Closing the Loop: Circularity and the Future of Critical Raw Materials in Europe

CRM Alliance
Critical Raw Materials

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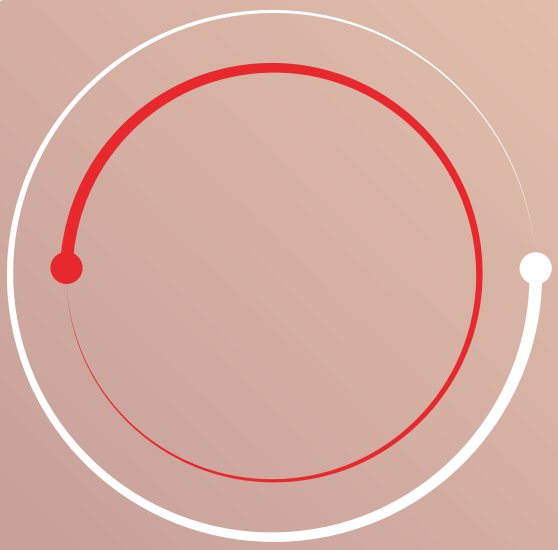
Introduction

Europe's path toward sustainability and strategic autonomy depends on one simple truth: there is no green or digital transition without critical raw materials (CRMs). From batteries and semiconductors to renewable energy and defence applications, CRMs form the backbone of industrial growth and innovation.

To make Europe more resilient, we must move beyond the traditional linear model of extraction, production, and disposal — and embrace a genuinely circular economy where materials are kept in use for as long as possible. Recycling is an important route to recover minerals, but it should be considered within an ecosystem of options, alongside responsible primary sourcing, processing, and trade. Achieving circularity for CRMs is not only a technological challenge; it also requires coherent policies, economic realism, and investment in both primary and secondary supply.



Circularity and Security Must Advance Together

Recycling and recovery can significantly reduce Europe's exposure to supply risks, but they cannot replace the need for secure access to primary raw materials. Many CRMs are used in small quantities or embedded in complex products, making recovery technically difficult or economically unfeasible. Recycling and mining are two sides of the same coin: a secure European supply chain is one that maximises both. To be genuinely impactful, recycling must also be economically viable and competitive with primary supply. Circularity must therefore go hand in hand with responsible mining, refining, and processing in Europe and through trusted global partnerships.

Turning Waste Into Value

Mining waste, slags, and industrial by-products represent valuable yet largely untapped resources. Recognising and valorising these materials as legitimate sources of Critical Raw Materials can generate significant sustainability and efficiency gains.

At the same time, Europe should, wherever possible, retain valuable production scraps and end-of-life products within its borders. However, for certain CRMs, the European market remains too limited in scale to justify the investments required for specialised recycling or reprocessing facilities. In such cases, and as long as no European facility is available, it is essential for both economic viability and supply security that production scraps can be sent to trusted facilities outside Europe—provided these facilities operate under equivalent environmental and sustainability standards.

Permitting remains a major barrier to new recycling and re-processing capacity in Europe. The EU should raise the need and opportunity for local waste-processing plants, including those recovering CRMs from tailings and other secondary sources, by promoting more efficient and coordinated permitting procedures.

Aligning Ambition with Reality

Circularity policies must be grounded in the economic realities of CRM markets. Many of these markets are distorted, volatile, and marked by thin margins — or even losses. Recycling efforts will only succeed if they are viable. Public support, innovation incentives, and predictable regulation are essential to bridge the gap between environmental ambition and market conditions.

Coherence Across Policies

A circular economy cannot thrive if its rules conflict. Fragmented or overlapping regulations, especially in areas like chemicals management, can undermine recycling and processing efforts. Europe needs a coherent, risk-based, and science-driven policy framework that enables investment, innovation, and the development of safe circular supply chains.

Building the Infrastructure of Circularity

Europe's waste and recycling systems were designed for bulk materials like steel and aluminium. To recover dispersed CRMs — gallium in LEDs, antimony in plastics, rare earths in magnets — new infrastructure is needed for collection, sorting, and specialised treatment. Harmonised standards and streamlined cross-border transport rules are key to building an efficient internal market for secondary CRMs.

Accelerating Innovation

Closing the loop for CRMs will require breakthroughs in material science and advanced recycling technologies. Support for research, development, and demonstration projects must extend across the full spectrum of CRMs, not just a handful of strategic ones. Innovation must reflect the diversity of Europe's industrial dependencies — from silicon and manganese to graphite and tungsten.

Key Recommendations for a Resilient Circular Economy

- Maximise recycling while ensuring secure primary supply — circularity and security are complementary, not competing goals.
- Recognise tailings and industrial by-products as valuable CRM sources.
- Ensure economic viability through market-based incentives and investment support.
- Avoid one-size-fits-all targets — each CRM has distinct supply and recycling challenges.
- Modernise waste rules and facilitate intra-EU recycling flows.
- Invest in infrastructure, R&D, and skills to build the backbone of a circular CRM economy.
- Keep production scraps and end-of-life products in Europe to strengthen domestic recovery.
- Ensure policy coherence and a risk-based approach across environmental, industrial, and trade policies.

Europe's Opportunity

Europe now stands at a crossroads. Circularity is not a distant ambition but an urgent necessity to secure its industrial future. By aligning sustainability with competitiveness, Europe can build a resilient CRM base — one that supports climate neutrality, technological leadership, and industrial independence.

The future of circularity depends on closing the loop not only on materials, but on policy, investment, and innovation. **Recycling alone will not meet future demand — but together with secure supply, coherent policy, and immediate action, it can power a stronger, more sustainable Europe.**

About Us

The Critical Raw Materials Alliance represents primary producers, traders and associations of raw materials that the European Commission has determined to be critical to the EU economy. Critical Raw Materials are those raw materials which are economically and strategically important for the European economy but have a high-risk associated with their supply. Used in environmental technologies, consumer electronics, health, steelmaking, defence, space exploration, and aviation, these materials are not only “critical” for key industry sectors and future applications, but also for the sustainable functioning of the European economy.

The CRM-A stresses the need of a unique approach in regulation and policymaking when addressing CRMs to avoid overregulation, innovation barriers and loss of EU competitiveness and societal well-being.

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