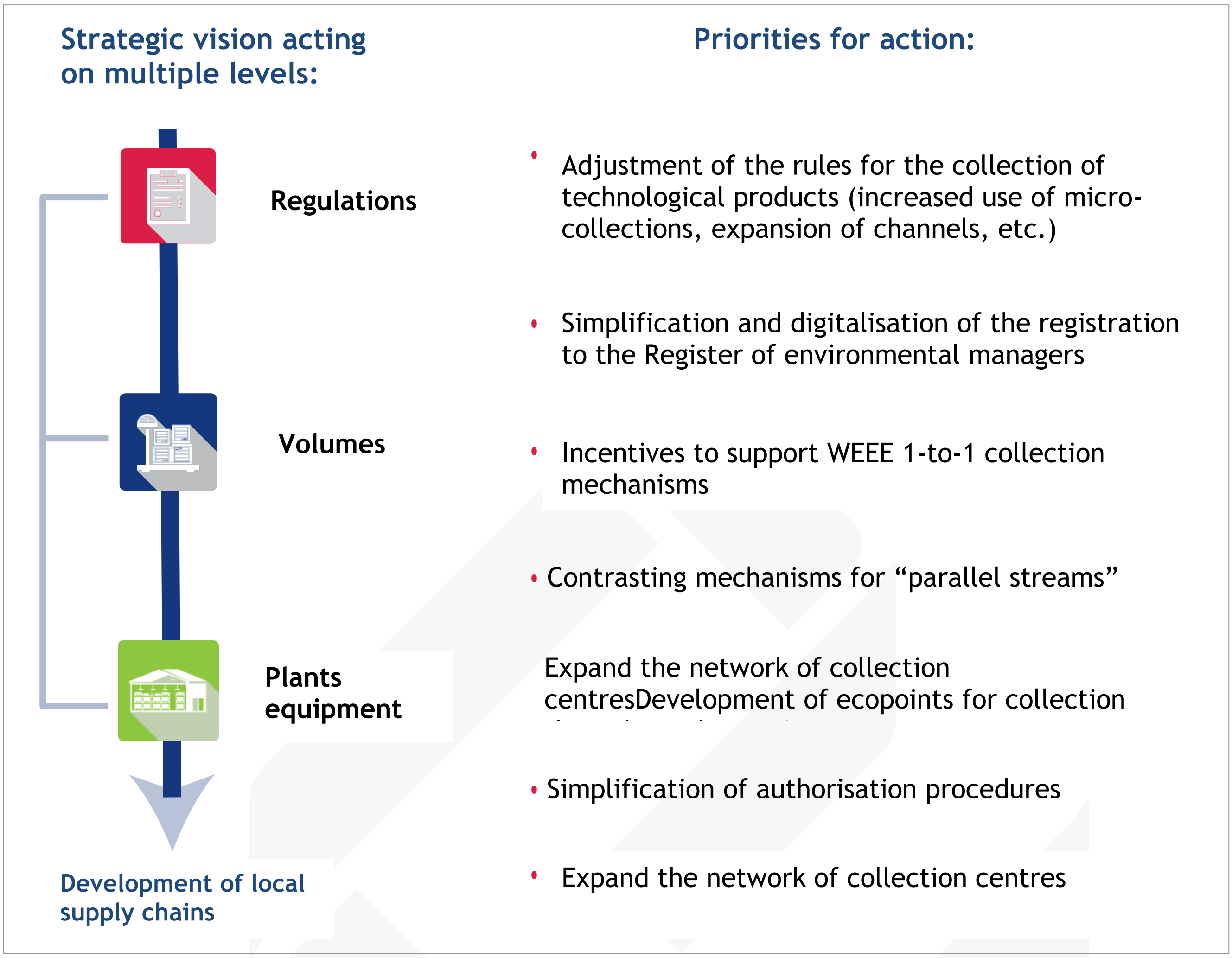


Figura IX. *The evolutionary vision to enhance the recycling of technological products. Source: The European House - Ambrosetti 2022 processing*

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Via Messina, 38
20154 Milano
www.erion.it
comunicazione@erion.it