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REEPRODUCE

POLICY RECOMMENDATIONS FOR A RARE EARTH PERMANENT MAGNET RECYCLING VALUE CHAIN IN EUROPE

Evidence from the REEPRODUCE project for the implementation of the RESourceEU Action Plan and the development of the Circular Economy Act.

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Executive summary

Europe's industries rely heavily on rare earth elements (REEs), classified by the European Union (EU) as critical raw materials (CRMs) since 2011. Yet almost all are imported, and domestic recycling of products containing REEs remains minimal. Some REEs are key components of permanent magnets (PMs), used in e-mobility, industrial motors, wind power generators, and defence applications, among others. By 2050, the EU demand for Neodymium (Nd), Praseodymium (Pr), and Dysprosium (Dy) in wind power is projected to increase roughly five- to six-fold, whereas demand for Nd and Dy used in e-mobility (traction motors) is projected to grow approximately nine- to ten-fold.[1] These elements already rank among the highest-risk materials in the EU's fifth CRM list.[2]

Recent export controls and trade restrictions have exposed how fragile these supply chains are. But Europe can capture an emerging opportunity; Europe is projected to generate around half of global End-of-life (EoL) magnet scrap feedstocks from wind turbines and a quarter from EV motors by 2030, yet today, most of this material is not fully recovered.[3] Without changes to current recycling practices, those valuable materials will not be sufficiently recovered and potentially lost and import dependency on China is likely to persist.

Despite growing demand and increased policy attention through the Critical Raw Materials Act (CRMA), the RESourceEU Action Plan and the forthcoming Circular Economy Act (CEA), the EU lacks an integrated value chain to recover REEs from EoL products at scale. Improving the identification, recovery and recycling of rare earth PMs is therefore a critical issue for Europe's industrial resilience and strategic autonomy.

The considerations presented in this policy paper draw on empirical evidence from the Horizon Europe project REEPRODUCE, which is demonstrating at industrial pilot scale, a first sustainable and complete European REEs-recycling value chain of EoL products. The evidence is complemented by input from its External Advisory Board, external industry stakeholders, and EU-funded projects in the cluster hub "CRM4EU". These responses were collected through a targeted survey, with the aim to reflect practical experience from projects and stakeholders working along the REE recycling value chain and understand which barriers they face in how they handle EoL products containing REEs.

Based on this evidence, the paper identifies persistent barriers preventing large-scale recycling of rare earth PMs in Europe, and sets five policy recommendations to support the rollout of the RESourceEU Action Plan, the implementation of the CRMA and the development of the CEA:

1. **Ensure labelling and digital products passport requirements deliver actionable data across the full rare earth recycling value chain.**
2. **Introduce short-term identification measures for EoL products already in the waste stream, to complement the long-term labelling requirements.**
3. **Establish operational requirements for the identification, separation, extraction and physical recovery of PMs from EoL products.**
4. **Support the scale-up of European REE-recycling from pilot to industrial capacity.**
5. **Ensure coherent definitions, reporting requirements and recovery obligations across policy instruments.**

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[1] Carrara, S. et al. (2023). Supply chain analysis and material demand forecast in strategic technologies and sectors in the EU – A foresight study. Page 50. Publications Office of the European Union, Luxembourg. JRC132889.
[2] Regulation (EU) (2024). 2024/1252, Annex II, OJ L 2024/1252, 3 May 2024.
[3] International Energy Agency (IEA) (2026)/ Rare Earth Elements: Pathways to secure and diversified supply chains, page 51.

Problem statement

Europe's transition to climate neutrality, digitalisation and strategic defence capabilities depends on secure access to rare earth permanent magnets (PMs). Yet the EU remains almost entirely dependent on imports for REEs and PMs, with China controlling over 90% of the supply chains.[4] Recent export controls and trade restrictions have shown how fragile these supply chains are, thus jeopardising strategic industrial and technological developments. Global demand for REEs and PMs has doubled since 2015 and is set to expand further by a third by 2030, thanks to the deployment of renewable energy and growing electrification.[5] At the same time, there are currently no market-ready substitutes in Europe, and without changes to current recycling practices and capabilities, import dependency on China is likely to persist. Securing alternative sources of CRMs for European industry starts with recovering what is already embedded in products on the European market, but this cannot be achieved without resolving some practical barriers first.[6]

EoL products represent a growing opportunity to reduce this dependency and the security of supply. Large volumes of rare earth magnets embedded in EoL products are already collected in Europe but rarely recovered. Recovery rates remain very low, largely limited to pre-consumer in-process waste, while valuable secondary resources are lost through shredding, export or downcycling.[7]

Europe currently has no industrial recycling capacity for REEs, a gap that is primarily due to the absence of systems and obligations to consistently route Nd-based magnets from diverse EoL products into dedicated recycling processes. There are no mature and industrially proven technologies that can reliably identify if and where they are located inside different EoL products, nor technologies to sort and extract them in a cost-effective way, with minimal impurities. Moreover, the processes needed to recover and purify REEs from different magnet types – different chemistries, coatings and impurities – are not yet mature.[8] Although technical knowledge already exists in Europe, these processes are not yet robust at scale. These barriers span the full recycling value chain and require coordinated responses at every stage. Addressing this would also deliver significant environmental benefits, not only in terms of toxic and radioactive waste, wastewater avoidance and overall reduction of GHG emissions related to primary production, but also would contribute significantly potential reduction of EoL landfilling.

Despite policy attention through the CRMA, the RESourceEU Action Plan and the forthcoming CEA, no framework yet establishes operational requirements for physical identification, separation and recovery of PMs from EoL products. Recycling in Europe will only become viable if PMs containing REEs can be reliably identified, sorted and extracted from a wide range of products, supported by coherent regulatory frameworks. With the three frameworks developing in parallel, there is a further risk of overlapping or inconsistent obligations across the full REE-recycling supply chain. *

In this context, the Horizon Europe project REEPRODUCE provides concrete evidence for this paper on how a European rare earth PM recycling value chain can be piloted and scaled at competitive cost with sustainable technologies, and how such efforts align with existing and emerging EU policy.

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[4] Hart, C., (2025). Atlantic Council. Mapping China's strategy for rare earths dominance.
[5] International Energy Agency (IEA). (2026). Rare Earth Elements: Pathways to secure and diversified supply chains, Executive Summary.
[6] European Commission. (2025). Speech by Commission President Ursula Von Der Leyen at the 2025 Berlin Global Dialogue, 25 October 2025, Berlin.
[7] Govern, L. Tapoglou, E., Georgakaki, A. (2025). Material streams from wind energy decommissioning to 2050, Publications Office of the European Union, Luxembourg.
[8] International Energy Agency (IEA). (2026). Rare Earth Elements: Pathways to secure and diversified supply chains, page 51.
** Full value chain: Primary suppliers, collectors, dismantlers, sorters, separators, those involved in REE recovery, rare earth alloy producers, PM manufacturers or REE product manufacturers, and end users of PMs.*

Policy Context

The Critical Raw Materials Act (CRMA)

*Regulation (EU) 2024/1252) entered into force on 23 May 2024, setting targets for 2030: **10%** of EU demand to be met by domestic extraction, **40%** by processing in the EU, and **25%** by recycling, while limiting dependence on any single third country **65%** at any stage of the mineral supply chain.*

PMs are explicitly identified in the regulation as a priority product group for increasing circularity and worth recovering, given the significant amounts of CRMs they contain and minimal recycling rates in the Union today, only performed at small scale or in the context of research projects. The regulation recognise that effective recycling of PMs depends on access to clear information on their presence, location, composition and safe removal from products.[9]

The CRMA introduces two core tools for PMs. Article 28 requires products containing magnets to carry information relevant for recyclers, including magnet type, weight, location, chemical composition and safe removal instructions, accessible for the product lifetime and beyond. The Commission must adopt an implementing act establishing the labelling format by 24 November 2026, after which labelling obligations apply two years later.[10] Article 29 introduces recycled-content disclosure obligations for rare earths used in magnets, requiring manufacturers to make publicly available the share of specified REEs recovered from post-consumer waste present in their magnets, applicable from 24 May 2027 or two years after the entry into force of the relevant delegated act, whichever is later. Minimum recycled content shares are to be set by delegated acts after 31 December 2031.[11]

Under Article 26(7), the Commission is also required to list the products, components and waste streams considered as having relevant CRM recovery potential, to serve as a reference for national circularity programmes. The Commission Implementing Regulation 2026/1116 of 26 May 2026 fulfils this obligation, identifying PMs as a priority component across electrical and electronic equipment, wind turbines and motor vehicles.[12] While the list improves transparency and is a useful tool for national measures, it does not establish operational requirements for the physical identification, separation, extraction or recovery of PMs from EoL products, nor does it address how this can be achieved in practice across different EoL product streams.

The Commission has since proposed targeted amendments to these provisions under the RESourceEU Action Plan, including expanding the scope of products covered by labelling requirements and strengthening recycled content obligations, discussed further below.

RESourceEU Action Plan

Adopted in December 2025, RESourceEU builds on the CRMA and sets out short-term actions to accelerate its implementation and reduce EU dependence on CRMs imports. Treating raw materials as a strategic infrastructure, it focuses on scaling up domestic extraction, processing, refining and recycling of CRMs, while reducing reliance on dominant suppliers through targeted financing, coordination across the value chain and measures to improve access to secondary raw materials.

[9] European Union (2024). Regulation (EU) 2024/1252, Recital 57 and 58, OJ L 2024/1252, 3 May 2024.
[10] European Union (2024). Regulation (EU) 2024/1252, Article 28 (1), (4) and (7), OJ L 2024/1252, 3 May 2024.
[11] European Union (2024). Regulation (EU) 2024/1252, Article 29 (1), Article 29 (3), OJ L 2024/1252, 3 May 2024.
[12] European Union (2024). Regulation (EU) 2026/1116, Annex, OJ 2026/1116, 26 May 2026.

A central pillar of the Action Plan is mobilising and coordinating EU financing, which has to date remained fragmented across instruments and actors. The Commission plans to mobilise close to €3 billion in EU financing in the short term, prioritising strategic projects operational by 2029. To coordinate this, the Commission will establish a CRM financing hub to bring coherence across funding sources, from research and upscale funding to grants management, and providing technical assistance to project promoters and national administrations. The hub will cover different pillars with a specific emphasis on recycling, and different levels of technological maturity, from innovation to market deployment. The Commission will also work with the European Investment Bank and European Bank for Reconstruction and Development to support CRM projects, with a new approach to project financing launching in 2026.[13]

A second key focus is improving access to secondary raw materials. The Commission acknowledges that Europe currently collects around 40% of EoL products but recovers less than 1% of REEs ([14]), mainly from PM scrap (in-process waste), and magnet-bearing products often leaving the EU or end up in landfill.[15] To address this, the Commission will propose export restrictions on PM scrap and waste from EU countries in the second quarter of 2026, and develop new EU waste and customs codes under the Combined Nomenclature and the European Waste catalogue to track magnets, magnet scrap and components containing magnets. EU recyclers, with sufficient feedstock access, could scale up production of rare earth PMs to around 3,800 tonnes in the coming years, roughly 20% of current EU demand.[16] Simultaneously, the available feedstock from EoL PMs is expected to grow by about 50% by 2035. By 2030, Europe is expected to account for around half of global EoL magnet volumes from wind turbines and about a quarter from EV motors. By contrast, other electronic and electrical waste streams already contain an estimated 50 kilotons of rare earths.

The Action Plan is accompanied by a targeted amendment of the CRMA to boost recycling of PMs in the EU. Under article 28(1) and 29, the Commission proposes to expand the list of products containing PMs for which a label providing relevant information for recyclers is required, adding hard disk drives, transducers, loudspeakers, drones for civil use, and motorised toys. It also proposes a requirement for a minimum share of CRMs recovered from domestic pre- and post-consumer waste to be used in PMs incorporated in products. These measures aim to make the CRMA's 2030 recycling target of 25% easier to achieve.[17] Current recycling data confirms, however, Europe remains far below the CRMA's 25% recycling target today.[18] The Council of the EU has adopted its position supporting these objectives, while requiring the European Commission to inform Member States and the European Critical Raw Materials Board about which companies are identified as "large" and indicates their vulnerabilities, clarifying the European Commission's authority to propose risk mitigation measures, and supporting the use of digital products passports (DPPs).[19] The European Parliament's ITRE Committee adopted its position on 24 June 2026, which will be confirmed in the Parliament's July plenary session. Trilogue negotiations are therefore expected to begin shortly thereafter.[20]

[13] European Union (2025). RESourceEU Action Plan, COM (2025) 945 final.
[14] McGovern, L., Tapoglou, E. and Georgakaki, A. (2025). Publications Office of the European Union, Luxembourg. JRC139814.
[15] European Union (2025). RESourceEU Action Plan. p. 9. COM (2025) 945 final.
[16] European Union (2025). RESourceEU Action Plan, COM (2025) 945 final.
[17] European Commission (2025). Proposal for a Regulation of the European Parliament and of the Council amending Regulation (EU) 2024/1252, 946 final.
[18] European Court of Auditors (2026). Special report: Critical raw materials for the energy transition – Not a rock-solid policy. Publications Office of the European Union.
[19] Council of the European Union (2026). Raw materials: Council adopts position to reinforce the security of supply and the circularity of EU industry. Press release, Council of the EU, 4 March 2026.
[20] European Parliament (2026). Critical Raw Materials: MEPs back new measures to secure supply. Press release, ITRE Committee, 24 June 2026.

Circular Economy Act (CEA)

Due for adoption in September 2026, the CEA aims to establish a single market for secondary raw materials, increase the high-quality recycled materials and stimulate demand for these materials across Europe, and reduce the EU's strategic dependence on resources from third countries.

The CEA would constitute a central pillar of the Clean Industrial Deal and the Competitiveness Compass for the 2024-2029 mandate.[21] The CEA is expected to turn circularity into a core competitiveness strategy by creating a predictable, integrated market for recycled materials, activating durable demand, aligning fiscal tools with circular outcomes and strengthening governance, enforcement, and administrative capacity. It will also facilitate the free movement of circular products and secondary raw materials by removing barriers linked to fragmented national rules in Member States, particularly around End-of-waste criteria, which currently differ in definitions across Member States and hamper flows of secondary materials across borders. Practical barriers to circular operations therefore persist for companies, for example in terms of dismantling and remanufacturing in different countries. [22]

At this stage, the Act has not yet been proposed, and it remains unclear how its rules will interact with the proposed amendments to the CRMA under RESourceEU. Commissioner for Environment, Water Resilience, and a Competitive Circular Economy Jessika Roswall have highlighted that the CEA should simplify where rules are fragmented.[23] But there is a risk of overlapping or inconsistent definitions, reporting obligations, or recovery expectations applying to the same materials. Without coordination, this could create practical difficulties for manufacturers, dismantlers, and recyclers who operate across both frameworks.

Evidence and stakeholder input

A set of pilots for a competitive European REE-recycling value chain

REEPRODUCE demonstrates, at pilot scale, that a complete European recycling value chain for rare earth PMs is technically feasible, from intelligent sorting and dismantling of EoL products through magnet extraction, REE oxide recovery, REE metal manufacture and production of new magnet alloys. While sorting and dismantling represent a first critical bottleneck, scaling to industrial capacity introduces a second: recycling processes must be capable of handling large and variable feedstock volumes, such as magnets with different chemistries, coatings and impurity profiles, without compromising process efficiency, environmental standards or economic viability.

Stage 1: Intelligent sorting and dismantling of devices containing Nd-based magnets

A semi-mobile intelligent sorting machine was successfully developed and validated at TRL7, capable of recognising and separating incoming waste electrical and electronic equipment (WEEE) streams that contained Nd-based PMs. The sorting machine is equipped with vision devices, AI-powered software and an enriched database to support the identification and sorting. The system was tested and validated at partners' recycling facilities in Europe with real waste streams.

[21] European Parliamentary Research Service (2026). Circular economy act – briefing.
[22] European Commission (2025). Call for evidence – Ares (2025)6250342, Circular Economy Act.
[23] European Commission (2026). Commissioner Roswall's address at the event 'Circular Economy Act: Key Priorities' hosted by Business Europe.

However, the lack of information on the chemical composition of PMs in WEEE, for instance, distinguishing Nd-based magnets from ferrite types, limits the development of databases robust enough for sorting equipment to operate at full efficiency.

For dismantling, a robotic pilot machine was developed to remove the components containing Nd-based magnets from EoL products. The intelligent robot carries out tasks such as unscrewing, drilling and housing removal to access the targeted components containing the Nd-based PM. Computer vision modules and machine learning guide the robot's understanding, movement and plan of action.

Stage 2: Extraction of Nd-based magnets from components

Following the previous steps, partners developed pilot units to extract Nd-based magnet blocks from a range of components in which magnets are embedded, including rotors from electric vehicle drive units and heat pump compressors, e-scooter wheels and hard disk drives' steel yokes.

Rotors from these applications differ significantly in size, geometry and construction. Therefore, dedicated process chains are required for each, as well as incorporation of vision devices to better adaption of the pilot units to each case. The process chain for each application implies sorting, handling, rotor dismantling, thermal demagnetisation, and ejection of the magnets.

For hard disk drives (HDDs), a dedicated system was designed to separate Nd-magnets from the steel yokes that hold them in place. In this case, vision devices are also incorporated in the pilot to adapt to the different sizes and the yokes. Extraction was achievable across these component types, using a conveyor-based belt connected all the individual steps so the entire process could run continuously, combining thermal demagnetisation and automated sorting.

A remaining challenge at this stage is the difficulty of extracting rotors intact from electric motors in an automated, robotised way. This is partly because motor designs vary widely in their compositions and are consistently evolving, and partly because conventional dismantling often damages the rotor, which prevents efficient magnet recovery and limits the share of feedstock that can be processed through automated lines. The challenge is compounded by the fact that only specific EV models contain Nd-magnets in their motors, making it complicated to determine in advance which units are worth routing through automated extraction.

Stage 3: Recovery of REEs as oxides

Building on earlier work in the REE4EU project, funded under Horizon 2020, on an advanced hydrometallurgy (AHM) process for extraction of REEs contained in used Nd-based PMs and recovered as a high-purity mixture of REE oxides (REO-mix), the REEPRODUCE AHM process was improved to handle a broader range of dismantled Nd-based PMs, with the aim to reach the highest capacity of the recycling plant. This stage also encompasses the upstream pilot-scale extraction of Nd-based PMs from sorted EoL products, the downstream conversion of REE oxalates into REE alloys, and the production and validation of new PMs using recycled REEs, covering a substantial portion of the full value chain. The validation tests confirmed that the process is feasible within a conventional hydrometallurgical facility and has proven effective in treating spent PMs varying compositions and sizes.

However, several aspects require further development to enable full industrialisation. While the variable chemical composition of the raw materials could easily be overcome, one critical improvement needed is at the initial leaching stage of PMs, where handling the materials, managing reaction kinetics and controlling the hydrogen evolution reaction, all present challenges essential to ensuring a safe and economically viable scale up. Maintaining sufficiently large leaching batch volumes while managing these reactions, validating the reuse or recovery of products, and implementing robust wastewater treatment treatments are all necessary to ensure both the circularity and environmental sustainability of the process at industrial scale. These blockages illustrate that moving from pilot to industrial scale requires targeted investment and regulatory certainty around environmental standards.

Stage 4: Conversion of REE oxides into REE metals and alloys

The final processing stage, converting REE-oxide (REO) mixtures into rare earth metals suitable for new PM production, represents a critical gap in the European value chain, as no industrial scale capacity for this step currently exists in the EU. This makes it one of the most critical structural gaps for establishing a complete and self contained European recycling value chain for rare earth PMs. REEPRODUCE is addressing this through the development and upscaling of a unique high-temperature electrolysis (HTE) technology. Unlike conventional routes that require energy-intensive separation of individual REEs prior to processing, HTE converts mixed REO-mix feedstock directly into rare earth alloys, reducing the resource-intensive processing steps, costs, and environmental impact.

Comparative sustainability assessments carried out indicate that a European REE-recycling route can deliver significantly lower environmental and social impacts than conventional primary production routes and offers strong long-term sustainability benefits. Realising these benefits at scale, however, will depend on policy measures that reduce uncertainty around feedstock access, reliable information on the presence and location of PMs in EoL products, and stable market demand for recycled REEs.

Critical bottlenecks reported by REEPRODUCE’s External Advisory Board, Horizon Europe projects, and external stakeholders

The survey was responded by beneficiaries of Horizon Europe projects, members of REEPRODUCE's External Advisory Board and external stakeholders, all active across the rare earth recycling value chain – collection, dismantling, REE recovery and refining, PM production, and end users of PMs. The aim of the survey was to reflect practical experience from the “CRM4EU” cluster projects and stakeholders working along the rare earth recycling value chain, and to understand which barriers they face in how they handle EoL products containing REEs. Beyond the ongoing challenges of export controls and the dependency on China, they report that REE-recycling for PM production is not yet industrially viable at scale in Europe, pointing towards a consistent set of structural barriers.

Lack of demand for recycled output

Across the value chain, the lack of demand for recycled output is identified as the single most critical bottleneck, particularly from the rare earth metal production and REE recovery side. Without market demand, investment in collection, sorting and refining infrastructure cannot be justified. PM producers are direct: once demand is in place, manufacturers will start requesting recycled content from their suppliers. Without regulation that mandates or incentivises the use of recycled materials, a change in market behaviour is hard to foresee. Minimum recycled-content requirements could help, but only if supported by clear standards and regulations, reliable certification systems, and stable supply conditions.

Operators lack product information needed to make basic operational decisions

Knowing whether a magnet is present in the product is the baseline gap. Without this knowledge, it is difficult to sort, route, or dismantle the EoL product. Location comes next, as operators frequently do not know exactly which subcomponent holds the magnet, which affects dismantling line design and tooling choices. Chemistry matters for sorting decisions – for example to distinguish ferrite or Nd-based PMs – and refining process design, as it determines the cost and feasibility of producing the REE metal. Removal instructions are largely absent across product types. Knowing where a magnet is located, how it can be extracted, and how it should be treated ultimately determines whether a certifiable secondary material can be produced. Coating type affects the effort required to produce feedstock material cost-effectively, and high shares of heavy REEs offer economic potential, but only where this information is available upfront. Knowing the magnet's presence makes recycling more economically competitive and avoids the loss of high-REE content.

Introduction of labelling and DPPs will not cover products already in the waste stream

DPPs and CRMA labelling requirements apply only to products placed on the market from a future date. EoL products arriving at facilities today are far older than two to five years, meaning labelling changes will only appear in the waste stream in five to ten years from now. Respondents emphasise that a combination of measures will be needed: shared databases linking product categories to the likelihood of containing Nd-magnets; OEM collaboration via Vehicle Identification Numbers (VIN) or International Dismantling Information System (IDIS) data for ELVs; manual or semi-automated dismantling of high-value or easily accessible streams; sensor-based magnetic response detection post-shredding; product-category sorting targeting high-probability streams such as EV motors and HDDs; and AI-based vision systems and product databases for probabilistic identification. A simple physical label indicating magnet presence on new products is seen as a practical and immediate step. There is a broad support for the DPP format, as it carries composition, location and removal data accessible to all actors in the value chain throughout the product lifecycle, integrating with existing digital systems, and can be updated without modifying the physical product.

Economic and regulatory uncertainty prevents the uptake of secondary REEs

"End-of-waste" criteria differ across member states but are needed to enable safe and efficient use of secondary REEs across markets. These include compliance with waste classification and REACH regulations, which can limit material reuse. Standardised certification and traceability systems would increase trust and facilitate their integration into industrial value chains.

Unclear and volatile pricing creates further uncertainty for procurement and long-term planning, while inconsistencies in material quality and specifications can lead to challenges for end users in meeting performance requirements for new products. These barriers make it difficult for end users to comply with regulatory requirements under current sorting and recovery capabilities.

There are significant practical gaps in meeting CRMA obligations under current conditions

End users were asked directly how the CRMA's timeline obligations in Article 28 (3) to Article 29 (3) align with available secondary material and recovery capacity in Europe. Some respondents did not consider the timeline well aligned with industrial reality and is already developing alternative motor technologies in response. Others note that producing recycled magnet material at industrial scale in Europe is a significant challenge for the industry. The value chain would thus need to move faster than current conditions allow. While secondary REE materials may be available in principle, recovery capacity and industrial scale recycling of PMs are not currently in place. The European Commission has not yet finalised the definition of recycled content under CRMA, expected no earlier than 2031.

Practical barriers today include the absence of any EU supplier capable of delivering recycled magnet material at industrial volumes, limited magnet scrap availability, unclear pricing, and the cost of recycled magnet material in the market and production validation burden of switching to recycled feedstock. For OEMs, the economic design of these obligations affects the entire supply chain, not OEMs alone, and limited market availability and technical feasibility must be carefully considered when setting quotas, e.g. by requiring public financial support.

Policy recommendations

1. Ensure labelling and DPPs requirements deliver actionable data across the full rare earth recycling value chain

The proposed CRMA amendment expands the list of products covered by labelling requirements and supports the use of DPPs to comply with information obligations for PMs. However, information requirements should not only be for compliance or reporting purposes. For labelling and DPPs to drive real change across the full REE-recycling value chain, the data they carry must be specific enough to support decisions at every stage of the chain.

This means requiring that labelling and DPP data include Nd-based magnet presence, precise location within the product, chemical composition, coating type and even safe removal instructions in a standardised, readable format accessible to all actors in the REE-recycling value chain.

Because physical labels on WEEEs are often damaged or destroyed by the time products reach the recycler site, this information should also be required in the equipment manufacturer's product specifications and documentation or technical manuals. This would keep the data accessible even when the physical label is damaged or destroyed at the recycling site. This information must also be sufficiently detailed to support feed characterisation for the REE recovery processes. Standardised data formats should be developed in coordination with industry to ensure interoperability across member states, while also protecting the sensitive information relevant for OEMs. Safe dismantling instructions present a further challenge today, as they require procedural knowledge, in addition to static data. We recommend the exploration of manufacturer take-back schemes, although the practical feasibility would need careful assessment.

2. Introduce short-term identification measures for EoL products already in the waste stream, to complement the long-term labelling requirements

The labelling obligations under CRMA will apply to future products only. EoL products arriving at facilities today are 10 to 15 years old and carry no machine-readable information. No current EU measure addresses this gap, which means that even a well-designed DPP framework will leave the current EoL feedstock invisible to recyclers for years to come.

Immediate, short-term measures are needed to support identification and recovery of PMs from existing EoL products to complement the long-term requirements, until mandatory labelling becomes effective. In the short term, shared databases linking product categories to the likelihood of containing Nd-based magnets should be developed, drawing on OEM collaboration and existing product specifications, including access to product-level data via e.g., VIN and IDIS references in the case of EoL vehicles. Regulatory support should be directed toward product-category sorting targeting high-probability streams such as EV traction motors, HDDs and heat pump compressors, alongside pilot schemes for sensor-based and AI-assisted identification of magnet-containing fractions in existing waste streams.

3. Establish operational requirements for the identification, separation, extraction and physical recovery of PMs from EoL products

Neither the CRMA, RESourceEU nor existing waste legislation currently establishes operational requirements for the identification, separation, extraction or recovery of PMs from EoL products. Implementing Regulation (EU) 2026/1116 identifies PMs as a priority component but does not specify how recovery should be carried out. This gap should be closed through the most appropriate legislative instrument, such as the proposed CEA, which should create market conditions making recovery of REEs in PMs economically viable.

A related weakness is that the CRMA's 25% recycling target applies to CRMs in general, without a specific target for REEs. Since the target can be met through other base metals such as aluminium or copper, and REEs constitute only a small part of the whole motor while being disproportionately difficult to sort and extract, the overall recycling target risks being met without REEs being recycled at all. Dedicated recycling targets for specific metals, such as REEs, is therefore needed to drive recovery of these materials specifically.

At a minimum, this means establishing operational standards for the handling of PM-bearing products at EoL, covering identification, separation and extraction of magnets prior to shredding or bulk treatment, with product-specific treatment requirements for streams containing high-volumes of Nd-based PM, such as EV traction motors, wind turbine generators and HDDs. It also means ensuring that the export restrictions on PM scrap, expected from Q2 2026, are accompanied by sufficient domestic treatment capacity and sorting infrastructure to process retained material.

4. Support the scale-up of European REE-recycling from pilot to industrial capacity

REEPRODUCE demonstrates that a complete European REE-recycling value chain is technically feasible at pilot scale. Scaling to industrial capacity requires processes capable of handling large and variable feedstock volumes with different chemistries, coatings and impurity profiles. Current EU instruments do not yet provide sufficient support to derisk the industrial deployment needed to bridge this gap.

The development and scale-up of advanced technologies for the identification, sorting and extraction of Nd-based PMs from diverse EoL product streams, and for the high-efficiency recovery and purification of REEs from magnets with varying compositions and impurity profiles, should be actively supported through dedicated EU funding and coordination for the creation of a sustainable investment environment, for instance through engaging OEMs and PM producers in offtake agreements, or the establishment of stockpiling at the EU level for this strategic material. This should be paired with regulatory certainty around environmental standards for hydrometallurgical and electrolysis processes at industrial scale, and with better coordination between RESourceEU financing instruments and the future European Competitiveness Fund to avoid fragmented support and bring promising pilot-scale technologies to commercial deployment.

5. Ensure coherent definitions, reporting requirements and recovery obligations across policy instruments

The CRMA, RESourceEU and the upcoming CEA should align and establish coherent definitions, reporting requirements and traceability rules for PMs and secondary REE materials. Without coordination, manufacturers, dismantlers and recyclers risk facing contradictory obligations on the same materials. End-of-waste criteria currently differ across member states, and no standardised certification framework exists for secondary REEs, which would increase trust and facilitate their integration into industrial value chains.

Definitions of recycled content, secondary materials and waste status should be aligned across the CRMA, CEA and relevant waste legislation, with particular attention to Articles 28 and 29 of the CRMA and the CEA's provisions on secondary raw materials. Harmonised waste criteria for REE-containing material should be established at EU level, removing the fragmentation of the single market that currently hinders the cross-border flow of secondary raw materials. The timeline for setting minimum recycled-content shares under CRMA Article 29 should also be brought forward rather than waiting until after 2031, to create earlier and stronger market demand.

List of abbreviations

AI	Artificial Intelligence
AHM	Advanced Hydrometallurgy
CEA	Circular Economy Act
CRM	Critical raw material
CRMA	Critical Raw Materials Act
Dy	Dysprosium
DPP	Digital Product Passport
EoL	End-of-Life
EV	Electric Vehicle
EU	European Union
HTE	High-temperature electrolysis
HDD	Hard Disk Drives
IDIS	International Dismantling Information System
Nd	Neodymium
Pr	Praseodymium
PM	Permanent magnets
REEs	Rare earth elements
REA	Rare earth alloys
REO	Rare earth oxides
VIN	Vehicle Identification Numbers
WEEE	Waste Electrical and Electronic Equipment

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