A NEW EUROPEAN INDUSTRIAL POLICY FOR THE CIRCULAR ECONOMY

Strategic Report



TEHA

CONAI
CONSORZIO NAZIONALE IMBALLAGGI

A NEW EUROPEAN INDUSTRIAL POLICY FOR THE CIRCULAR ECONOMY

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September 2026

Strategic Report prepared by TEHA Group in collaboration with the Italian National Packaging Consortium (CONAI).

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The contents of this Strategic Report relate exclusively to analysis and research work and represent the opinion of TEHA Group.

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Chairman, CONAI

Europe is a continent that uses raw materials, transforms them and has built a significant part of its prosperity on this manufacturing capability. Yet this is also one of its vulnerabilities: the resources needed for production are largely sourced outside its borders, while global competition to secure them is intensifying.

Added to this dependence is a less visible fragility: Europe does not yet manage end-of-life materials in a fully efficient way. Part of its waste is still sent to facilities outside the Union, when it could instead return as a resource for our value chains.

This is where the circular economy takes on an industrial dimension. Its environmental value is self-evident. Its economic value may be less apparent to the individual citizen, but it is nonetheless tangible and measurable.

Secondary raw materials are a genuine industrial resource for our continent. Their development concerns the competitiveness of the production system, security of supply and Europe's ability to retain within its own borders a larger share of the value generated by the transformation of resources.

The recycling and secondary raw materials value chain is already substantial: to cite just one figure, it accounts for more than 3 million jobs. Even so, its potential remains partly untapped. The main manufacturing value chains still use secondary inputs only to a limited extent, while European competitiveness remains exposed to market dynamics and to imports from third countries.

This is why this study identifies three essential lines of action: a more integrated single market with coherent rules; fair competitive conditions; and investments capable of strengthening European industrial capacity.

For this reason too (or perhaps above all), the role of extended producer responsibility is becoming ever more vital to our sustainable development.

EPR systems have helped build infrastructure that is essential to material management and the achievement of European targets. They can become even more effective through greater dialogue between the various national systems, fostering interoperability, data sharing and the diffusion of best practices.

Then, of course, there is the role of finance. Growing recycling capacity requires capital, but it cannot be accompanied by further administrative complexity. The quality of regulation, after all, is also measured by its ability to make investing simpler. Permitting is a clear example: for many plants, the time required to obtain authorisations is as tangible an obstacle as the cost of capital. In this respect, extending to recycling technologies the approaches already envisaged for net-zero technologies can offer a pragmatic way forward: faster authorisation procedures, clear criteria and easier access to financing instruments.

This is the perspective from which to read this document, which seeks to contribute to a shift in outlook through economic evidence, industrial expertise and analysis of the dynamics that are reshaping European value chains: making circularity a component of European industrial strategy.

The challenge now is to turn this awareness into choices.

Secondary raw materials are part of the resources with which Europe will be able to continue producing and creating value. And part of our industrial strength will likewise depend on our ability to keep them circulating within our value chains.

"We did not inherit the Earth from our fathers: we are borrowing it from our children."
Attributed to Wendell Berry, 1971

Valerio De Molli
Managing Partner & CEO, The European House - Ambrosetti and TEHA Group

The Study "*A new European industrial policy for the Circular Economy*", prepared by TEHA in collaboration with the CONAI Consortium, starts from a fundamental premise: the circular economy can no longer be regarded solely as an environmental objective, but must become a structural component of European industrial policy. The European Union is today at a crucial regulatory juncture: after more than a decade of progressively building its legislative framework on sustainability and the circular economy - which has given Europe the most advanced system in the world in this field - the next twenty-four months will be decisive in setting the rules for the years ahead. The new European roadmap "*One Europe, One Market*" brings together within the same time frame four complementary initiatives - the Circular Economy Act, the European Product Act, the Critical Raw Materials Centre and the reform of public procurement - which will have significant implications for the European secondary raw materials value chain.

This moment of regulatory momentum, however, coincides with a phase of significant strain for Europe's industrial recycling base. In 2024 the EU handled around 7.7 billion tonnes of materials, but only 14% came from recycling and backfilling; the circular material use rate stood at 12.2%, against a target of 24% by 2030, which would require doubling it in just six years. In 2023, moreover, as many as 21 Member States were at risk of missing the 55% municipal waste recycling target. Compounding this gap between ambition and results is mounting pressure on the sector's industrial competitiveness that undermines its economic sustainability: higher energy, labour and compliance costs, still insufficient demand for secondary raw materials in some value chains, and competition from virgin and recycled materials originating in third countries. The effects on production capacity are already visible: in the plastics value chain alone,

almost 1 million tonnes of recycling capacity has been lost over the past three years, while preliminary data for 2025 point to a 50% increase in plant closures compared with the previous year.

For the first time at European level, the Study has applied TEHA's proprietary methodology to quantify the value generated by the recycling value chain: starting from €218 billion in direct turnover, the sector activates a further €225 billion along the value chain and €112 billion through induced effects, for a total economic impact of €555 billion per year, total value added of €222 billion (equal to around 1.2% of EU GDP) and more than 3 million jobs supported. To this is added a second, equally strategic dimension: the enabling function that secondary raw materials perform for European manufacturing, which generates a further €325 billion in turnover, €96.1 billion in value added and 1.14 million jobs in the main downstream industrial value chains.

The cost-benefit analysis of the European system for managing and recycling packaging waste, which is therefore distinct from the analysis of the recycling industry as a whole, completes this picture by focusing on a specific and particularly strategic segment: the Study estimates €18.8 billion in annual costs for the operation of the system, against €31.2 billion in economic, environmental and social benefits: in other words, **every euro invested in the European packaging system generates €1.66 of benefits for society**.

Preserving this value chain therefore means safeguarding an existing industrial, employment and strategic asset, even before it means pursuing an environmental objective. On this basis, the Study proposes a new operating model for the secondary raw materials market in Europe, built on five vertical pillars – Market design, Governance and regulatory framework, Standards and quality, Industrial scale and finance, Strategic autonomy and trade - and a sixth horizontal pillar of enabling factors. Four distinctive lines of action emerge from this architecture: building a framework based on mutual regulatory recognition; strengthening industrial symbiosis between those who produce and those who use secondary raw materials; mobilising the investment needed to close the gap estimated at around €202 billion per year, of which €82 billion is still uncovered; and, finally,

strengthening Europe's strategic security by retaining and enhancing within its own borders the materials, production capacity and know-how essential to the continuity of industrial value chains.

From this framework stem the three industrial policy priorities that the Study identifies for the sector: building genuine Single Market governance through common rules; reconnecting industrial supply and demand within a logic of symbiosis rather than mere waste management; and mobilising public and private finance to make recycling investments bankable and competitive. As the quotation cited at the outset reminds us, our responsibility towards those who will come after us is measured by the choices we make today: Europe has built the most ambitious set of rules in the world for the circular economy, but it risks seeing them stripped of effectiveness unless it builds, within the same time frame, the market, the demand and the investment needed to sustain them. The challenge of the next twenty-four months is therefore not to raise ambition still further, but to turn this regulatory moment into a genuine industrial policy, capable of generating growth, employment and strategic autonomy for Europe.

This work would not have been possible without the joint commitment of the TEHA Working Group and CONAI's management in addressing an issue now at the centre of the European debate, nor without the expert contribution of the Scientific Committee - composed of Enrico Letta, Markus Kerber and Nicola Pedde - and of the many stakeholders in the European sustainability value chain who shared their experience with us.

CONTRIBUTIONS OF THE SCIENTIFIC COMMITTEE

Enrico Letta
Dean of the IE School of Politics, Economics and Global Affairs at IE University, Madrid; President of the Jacques Delors Institute; former Prime Minister of Italy

The circular economy is today one of the areas in which Europe's ability to adapt its Single Market to the transformations of the global economy is most clearly tested. In my report *Much More Than a Market* on the future of the Single Market, the proposal to build a Circular Single Market stemmed from the conviction that circularity could no longer be regarded exclusively as a component of environmental policy. The ability to keep products and materials within the European economy for longer, recovering their value and reducing the need for new resources, bears directly on the competitiveness of our enterprises, on innovation, on security of supply and, ultimately, on Europe's strategic autonomy.

This approach has become even more relevant in the new geopolitical context. Europe remains heavily dependent on external sources for many of the raw materials its industry requires. At the same time, a significant share of recovered materials still does not find, within the Single Market, conditions sufficient to be valorised at European scale. Strengthening the circular economy therefore also means making better use of the resources already present on our continent, reducing external vulnerabilities and keeping industrial activity, investment, technology and employment in Europe.

The Study prepared by TEHA Group and CONAI makes an important contribution to this reflection. The evidence gathered shows how Europe has built a particularly ambitious regulatory framework in recent years, without that ambition yet being matched by a genuine European market for circularity, capable of integrating products, materials, investment and new industrial capacity at European scale. Differences persist between Member States in the classification of materials, in extended producer responsibility schemes, and in standards and certification; industrial demand remains weak or volatile for some materials; and the necessary investments require

a more predictable framework. It is precisely this distance between regulatory ambition and the actual functioning of the market that must now be closed. The central issue is competitiveness. Environmental objectives can deliver lasting results only if they are accompanied by the industrial conditions needed to achieve them. Regulation, industrial policy and trade policy must therefore be designed coherently, so that higher environmental standards strengthen European competitiveness rather than causing a progressive relocation of industrial value.

Equally important is the principle of subsidiarity. A more integrated Single Market does not necessarily require all national systems to become identical. European experience shows that different models can deliver positive results when they are underpinned by efficient infrastructure and effective governance. What is needed, therefore, is the right balance between common European rules, interoperability, mutual recognition, data comparability and the diffusion of best practices. This approach is consistent with the Report, which explicitly recalls the principles of proportionality and subsidiarity within the Single Market regulatory framework and combines harmonisation and mutual recognition according to the Delors method. In the case of end-of-waste, the Report sets the definition of common criteria at European level as the objective and, should these not be introduced swiftly, identifies mutual recognition of national criteria as a possible intermediate solution, provided that a high level of environmental protection is guaranteed.

There is, finally, a question of timing. The One Europe, One Market roadmap, agreed by the European institutions in April 2026, offers a particularly important window. The Circular Economy Act, the European Product Act, the Critical Raw Materials Centre and the revision of public procurement rules all fall within the same political and legislative cycle. Their simultaneity makes it possible to build greater coherence today between the circulation of materials, standards and traceability, security of supply and investment, which would be far harder to reconstruct later on.

For this opportunity to be seized, it will also be decisive to mobilise the resources needed for industrial transformation. Building the Savings and

Investments Union, by connecting European savings with Europe's strategic investments, can provide one of the key instruments to finance infrastructure, innovation and new production capacity in the field of the circular economy as well. Building a Circular Single Market therefore means much more than improving the functioning of the European recycling system. It means making circularity a fully integrated component of the Single Market and of European industrial policy. The challenge of the coming years will be to turn shared objectives into industrial capacity, investment and a genuinely European market.

Markus Kerber
Political Advisor, Albright Stonebridge Group – USA; former Chief Economist of the German Federal Ministry of Finance; former Director General of the Federation of German Industries – BDI

Europe and the European Union are going through a particularly demanding geopolitical and geo-economic period, probably the most difficult since the end of the Second World War. Great-power competition and the setbacks suffered by rules-based globalisation, together with the increasingly isolationist stance of the United States of America, have made the creation of a sovereign, powerful and resilient European Union a strategic imperative. In order to be sovereign and resilient, the concept of power has returned to the fore. Power is a resource-based concept. Without resources, power cannot be exercised. And in this context natural resources play a major role. It is precisely here that our study seeks to make a decisive contribution. In a world in which trade and exchange-based supply chains can no longer be relied upon, the pursuit of recycling Europe's existing resources and the role of secondary raw materials become a matter of the utmost economic and political importance.

The TEHA study commissioned by CONAI has proved invaluable in this context. Not least because Italy is Europe's second-largest industrial economy and therefore holds an immense stock of secondary raw materials across its many production processes, but also because its current recycling systems have much to teach the other Member States of the European Union, as well as the European Commission in Brussels. As a first step, it was extremely useful to assess the scale of the current secondary raw materials sector in the EU. With almost 700,000 enterprises and 5.2 million employees, the sector generates annual turnover of €1.2 trillion and gross value added of more than €350 billion. Vast as this sector may appear, the Study has unfortunately also shown that only a few secondary raw materials markets in the European Union function effectively and that, as a result, dependencies on non-EU states persist. Steel, paper, plastics and aluminium are four key strategic industrial sectors in which the consumption of secondary raw materials still covers only a partial share of the total. The Study has further shown that the competitiveness of the

European secondary raw materials market depends to a large extent on non-European third countries such as India, Türkiye and Egypt. Supply and demand are therefore determined by factors that Europeans cannot directly control. The question is thus: what could and should the European Union do to mitigate such dependencies?

The key lies, on the one hand, in Europe's recycling industries and their capacity and, on the other, in a far more strategic regulatory framework. The TEHA study has highlighted what is needed: the creation of market conditions that support and enhance the sector's competitiveness; trade policies, quality standards and anti-dumping measures that ensure fair competition; the harmonisation of Member States' highly fragmented regulatory patchwork; predictable and stable prices for the main cost factor of the primary process, namely energy; and, finally, a carefully designed waste management system that maximises both quality and value retention. Finding the right regulatory framework to achieve all these objectives within a relatively short period may appear impossible at first sight. By applying the "28th regime" concept drawn from the Letta Report, matters could move much faster, and the opportunity created by the European Commission in March 2026 with the "EU Inc." instrument should be exploited in this important policy area.

One aspect that deserves further examination in the European secondary raw materials landscape is the drafting of a roadmap setting out the virgin and secondary raw materials required by the European defence and security industrial complex. From military equipment to satellite manufacturing, from ammunition to data centres, all the required quantities of raw materials must be compared with Europe's internal supply capacity, in order to assess the import volumes needed and the partial shares that could be met through a more effective circular economy approach within the European Union itself. Resilience cannot improve unless we measure our vulnerabilities and develop countermeasures and policies aimed at eliminating those dependencies and vulnerabilities. The European Commission and the Member States of the European Union should make this task a top priority in the civil-military domain.

Nicola Pedde
Director of the Institute for Global Studies – IGS; Professor of Geopolitics of Energy and the Environment at Roma Tre University

The current international system is going through a phase of instability that differs, not only in intensity but also in nature, from that which characterised the decades following the end of the Cold War. What defines the present context is not simply a higher degree of unpredictability, but rather the emergence of a more complex form of systemic risk, in which geographically distant crises can overlap, reinforce one another and generate economic and strategic consequences far exceeding the impact of each crisis taken in isolation. An event may be serious without becoming systemic if its effects remain contained; systemic risk arises instead when different crises activate common transmission mechanisms - commercial, financial or energy-related - capable of turning local instability into broader global disruption. This phenomenon is increasingly evident in Europe, where an arc of instability extending from Eastern Europe and the Caucasus through the Middle East, the Horn of Africa and the Sahel, as far as South and South-East Asia, is concentrated in areas that are both geographically close to Europe and deeply connected to the trade and energy routes on which the European economy remains structurally dependent.

The strategic relevance of this geography therefore lies not simply in proximity, but in interdependence. A significant share of the trade and energy flows linking Asia to Europe passes through a limited number of critical maritime corridors - the Strait of Malacca, the Strait of Hormuz, Bab el-Mandeb and the Suez Canal - before reaching the Mediterranean and European markets. These passages should not be viewed as independent pieces of infrastructure, but as a genuine chain of vulnerability, in which the disruption of a single link can compromise the continuity of downstream flows even when the remaining sections remain fully operational. European security of supply therefore depends not on the overall resilience of the system, but on the security of its weakest chokepoint at any given moment. This explains why crises that may initially appear marginal to European interests can translate, often within a relatively short period, into higher

logistics costs, energy price volatility and disruptions to industrial supply chains.

This vulnerability takes on particular significance for a continent that retains one of the world's leading manufacturing bases and remains highly integrated into international markets. Numerous European economies - including Germany, Italy, France, Spain and the main industrial systems of Central Europe - depend on continuous and predictable flows of raw materials, intermediate components and energy, a significant share of which originates outside the Union. For production systems of this kind, disruptions along critical trade routes are not merely temporary logistical inconveniences, but can rapidly translate into higher production costs, loss of competitiveness and risks to industrial business continuity. Logistical vulnerability is therefore directly intertwined with industrial vulnerability, making security of supply an increasingly central component of European economic policy.

The consequences are also macroeconomic in nature. Shocks affecting energy costs, raw materials and logistics can be transmitted rapidly to prices, industrial margins and investment, with particularly significant effects for economies that are heavily manufacturing-based and open to international trade. Europe's economic and industrial security can therefore no longer be conceptually separated from the security of global trade routes and from the continent's ability to reduce its most critical dependencies. Within this framework, resilience does not simply coincide with the geographical diversification of supply, but also requires a greater capacity to retain value, materials and resources within the European economic system, strengthening domestic value chains and reducing exposure to external shocks.

The geography of contemporary conflicts, the geography of global trade and the geography of European industrial dependencies can therefore no longer be considered separately. They are dimensions of the same map, observed from complementary perspectives. For Europe, the challenge no longer consists solely in managing individual crises as isolated foreign policy events, but in understanding the mechanisms through which they can interact and transmit their effects to the entire economic and production

system. Strengthening European resilience therefore means acting simultaneously on external points of vulnerability and on the domestic capacity to source, transform and recover materials. From this perspective, the ability to valorise secondary raw materials and to strengthen recycling value chains also acquires a strategic dimension: not only environmental, but industrial, economic and geopolitical.

THE KEY MESSAGES OF THE STUDY

1. The next twenty-four months will represent a genuine moment of opportunity for shaping the future EU regulatory framework on sustainability and circularity. Four legislative acts negotiated in parallel offer the chance to revise the existing framework in the direction of greater competitiveness and enhanced value for the European circularity value chain.

The European Union is today facing a crucial regulatory moment. After more than a decade of progressively building the EU framework for sustainability and the circular economy – which has led the EU to develop one of the most advanced regulatory systems in the world, with 35 binding targets – the next twenty-four months will be decisive in setting the rules of the market for the years to come.

The European roadmap "**One Europe, One Market**" concentrates within the same time frame four complementary initiatives with major implications for the secondary raw materials value chain: the **Circular Economy Act**, aimed at fostering the creation of a European market for secondary raw materials; the **European Product Act**, which will act on ecodesign and recycled content; the **Critical Raw Materials Centre**, intended to strengthen market intelligence, demand aggregation and the strategic management of supply; and the **reform of public procurement (Public Procurement Act)**, which can use public demand as a lever to support the use of recycled materials.

The challenge therefore does not consist in raising environmental ambition still further, but in using this regulatory window to turn circularity into a structural component of European industrial policy, of its competitiveness and of its strategic autonomy. The simultaneity of these initiatives is a unique opportunity to overcome the fragmentation between 27 national systems and build a genuine European Single Market for secondary raw materials, supporting industrial value chains and putting forward a regulatory architecture rooted in European industrial reality.

2. The European secondary raw materials value chain – albeit with specific features that distinguish different materials and different Member States - is currently going through a phase of great complexity, characterised by an incomplete alignment between supply and demand, volatile dynamics associated with cyclical pressures, and competition from imports from third countries.

Supply of and demand for secondary raw materials remain misaligned for several materials, and the use of secondary raw materials is not sufficient to fully sustain Member States' recycled production capacity, with substitution rates between virgin and recycled material lower than expected. In 2024, of around 7.7 billion tonnes of materials processed by the European economy, only 1.04 billion – some 14% – came from recycling and backfilling. In the same year, the circular material use rate stood at 12.2%, against an EU target of 24% by 2030. This would require almost a doubling in just six years, pointing to a **disconnect between targets and European industrial reality**.

Also weighing on the industrial sector and on the alignment between European supply of and demand for secondary raw materials are **price dynamics**. In the case of plastics, for example, the value of the secondary raw material fell from €472 per tonne in 2022 to €321 in 2024, a decrease of 32%, while the recycling rate remained broadly stable at around 40%. To this are added higher European costs for energy, labour and compliance, competition from virgin materials and from recycled materials imported from third countries at lower cost and not always subject to verifiable equivalence standards, as well as persistent regulatory and market fragmentation.

The effects on industrial capacity are already visible. In 2024 European installed capacity for plastics recycling stood at 13.5 million tonnes, but **almost 1 million tonnes of capacity was lost in the previous three years**. Data for 2025 further indicate a 50% increase in plant closures, despite the introduction of minimum recycled content obligations in certain applications (e.g. PET bottles). A growing contradiction is thus emerging

between increasingly ambitious European targets and a production base under mounting pressure. The priority remains that of building a genuine industrial policy for circularity, capable of **generating demand, scale, investment and fair competitive conditions**, so as to prevent new European obligations from ultimately supporting production capacity located outside the Union.

3. The stakes are high: preserving the EU recycling value chain represents a genuine choice of industrial policy and strategic security for manufacturing. It generates €555 billion of annual economic impact (direct, indirect and induced), €222 billion of value added and more than three million jobs in local economies.

Preserving the European recycling value chain means safeguarding an **industrial, employment and strategic asset that already exists**, and which has developed and taken shape partly as a result of EU environmental priorities. To quantify its value, the Study has applied for the first time at EU level TEHA's proprietary impact measurement methodology to the core recycling value chain, covering the collection, treatment, recovery and transformation of waste into new raw material.

The results reveal an industrial dimension of the utmost significance. Starting from €218 billion in direct turnover, the sector activates a further €225 billion along the supply chain and €112 billion through induced effects, reaching a total economic impact of **€555 billion** per year. In terms of wealth generated, total value added (direct, indirect and induced) reaches €**222 billion**, equal to around 1.2% of the Union's GDP, while the jobs supported exceed **3 million**, counting direct, indirect and induced employment.

The multipliers – **2.54 on turnover, 3.04 on value added and 2.66 on employment** – confirm how deeply recycling is embedded in Europe's production fabric and how capable it is of generating value well beyond the industry itself. The value chain therefore emerges not as a simple environmental service, but as a genuine European industrial infrastructure, with widespread effects on growth, employment and economic resilience.

To this is added the impact enabled through the supply of secondary raw materials to the so-called **Strategic Manufacturing Value Chains** *(plastics, bioplastics, glass, steel, aluminium, paper and board, wood)*. The model quantifies the downstream industrial activity made possible by the use of recovered materials, relating the availability of secondary raw materials, recycled input rates and the activity of user industries. Across the main industrial value chains analysed, this enabling function supports around **€325 billion in turnover, €96.1 billion in value added and 1.14 million jobs**. Recycling therefore emerges as a genuine link in the European industrial supply chain, capable of reducing dependence on virgin and imported raw materials while at the same time strengthening the Union's resilience and strategic autonomy.

4. The EU packaging recycling system generates benefits for society and citizens that exceed the costs it requires: every euro invested in collection, sorting and recycling produces €1.66 of economic, environmental and social benefits.

When the net benefits arising from packaging recycling are considered, the **overall balance for European society is positive**. To measure it, the Study developed a cost-benefit analysis that considers the packaging recycling system from a broader perspective than operating costs alone, including both the resources needed for collection, sorting, transport and recycling, and the system costs and externalities connected with compliance, the treatment of residual streams and transport. Set against these components are the economic, industrial and environmental benefits generated by the value chain: the commercial value of the secondary raw materials recovered, the economic effects induced along the production system, avoided disposal costs, reduced CO_2 emissions and the benefits associated with energy recovery.

The results show how **the system is able to return to society a value significantly higher than the resources needed for its operation**. Against around **€18.8 billion in annual costs** for the packaging collection, sorting and recycling system, **total benefits reach €31.2 billion**, producing a

positive net balance of around €12.4 billion, equal to approximately **€62 per household per year**.

In other words, **for every euro invested in the European recycling system, €1.66 of benefits is generated for society**. This evidence further reinforces the need to view recycling not only as a means of achieving the Union's environmental objectives, but as an infrastructure capable of producing widespread and monetisable economic and social value, as well as of securing stable and lasting supply chains within the European Union.

5. In order to preserve and increase this value in the light of the major changes under way, the Study has identified a set of strategies and actions for the effective functioning of the European secondary raw materials market, built on five functional building blocks and on a set of cross-cutting enabling factors.

In the light of the evidence gathered, the Study proposes a new operating model for the European secondary raw materials market, built around a central question: which market, regulatory, industrial and financial levers are needed to strengthen Europe's secondary raw materials ecosystem and make it genuinely competitive, also in the light of the changed operating context?

The model therefore does not act on a single element of the value chain, but addresses in an integrated way the conditions required to make the market work at European scale, with the aim of contributing to the regulatory momentum and to EU decision-making

The architecture is organised along **five vertical pillars and a sixth cross-cutting block**. The first, **Market Design, Demand-Pull & Supply**, aims to rebuild a stable balance between the production of secondary raw materials in the EU and industrial demand. The second, **Governance and Normative Framework**, seeks to make national rules and systems interoperable within the Single Market. The third, **Standards, Quality & Trust**, concerns the creation of common conditions of quality, traceability and reliability, which are indispensable if SRM are to be recognised and

traded as genuine industrial inputs. The fourth, **Industrial Scale, Finance and Investments**, addresses the need to consolidate European production capacity and mobilise the capital required for investment and growth. The fifth, **Strategic Autonomy & Trade**, aims instead to preserve the strategic value of resources within Europe, reducing dependence on virgin raw materials and non-EU markets. Alongside these is a set of **cross-cutting enabling factors**, which are decisive for the overall effectiveness of the model and are explored in the following Key Message.

6. Cutting across the model are enabling factors that lie outside the specific secondary raw materials sector and the sustainability regulatory framework, yet condition their effectiveness: EU energy policies, training and skills development, innovation and data, and the social acceptability of green policies.

The first factor concerns **energy**, which is decisive for the competitiveness of activities such as material recycling and recovery, characterised by significant energy intensity. Some 75% of European enterprises identify energy costs as an obstacle to investment: the availability of competitively priced, stable and low-carbon energy is therefore an essential condition for sustaining production capacity and new investment.

A second area is **innovation and data**. More than 70% of European enterprises have already invested in digital transformation and, in recycling, digitalisation, data interoperability and advanced sorting technologies can improve traceability, process efficiency and the verification of recycled content.

Equally relevant is the availability of **skills and a qualified workforce**: 79% of European enterprises cite the shortage of skilled workers as a barrier to investment. Growing recycling capacity will therefore require specialised profiles and training and reskilling policies.

Finally, **social acceptance** remains central. Although 96% of European citizens consider resource efficiency important, public support for new infrastructure and green policies cannot be taken for granted. Community

engagement and clear communication of the environmental, employment and economic benefits are therefore essential to strengthen acceptability.

7. The operating model rests on four features designed to make it applicable to the twenty-seven national systems and consistent with European objectives: *mutual recognition* and *the sharing of best practices*, *industrial symbiosis*, *investment activation* and *strategic security*.

For each functional building block of the model, the Study analysed the main areas for improvement in the current European set-up, examined case studies from other countries and sectors, and identified possible operating rules. Four **distinctive features** emerge from this process, guiding the shift from a predominantly regulatory approach to a genuine industrial policy for secondary raw materials.

The first is **mutual recognition** as a founding principle. In a Europe characterised by different national systems and Extended Producer Responsibility (EPR) models[1] that reflect deeply rooted local specificities, the objective must not be a new, centralised and forced harmonisation, but the recognition and interoperability of the systems that work, within common guidelines and a common framework, while encouraging the diffusion of best practices.

The second is **industrial symbiosis**: recycling capacity must be reconnected to the demand of industrial value chains, overcoming the misalignment between the availability of secondary raw materials and the market's ability to absorb them, through a clear, shared and long-term industrial policy and through mechanisms to reduce volatility, reasoning along multi-sectoral lines rather than within individual segments (from the primary sector, which can make use of the output of organic recycling, to the secondary sector, which can absorb the secondary raw materials generated by mechanical and chemical recycling).

[1] A system in which the producer assumes financial, and in some cases also operational, responsibility for managing the product once it has become waste.

The third feature is **investment activation**. Strengthening European production capacity requires bankable investments, supported by solid business cases, lower exposure to price volatility, public-private cooperation and European instruments for risk sharing and for stimulating investment aimed at strengthening the circularity of the European economy. Against around €120 billion invested each year in the EU circular economy, an unfunded gap of €82 billion is estimated to remain.

The fourth is **strategic security**, which recognises secondary raw materials as a component of European security of supply - and which the Study places as the guiding criterion for the entire set of proposals. The objective, stated from the outset in the Study's priority selection criteria, is not to maximise circularity as an abstract parameter, but to **preserve in Europe the manufacturing, value and employment that circularity generates**: this is why strategic security cannot be treated as one sectoral theme among others, but as the thread holding together all three of the model's other features. Strengthening recycling means reducing dependence on imported virgin materials, limiting exposure to geopolitical *shocks* and retaining within the Union materials, production capacity and industrial value - which is, ultimately, what the Study identifies as the asset to be protected through each of the proposed actions, rather than as one objective among many. For this to happen effectively, it is necessary to recognise the specificities of each strategic value chain and the role that EPR systems play, and will increasingly be able to play, in securing stable and lasting supply chains within the European Union.

8. Three policy priorities have been identified. The first concerns the governance of the value chain and the creation of common rules for the European Single Market for secondary raw materials.

The fragmentation of governance is not an implementation problem, but the consequence of **twenty-seven national systems built on different premises and different value chain contexts**. Criteria establishing when a recovered material ceases to be waste currently exist at European level only for metal scrap and glass, while the regulation on plastics is still under

discussion[2]. The practical consequence is that the same material can be classified as a product in one Member State and as waste in another, with an additional cost for the European plastics recycling sector alone estimated at around €120 million per year[3].

The comparative analysis carried out across the twenty-seven Member States shows that **no governance model is structurally better than the others**: Italy and Germany, two of Europe's largest **manufacturing economies with high demand** for raw materials, both achieve high performance in terms of packaging recycled per inhabitant, albeit through opposing EPR system architectures. It is this evidence that steers the policy choice towards **mutual recognition** and the **sharing of best practices**, rather than towards forced harmonisation of system architectures.

The actions proposed by the Study build on this basis: a **technical platform for dialogue, involving EPR systems under a European institutional secretariat**, the promotion of mutual recognition of end-of-waste criteria defining when a recovered material may be placed back on the market as a secondary raw material, and the extension to secondary raw materials of the digital traceability tools already provided for by the European regulatory framework.

9. The second policy priority concerns industrial symbiosis, that is, the need to strengthen the integration between Europe's collection and recycling capacity and an industrial demand that is stable, predictable and able to absorb EU secondary raw materials.

The European secondary raw materials market is today the continent's only major raw materials market **without an organised trading venue and a public, shared price signal**. This absence weighs most heavily in materials where industrial demand remains weak relative to available supply.

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[2] European Commission, Accelerating Europe's transition to a circular economy: a pilot for boosting the circularity of plastics, COM(2025) 805 final, 23 December 2025

[3] European Commission, Joint Research Centre, EU-wide end-of-waste criteria for plastic waste, JRC139303, 2024.

The evidence gathered by the Study indicates that public demand instruments work best when **recycled content requirements are binding rather than merely rewarded**: a points-based criterion tends in fact to be offset on price by operators, without generating the stable demand needed to justify new industrial investment. At the same time, experience from other European strategic sectors shows that **stimulating demand without ensuring effective controls and a level playing field at the border risks translating into an advantage for non-EU production**, rather than for the European value chain.

The proposed actions therefore combine the creation of a single European marketplace for SRM, **the activation of binding public demand**, the **strengthening of controls on the standards applied to imported materials so that they are genuinely equivalent to those made in the EU**, all within a European planning roadmap designed to make investments bankable.

10. The third policy priority concerns finance for the growth of the sector and in support of circularity.

The analysis shows that the constraint does not lie in the availability of capital, which remains abundant in Europe, but in the **scarcity of projects able to pass financing assessments**.

To address this constraint, the proposed actions extend instruments that the Union has already tested in other strategic sectors, such as the **creation of a dedicated category for recycling technologies that would benefit from them**, modelled on the *Net-Zero Industry Act*[4], and the activation of **price risk mitigation mechanisms** inspired by the Contracts for Difference already used in the renewable energy sector. Alongside these is the possibility of linking the sector to the proposed reform of the Emissions Trading System (ETS)[5], which **envisages progressively extending its scope to the incineration and co-incineration of non-hazardous waste,**

[4] European Commission, 2026.
[5] Proposal for a DIRECTIVE OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL amending Directive 2003/87/EC and Decision (EU) 2015/1814 as regards driving competitiveness and cost-effective decarbonization.

including energy recovery. Introducing a price on the related emissions can **strengthen the economic incentives for prevention, sorting and material recycling**, while reinforcing the instruments financed through ETS revenues can help support **investment in the decarbonisation and circular transition of European industry**.

Completing the financial architecture, finally, requires the establishment of a European public platform dedicated to the sector and its connection with **the Savings and Investments Union**, so as to mobilise long-term private capital towards a sector which, given its size and industrial maturity, has the conditions to become a reference use case for the entire European strategy for financing competitiveness.

CHAPTER 1

THE EUROPEAN LANDSCAPE OF THE CIRCULAR ECONOMY AND OF SECONDARY RAW MATERIALS, BETWEEN COMPETITIVE CHALLENGES, GEOPOLITICAL TENSIONS AND NEW REGULATORY MOMENTUM

Over the past ten years the European Union has built the most comprehensive regulatory framework in the world on the circular economy. No other economic area has a comparable system in terms of the breadth of flows covered, the number of binding targets and the degree of integration between product, waste and raw materials policies. It is an achievement that Europe reached ahead of its competitors and has exported as a regulatory model to much of the world.

The same decade, however, has produced a second, less visible outcome pointing in the opposite direction. **Europe's industrial capacity to transform waste into usable raw materials has not grown at the pace of the targets**, and in some segments it is contracting. The gap between what the Union has set out to achieve and what its production system is able to deliver today - and, barring changes, will be able to deliver in the foreseeable future - risks **undermining Europe's competitive position in the circular economy**. These aspects are therefore central not only to environmental policy, but also become central to industrial, social, investment, trade policy, innovation support and competitiveness issues.

Against this background, this Chapter outlines the reference scenario for the circular economy, relevant to the formulation of a new operating model for the recycling and secondary raw materials sector in the EU. This scenario can be divided into three macro work streams. The first examines the **shift in perspective** that has moved the circular economy from the realm of environmental policy to that of industrial competitiveness and strategic autonomy, and the structural reasons - material consumption, external dependence, geopolitical pressure - that have made it necessary.

The second identifies the **structural challenges** that the secondary raw materials value chain faces today on three fronts: the market, governance and international competition, and seeks to show how the shortfall against targets is not an implementation problem but a question of industrial structure, making an approach centred on coherence between regulation and industrial synergy between supply and demand indispensable.

The third work stream highlights how the EU faces a **new regulatory momentum** that opened in 2026, with a window of opportunity - narrow and not soon repeatable - that it will offer in the coming years to shape common European industrial action in the field of recycling and the circular economy.

1.1 THE CIRCULAR ECONOMY AS A LEVER FOR INDUSTRIAL COMPETITIVENESS AND EUROPEAN STRATEGIC AUTONOMY

For some two decades, the circular economy was in practice a mainly environmental item on the EU agenda. Targets for reducing the quantity of waste sent to landfill guided Europe's governance, production and industrial set-up, through the monitoring of collection and recycling rate indicators. At institutional level too, the related policy framework developed mainly within environmental policy, with a central role for the European Commission's Directorate-General for Environment (DG ENV). In recent years, by contrast, it has become increasingly clear that circularity policies can support - or, conversely, adversely affect - European industrial competitiveness.

From an environmental dossier to the competitiveness agenda

This environmental imprint can be read in the regulatory framework that the Union has built over two decades, the most comprehensive in the world in this field: from the Waste Framework Directive to the Landfill Directive, from the WEEE Directive to the Batteries Regulation, through to the Packaging Regulation and the Single-Use Plastics Directive. A framework resting on **six distinct regulatory pillars and comprising more than thirty-five legally binding targets**, set out in detail in section 1.3.

Two major policy documents have helped shift the debate from environmental policy to industrial competitiveness.

The **Letta Report - *Much More Than a Market. Speed, Security, Solidarity***, presented in April 2024, placed the completion of the Single Market at the heart of the Union's competitiveness strategy, identifying market integration and economies of scale as the lever Europe can no longer afford to underuse, and proposing the Savings and Investments Union as the channel to finance it.

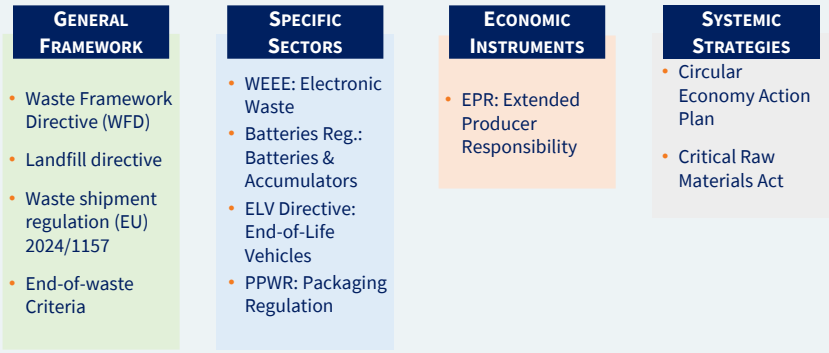
The **Draghi Report - *The Future of European Competitiveness***, published in September of the same year, identified energy costs, dependence on imported raw materials and the innovation gap as the three structural vulnerabilities of European manufacturing, and pointed to circularity as one of the levers capable of acting on the second.

On this basis, between 2025 and 2026 the Commission built a framework in which the circular economy no longer appears as a sectoral policy but as a **component of industrial policy**: the Competitiveness Compass makes it one of the factors for reducing external dependence, the *Clean Industrial Deal* adopts the Circular Economy Act as a central pillar, and the *RESourceEU* Action Plan of December 2025 explicitly links it to security of supply for critical raw materials. The three directions that European strategic guidelines now associate with circularity are, in order, **market integration and economies of scale**, **strategic autonomy and resilience**, and **competitiveness and industrial transformation**: none of the three, it will be noted, belongs to the exclusive or predominant domain of environmental policy, effectively marking a shift in perspective within the European regulatory framework on sustainability[6].

[6] Enrico Letta, Much More Than a Market - Speed, Security, Solidarity; Mario Draghi, The Future of European Competitiveness; European Commission, The Clean Industrial Deal: A Joint Roadmap for Competitiveness and Decarbonisation; European Commission, RESourceEU Action Plan - Accelerating our Critical Raw Materials Strategy to Adapt to a New Reality.

The European regulatory framework for recycling: six regulatory pillars

The regulatory architecture that the European Union has built for recycling rests on six distinct pillars, which together comprise more than thirty-five legally binding targets.



The general framework is set by the Waste Framework Directive, the Directive on packaging and packaging waste - now replaced by Regulation (EU) 2025/40 - and the Landfill Directive.

Economic instruments are entrusted to the principle of extended producer responsibility, which transfers to those placing goods on the market the financial, or financial and operational, burden of end-of-life management. Flow control is governed by the Waste Shipment Regulation and by end-of-waste criteria, which establish when a recovered material legally passes from the status of waste to that of secondary raw material.

Three pieces of legislation cover specific sectors: the WEEE Directive for electrical and electronic equipment, the Batteries Regulation and the End-of-Life Vehicles Directive. Systemic strategies are set out in the Circular Economy Action Plan and the Critical Raw Materials Act.

The packaging and plastics segment, finally, is governed by the PPWR Regulation and the Single-Use Plastics Directive. It is a framework that simultaneously reflects environmental priorities and strategic concerns regarding access to materials: the overlap between the two dimensions is not recent, but only recently has it been made explicit.

Source: TEHA Group elaboration on European Union legislation, 2026.

The role of secondary raw materials for European competitiveness

For the purposes of this Report, **virgin raw materials (RM)** means natural resources extracted directly from the environment and used as inputs in production processes, such as minerals, metals, biomass and fossil fuels. **Secondary raw materials (SRM)**, by contrast, means materials recovered from waste through recycling processes and reintroduced into the production cycle as usable inputs, fully or partially replacing the corresponding virgin raw materials.

The centrality of this repositioning of circularity within Europe's competitiveness agenda lies in the very structure of the European production model. Europe is an economy of **transformation, not extraction**: **primary goods** - raw materials, energy and agricultural products in their natural state - account for around **30% of European imports** but only 16% of exports, while outbound flows consist for the most part of **manufactured goods**, with machinery and transport equipment alone accounting for **39% of the Union's total exports**[7]. It follows that the two main variables determining its competitiveness as a complex industrial system are: the **cost** of material *inputs* and the **security** of their supply. The Union has limited control over both, and on both secondary raw materials and organic recycling can make a direct contribution: they are substitutes for virgin raw materials, and every tonne recovered on European territory simultaneously reduces exposure to the international price and to the physical availability of the corresponding virgin material.

The global context in which this substitution takes place is not favourable. Over the past fifty years the **material footprint per capita** has increased in every region of the world with the sole exception of Africa, and the sharpest increase is Asia's: taking the 1970 level as 100, Asia rose from an index of 115 in 1980 to **342 in 2023**, tripling its resource consumption per inhabitant. Over the same period Europe rose from 114 to **129**, South America from 119 to 151, North America and Oceania remained broadly stable, and Africa fell from 95 to 89[8].

[7] TEHA Group elaboration on Eurostat data and *"International trade in goods by type of good"*.
[8] TEHA Group elaboration on Eurostat and United Nations data.

The per capita figure, however, tells only part of the story, because over the same period the **world population rose from 4.4 to 8 billion inhabitants** with sharply diverging regional dynamics: Africa's tripled, Asia's almost doubled, while Europe was the region with the most contained demographic growth, at just 7%. Combining the two dimensions changes the picture substantially. **In absolute terms, material consumption has grown in every region of the world, Africa included**: the 6% fall in Africa's per capita footprint is more than offset by the tripling of its population, and translates into a **187% increase in the continent's total resource consumption**. Asia records an absolute increase of more than **fivefold (+436%)**, South America of 131%, Oceania of 112% and North America of 56%. Europe, at **+21%**, is the only region in which the growth of material consumption has remained contained, as the combined effect of a stable demographic profile, a modest per capita increase and a well-established production system.

A direct consequence follows for Europe's competitive positioning. Global demand for materials is growing structurally and by far the largest share continues to be met from non-renewable sources; but that growth is not evenly distributed, and it is all the more intense the more populous and industrialising the region. **It is a trajectory that makes competition for access to resources more intense** and that places the ability to recover materials on one's own territory among the long-term factors of competitive positioning.

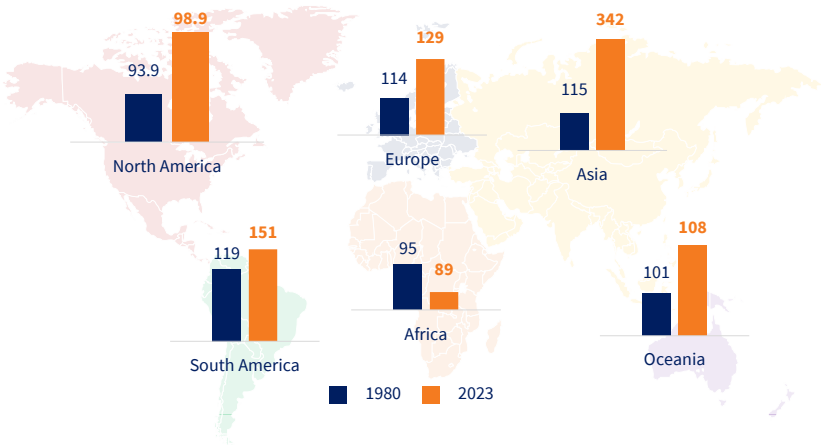


Figure 1. Material footprint per capita (RMC), comparison between continents (index 1970 = 100), 1980-2023. *Source: TEHA Group elaboration on Eurostat and United Nations data, 2026.* N.B.: RMC (Raw Material Consumption) measures net domestic consumption of raw materials - biomass, fossil fuels, metallic and non-metallic minerals - attributed to final demand.

To this virgin raw material substitution function is added a second dimension, equally relevant to European competitiveness. Secondary raw materials produced in Europe through the collection, treatment and recycling of waste are not only an input for downstream manufacturing value chains, but are themselves the **product of a complex industrial value chain**, encompassing collection, sorting, recovery and recycling activities, supported by the Union's businesses and citizens. Their valorisation therefore has a twofold economic significance: on the one hand, it **reduces European industry's dependence on virgin raw materials and on imports**; on the other, it **supports the development and production capacity of Europe's recycling and recovery sector**, generating value added, investment and employment locally.

The gap in the European recycling and reuse system

Against this external backdrop, the degree of integration of recycled materials into European industrial processes remains limited. In 2024 the Union's production system processed **7.70 billion tonnes of materials**, of which **5.17 billion (67%) came from the extraction of virgin natural**

resources, 1.49 billion from imports and **only 1.04 billion (14%) from recycling and backfilling**. Domestic material consumption remains close to **14 tonnes per inhabitant**, a high value by international comparison, even though there are signs of decoupling from economic growth: between 2021 and 2024, EU real GDP grew by 5.0%, while domestic material consumption (DMC) fell by more than 7.0%[9].

The summary measure of this relationship is the **circular material use rate**, which quantifies the share of resources used in the European economy that comes from recycled waste. **From 11.1% in 2014 this rate rose to 12.2% in 2024**, an advance of **0.6 percentage points between 2018 and 2024**, with growth interrupted by setbacks in 2019 and 2021. The European target for 2030 is **24%**: reaching it would require **almost doubling the current value in six years**, an increase of 11.8 percentage points against a decade-long trajectory that has delivered a fraction of that. On an unchanged trend, and in a context of growing demand for materials, the target therefore does not appear attainable.

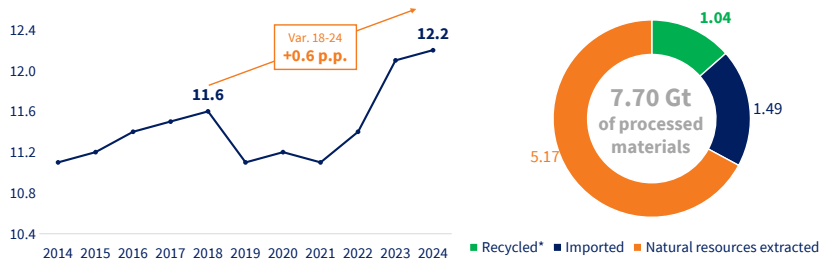


Figure 2. Left: circularity rate in the EU (% of material resources recovered and fed back into the economy), 2014-2024. Right: material flows at real scale in the EU by origin (billions of tonnes), 2024. *Source: TEHA Group elaboration on Eurostat data, 2026*. (*) The material base underpinning the production of goods and energy.

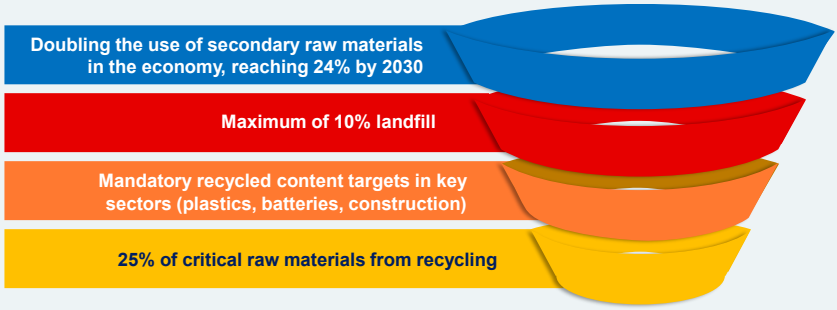
If circularity is a lever of competitiveness and strategic autonomy, then **it must be assessed against criteria and targets that also reflect industrial reality**: installed capacity, cost competitiveness, employment, and value retained locally. And if the circular material use rate is not growing, the

[9] TEHA Group elaboration on Eurostat data.

explanation is to be sought first not in the inadequacy of the targets - which are the most ambitious in the world - but in the **condition of the industrial system called upon to deliver them**.

European targets for secondary raw materials to 2030

The set of targets the Union has given itself for 2030 defines precisely the distance to be covered.



The headline goal is a doubling of the circular material use rate, which should rise from the 12.2% recorded in 2024 to around 24%: an increase of 11.8 p.p. in six years, against a decade-long trajectory that has delivered a fraction of that.

On the disposal side, the landfilling of municipal waste must not exceed 10% of total waste generated, and the organic waste value chain also plays a central role in achieving this result. On the industrial demand side, the framework provides for mandatory recycled content targets in key sectors - plastics, batteries and construction - designed to create a stable outlet market for recovered materials.

For critical raw materials, the relevant European Act sets at 25% the share that must come from recycling. To these are added high recycling rates for the main streams, which are the enabling condition for all the others: without material collected in adequate quantity and quality, no recycled content target is technically achievable.

Source: TEHA Group elaboration on European Commission and Eurostat data, 2026.

1.2 THE STRUCTURAL CHALLENGES OF THE SECONDARY RAW MATERIALS VALUE CHAIN ACROSS MARKETS, GOVERNANCE AND INTERNATIONAL COMPETITION

The shortfall against European targets is commonly interpreted as an implementation problem: adequate rules, insufficient enforcement. The

evidence gathered in the course of this Study points to a different reading. **The shortfall is the outcome of industrial and structural conditions that the regulatory framework does not address**, and which act simultaneously on three fronts - the functioning of the market, the governance set-up and international competition. These are elements that must be taken into account in defining a new operating model for the European circular economy sector from the standpoint of competitiveness and industrial policy.

The gap against the targets

As noted, over recent decades European policy on circularity has set stringent and ambitious targets. At the same time, performance against those targets reflects some of the sector's main weaknesses. In 2023, the recycling rate for **municipal waste** in the Union stood at **47.7%**, against a target of 55% by 2025 and 60% by 2030. **Packaging waste** reached **67.5%**, exceeding the 65% target for 2025 but remaining far from the 70% required by 2030[10].

The most severe gap concerns **waste electrical and electronic equipment** (WEEE), where, against European targets defined in terms of collection - 65% of equipment placed on the market or 85% of WEEE generated - the actual recycling rate stands at **30.8%**. This figure deserves attention because WEEE is the stream with the highest concentration of critical raw materials: **the gap is greatest precisely where the strategic value of the recovered material is highest**.

[10] European Environment Agency (EEA), *Waste recycling in Europe*, 2025; elaboration on Eurostat data.

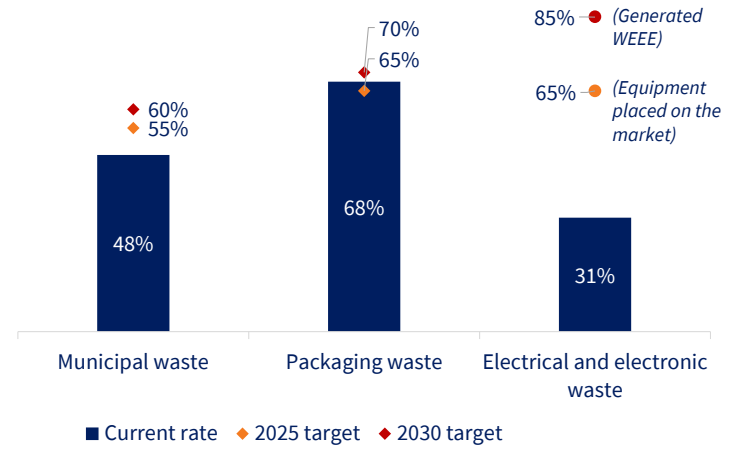


Figure 3. Recycling rates against European targets by waste stream (% values), 2023. *Source: TEHA Group elaboration on European Environment Agency data, 2026.* N.B.: For WEEE, European targets are defined in terms of collection (65% of equipment placed on the market or 85% of WEEE generated) and are compared here with the actual recycling rate.

The picture, moreover, shows wide differences and asymmetries between EU countries. On municipal waste recycling, the distance between Member States ranges from **68.7% in Germany** to **12.4% in Romania**: a ratio of more than five to one within the same internal market, with Italy at 50.8%, France at 40.3% and Spain at 43.3%. On packaging recycling the spread is narrower but equally significant, from **79.7% in Belgium** to **42.8% in Hungary**, with Italy at 75.6%. Overall, in 2023 **twenty-one Member States were at risk of missing the 55% municipal waste target** for 2025 and **eleven were at risk on the 65% packaging target**.

A divergence of this magnitude reflects **the existence of profoundly different national systems**, shaped by the transposition of European directives into different national contexts and by the evolution over time of regulatory choices, particularly on extended producer responsibility (EPR).

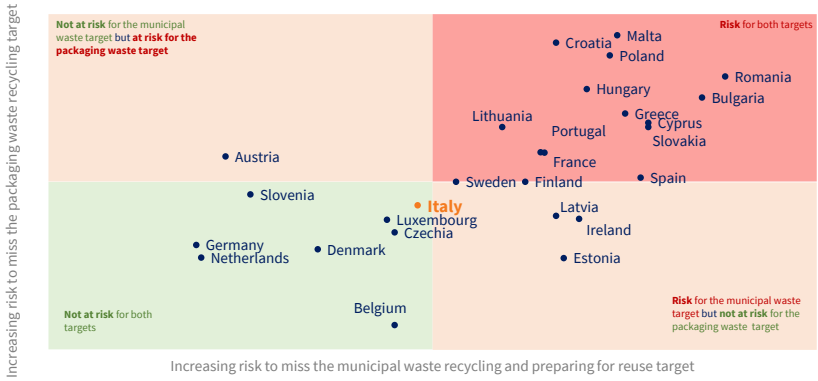


Figure 4. Risk of missing the targets for recycling and preparing for re-use of municipal waste and for recycling of packaging waste in EU Member States, 2023. *Source: TEHA Group elaboration on ESRI data, 2026.*

Market asymmetry: the demand and price question

In this fragmented context the central issue concerns the market, and it breaks down into two interconnected weaknesses: an **industrial demand deficit** and a **price competitiveness deficit**. The two are not independent: in several segments it is not high prices that depress demand, but weak demand that makes prices unstable.

The first imbalance can be precisely quantified: **only for some materials** - steel, aluminium, paper - **does a market function continuously**, while for others, and in particular for plastics, the penetration of recycled *inputs* remains marginal relative to overall demand[11]. In the case of plastics, the absorption of secondary material is also limited by the technical feasibility of its use in end products: the items that can most easily incorporate recycled material are often lower value-added applications – such as sacks, bins, pipes and other industrial uses – while for packaging the requirements linked to food contact are particularly significant.

Verifying this requires cross-referencing two variables that are normally observed separately - the recycling rate, which measures how much

[11] TEHA Group elaboration on Eurostat, European Container Glass Federation (FEVE) and Confederation of European Paper Industries (CEPI) data, 2026.

material the system recovers, and the share of industrial raw material demand met by secondary material, which measures how much of that material industry absorbs. A market works only when both are high: a high recycling rate coupled with low industrial demand does not describe an efficient value chain; it describes a system producing material that no one uses.

Applying this criterion to the main streams, steel, aluminium and paper sit in the virtuous quadrant, with both recycling rates and industrial penetration high. Glass and wood occupy an intermediate position. Plastics, organic waste, construction and demolition aggregates and textiles, by contrast, remain in the quadrant in which at least one of the two variables is inadequate.

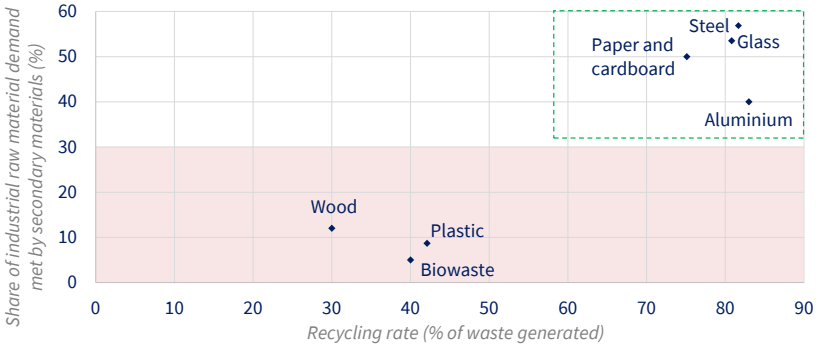


Figure 5. Recycling rate and share of industrial raw material demand met by secondary raw materials in the EU, by material category (%), 2022-2023. *Source: TEHA Group elaboration on EEA, Eurostat, FEVE, CEPI and Plastics Europe data, 2026*. N.B.: the values for the share of industrial demand met by secondary raw materials for plastics, wood, organic waste, construction and demolition aggregates and textiles are estimates based on EEA Report No. 12/2022 and sector literature; no homogeneous Eurostat dataset is available for this variable. For steel, the value is based on the ratio between ferrous scrap input and crude steel production ("general scrap use") in the EU, equal to around 59% in 2024 according to the European Commission's Joint Research Centre. No homogeneous Eurostat dataset is available for this variable across all material categories.

The second imbalance concerns **price**, and the case of plastics provides the clearest demonstration. Between 2020 and 2024 **paper**, at between 70%

and 75%, maintained **stable prices** or recovering ones: this is the typical behaviour of a functioning secondary market, in which steady industrial demand absorbs supply and supports prices. **Plastics** tell the opposite story. Against a recycling rate that barely moved from 40% over the same four years, the price of the secondary raw material rose to €472 per tonne in 2022 before collapsing to €321 in 2024: a **32% fall in two years**.

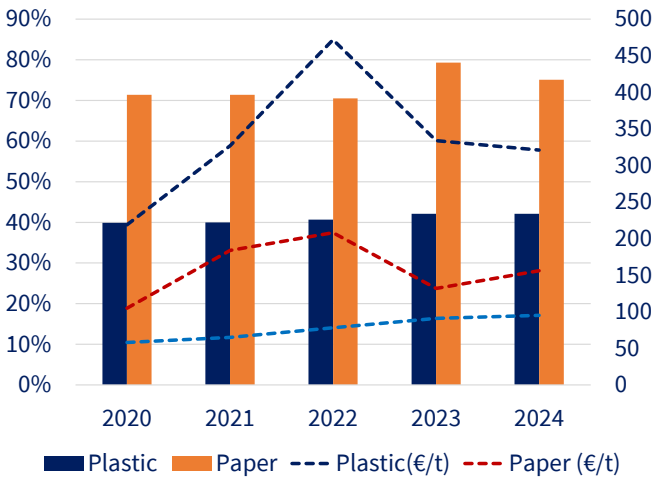


Figure 6. Recycling rate and price of secondary raw materials for plastics and paper in the EU, 2020-2024. *Source: TEHA Group elaboration on Eurostat and Confederation of European Paper Industries (CEPI) data, 2026.*

This collapse is not the effect of excess supply. Were that the case, it would be accompanied by a rise in the recycling rate, which instead has remained flat. It reflects, on the contrary, **weak and volatile industrial demand**, driven by three converging factors: the absence of binding recycled content obligations of sufficient scope and able to favour recovered material thanks to the support of EU businesses and citizens, competition from low-cost virgin plastic - whose price follows that of oil and does not incorporate the environmental costs of production - and the absence of harmonised end-of-waste criteria, which discourages industrial buyers from planning supply on a multi-year basis.

Compounding this dynamic is a **structural price competitiveness deficit**. European secondary raw material competes on the one hand with virgin

material in a market in which the price of the latter reflects international *commodity* costs and does not incorporate the full range of environmental costs; and on the other with imported secondary raw material produced at lower cost, including for structural reasons. The result is a compression of margins that stems not from any efficiency shortcoming of European operators but from the **relative cost structure** - energy, labour, compliance - within which they operate[12].

Persistent fragmentation at EU level also bears on this: **national markets for secondary raw materials are not integrated**. The price differential between Member States, measured as the coefficient of variation, forms a clear hierarchy: it is contained in materials with established technical specifications and mature markets - **paper at 4.1%, steel scrap at 6.2%, aluminium at 6.8% glass cullet at 10.8%** - and rises where quality is more variable and **standardisation** weaker -**, wood at 16.5%, plastic waste at 18.2%**. The correlation between the degree of standardisation and price integration is, in itself, an indication of where to act.

The international front: the plastics crisis as a warning signal

The third family of challenges concerns international competition. So far it is above all the European plastics value chain that has borne the cost. Europe's plastics recycling industry is going through a crisis that risks spreading to other materials affected by the same dynamics. In 2024 European installed capacity for plastics recycling stood at **13.5 million tonnes**[13], while over the past three years plant closures have caused the loss of **almost one million tonnes of recycling capacity**. Preliminary data for 2025 further show a **50% increase in plant closures compared with the previous year**, confirming the progressive deterioration of the sector's industrial conditions. The phenomenon is also borne out by the rise in individual business closures: a census of plastic waste treatment plants updated to January 2026 identifies **16 closures in the EU** since 2022, rising

[12] TEHA Group elaboration on European Commission, *Dashboard on energy costs for EU industry and major trading partners*, European Parliament, S&P Global, Eurostat, European Central Bank (ECB) and U.S. Energy Information Administration (EIA) data, 2026.
[13] Plastics Recyclers Europe, *2024 Data Reveals a Deepening Crisis of the European Plastics Recycling Industry*, 2025.

to 24 when the United Kingdom is included. These include plants dedicated to high value-added streams, including bottle-to-bottle PET recycling. The crisis therefore also affects segments for which European legislation has progressively created mandatory demand: since 2025, PET beverage bottles placed on the market must contain at least 25% recycled plastic[14].

Over the same period, as an example of how targets and industrial dynamics cannot proceed separately, the annual capacity growth rate needed to meet the targets of the Packaging Regulation stands at around **6%**: the actual trajectory and the required one diverge.

Were this not addressed, the risk is a further displacement of European industry. The mechanism producing this outcome is documented: **low-cost imports of recycled materials erode domestic demand and discourage investment**. And the phenomenon **is not confined to plastics**: the same dynamic is observed, with varying intensity, in paper, metals and glass.

A significant technical element contributes to this: European customs nomenclatures do not distinguish recycled materials from virgin ones, and therefore allow neither systematic verification of the compliance of imports nor the construction of a public price index.

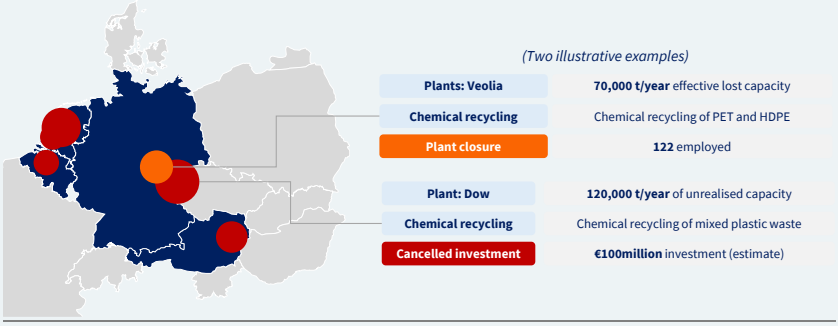


Figure 7. Main plant closures and suspended, postponed or cancelled investments in the plastics recycling sector in continental Europe (illustrative selection), 2023-2025. *Source: TEHA Group elaboration on S&P Global and Plastics Recyclers Europe data, Closed Plastic Recycling Plants (30 July 2025), 2026.* (*) Estimates based on Plastics Recyclers Europe and S&P Global data on plant closures and on the publicly

[14] Basel Action Network, *Closures of Plastic Waste Processing Plants*, updated January 2026; Plastics Recyclers Europe, *Wave of Surging Plastic Recycling Plant Closures Hits Europe*; Veolia, *PET Recycling Plant in Rostock*; Directive (EU) 2019/904

declared capacity of the main cancelled, suspended or postponed projects. Closures in the United Kingdom are excluded. Percentages are calculated against European installed capacity in 2024, equal to 13.5 million tonnes per year, and should therefore be considered conservative. The data refer mainly to nominal waste treatment capacity and not to actual recycled material output.

In this scenario the crisis of the plastics segment takes on the value of an **early warning signal**. Plastics are the stream in which the price gap with virgin material is widest, the quality of recovered material most variable and import pressure most intense. To this last element is added the limited capacity to control imported materials, currently based mainly on documentary checks and not always accompanied by substantive verification of the actual equivalence of recycling conditions, particularly as regards the environmental standards applied and the origin of the waste. Plastics therefore constitute the segment in which the three families of challenges act simultaneously and with the greatest intensity: what is observed there today shows **what can happen when such structural conditions are not addressed**.

The governance front: twenty-seven regimes for a single market

The second family of challenges concerns the institutional set-up. The legal concept that determines whether a recovered material may circulate as a product - **end-of-waste status** - was introduced by the 2008 Waste Framework Directive, but its application has remained largely national.

Harmonised European criteria currently exist only for **metal scrap and glass**; for plastics the regulation has not yet been approved. The consequence is that **the same recovered material can be classified as a product in one Member State and as waste in another**, with immediate effects on the ability to sell, transport and use it.

An asymmetry of the same nature concerns a stream adjacent to the seven materials covered by this Study, but instructive for the overall diagnosis: organic waste. Since **1 January 2024** the Union has required separate collection of the organic fraction in all Member States, but - unlike secondary raw materials, for which there are binding targets phased

through to 2030 - it has not accompanied that obligation with **any target, any milestone or any penalty**. It is an obligation without an enforcement apparatus, and its application indeed remains largely uneven across Member States.

To this fragmentation is added that of extended producer responsibility (EPR) systems, which form the operational backbone of European circularity for packaging materials and which differ between Member States in the number of implementing bodies, legal form, fee modulation criteria, the presence of deposit and return schemes, and reporting formats. The resulting picture is not that of a market with common rules, but of **twenty-seven systems pursuing common objectives through different architectures, now deeply rooted in local realities and reflecting the production structures of their respective contexts**. A solution is therefore needed that fosters mutual recognition and the exchange of best practice, without forcing regulatory and governance symmetries that fail to take account of the national, material-specific and industrial-structure specificities that have developed in each country in the meantime.

Quality and traceability deficit

The third element on this front is a **quality and traceability deficit**. An industrial buyer wishing to incorporate secondary raw material needs to verify its origin, composition and recycled content with the same degree of certainty with which it verifies a virgin material specification. The tools currently available do not allow this systematically and, in some value chains – such as plastics – the **high fragmentation of the recycling segment**, characterised by a strong presence of small and medium-sized operators, **further limits the capacity to invest in skills**, technologies and processes able to guarantee uniform quality standards in the face of variable input waste. To this is added the proliferation of voluntary certification schemes – which the Union itself has recorded in large numbers and with highly uneven levels of independent verification – which has aggravated the problem rather than solving it. In the absence of verifiable data and shared quality standards, **secondary raw material is purchased on "trust"**, and trust does not underpin an industrial supply

plan. It therefore becomes important to base approaches and targets on accredited traceability systems, which ensure independence and impartiality.

The three families of challenges are not independent, and none of them can be resolved in isolation. Weak demand makes investment in quality unfinanceable; the absence of quality standards prevents the integration of national markets; the fragmentation of national markets reduces the scale at which operators can compete with imports; and import pressure compresses margins and further reduces the capacity to invest in quality.

It is a system of mutual reinforcement, and this interdependence is why a genuinely new operating model is needed - one updated and consistent with the scenario set out here and with European industrial policy and competitiveness objectives - rather than a list of narrowly scoped fixes.

1.3 THE NEW EUROPEAN REGULATORY MOMENTUM AND THE WINDOW OF OPPORTUNITY FOR COMMON INDUSTRIAL ACTION

The scenario described in the preceding sections might suggest a pessimistic conclusion. A different one should be drawn instead, and it concerns timing: **in 2026 the European Union is in the most favourable position of the past ten years to correct course**. Four legislative acts relevant to the secondary raw materials value chain are being prepared simultaneously, the reform of the main instrument for financing industrial decarbonisation is under discussion, and the competitiveness framework has made politically feasible industrial policy instruments that were not so five years ago. It is a conjuncture, and like all conjunctures it has a defined duration. A window of opportunity that cannot be missed.

Ten years of regulatory construction: what Europe has already done

The current framework is the product of five distinct phases, each with its own function. **2015** marks the founding phase, with the launch of the first European Circular Economy Package and the recognition of circularity as an emerging priority. **2018** brings regulatory strengthening, with the introduction of binding recycling targets through to 2035 and the shift of

focus from waste treatment to waste prevention and re-use. **2019** produces strategic centrality, with the incorporation of the circular economy into the European Green Deal. **2020** introduces systemic transformation, with the adoption of the Circular Economy Action Plan and the shift from a sectoral approach to a systems model. The **2021-2027** period is one of investment acceleration, with around €10 billion mobilised through Horizon Europe and the European Regional Development Fund.

The result of this journey is a system of **more than thirty-five legally binding targets** covering municipal and packaging waste, product-specific streams - WEEE, batteries, end-of-life vehicles -, plastics and packaging materials with recycled content targets, critical raw materials with recovery targets, and construction and demolition waste. It is an architecture that simultaneously reflects environmental priorities and **strategic concerns regarding access to materials**: the overlap between the two dimensions is not recent, but only recently has it been made explicit.



Figure 8. The evolution of recycling as a priority across European legislative cycles, 2015-2027. *Source: TEHA Group elaboration on European Environment Agency and European Commission data, 2026.*

The "One Europe, One Market" roadmap and the four measures that will shape the decade

The step that opens the window of opportunity is the Council of the European Union's *roadmap* entitled **"One Europe, One Market", of 23 April 2026**. The document proposes four legislative acts intended to deepen Single Market integration, modernise public procurement, secure access to strategic resources and steer the circular transition, and it is

accompanied by an explicit institutional acknowledgement: **the next two years are decisive** in translating ambition into concrete results.

The four measures carry different weight for the secondary raw materials value chain, and it is worth examining what each can actually deliver.

Measure	Expected timing*	Relevance for the secondary raw materials value chain
Circular Economy Act (CEA)	Q3 2026	This is the central measure. Stated objective: to double Europe's circularity rate, bringing it to 24% by 2030. It provides for the creation of a European-scale secondary raw materials market through the harmonisation of end-of-waste definitions, measures on the availability, quality and traceability of recycled materials, actions to stimulate industrial demand and sectoral circularity targets. It has become a central pillar of the Clean Industrial Deal.
Critical Raw Materials Centre	Q4 2026	It stems from the RESourceEU Action Plan of 3 December 2025. It would operate as a public market operator: developing systemic intelligence on value chains and on primary and secondary markets, monitoring projects, managing strategic stocks of primary and secondary critical raw materials, conducting joint purchasing and matching supply and demand.
European Product Act (EPA)	Q3 2026	It extends ecodesign to almost all goods placed on the European market, building on the ESPR Regulation. Four pillars: Digital Product Passport, ecodesign for durability, recycled content requirements with minimum targets per product, and green public procurement. The creation of a circular single market for secondary raw materials is explicitly associated with it.
Public Procurement Act (PPA)	Q4 2026	It consolidates the three 2014 Directives into a single act. Relevant to public demand: alignment of procurement rules with environmental objectives, promotion of criteria on resource efficiency and recycled

Measure	Expected timing*	Relevance for the secondary raw materials value chain
		materials, introduction of European preference criteria in strategic sectors, and exclusion from procedures of third-country enterprises that do not guarantee reciprocity of access.

Table 1. The four legislative measures of the "One Europe, One Market" roadmap of 23 April 2026 and their relevance for the secondary raw materials value chain. *Source: TEHA Group elaboration on European Commission and European Parliament data, 2026.* (*) For the legislative proposal.

Read together, the four measures form a coherent design: the Circular Economy Act removes regulatory barriers to the circulation of materials, the Critical Raw Materials Centre provides the market infrastructure and *intelligence*, the European Product Act generates demand through recycled content requirements, and the Public Procurement Act generates it through public spending. **On paper, it is the full set of instruments needed to build a single market for secondary raw materials**.

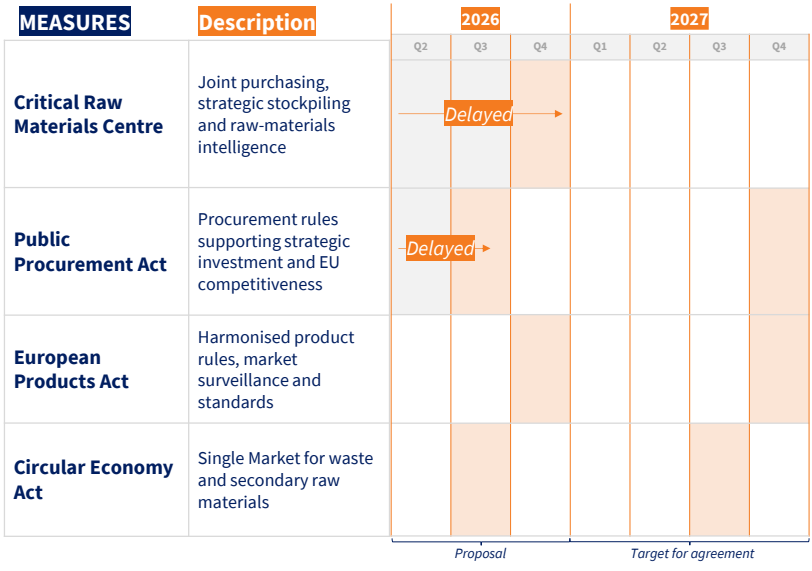


Figure 9. Main initiatives envisaged by the European institutions' joint "One Europe, One Market" roadmap to strengthen Single Market integration and the competitiveness of the European Union (expected quarter for presentation of the

initiatives), 2026. *Source: TEHA Group elaboration on European Commission and Council of the European Union data, 2026.*

A window of opportunity and not merely a calendar

Three circumstances combine to make this moment different from other legislative junctures of the decade.

The first is **simultaneity**. The four acts are being negotiated over the same period, and this makes it possible to build coherence between them - between the definition of end-of-waste status, recycled content requirements, procurement criteria and market infrastructure - while the texts are still being drafted. Once adopted, that coherence would have to be reconstructed through interpretation or deferred to a subsequent review: **alignment is possible now and will no longer be possible with the same degree of freedom**.

The second is **the concurrence with the reform of financing instruments**. The revision of the European emissions trading system, presented in July 2026, **strengthens and redesigns the financial architecture of industrial decarbonisation** and provides for the progressive **extension of the system to the incineration and co-incineration of non-hazardous waste, including energy recovery**. The regulatory and financial frameworks are therefore in motion at the same time, an infrequent coincidence whose operational implications are identified in Chapter 4.

The third is the **change in the conceptual framework** described in section 1.1. The recognition of circularity as a matter of competitiveness and strategic autonomy has opened the European debate to the possibility of using instruments traditionally associated with industrial policy - European preference criteria in procurement, border adjustment mechanisms, enabling categories for access to simplified permitting and investment support, and public financing platforms. **It is not a change in environmental sensibility, it is a change in the political admissibility of the instruments**, and it concerns precisely those the value chain needs.



Figure 10. The contribution of the four measures of the "One Europe, One Market" roadmap to building a European single market for secondary raw materials. *Source: TEHA Group elaboration on European Commission and European Parliament data, 2026.*

A window of opportunity carries a symmetrical risk, and in this case it can be identified precisely. The four acts under preparation can be drafted according to two alternative approaches. In the first they are **environmental instruments**: they set obligations, define thresholds, establish penalties, and leave it to the market to deliver the capacity needed to meet them. In the second they are **industrial instruments**: they accompany obligations with the conditions - of price, scale, access to capital and competitive parity at the border - that make it possible for European operators to comply.

The difference between the two approaches does not concern the level of environmental ambition, which may be identical, but **the industrial outcome**. The evidence gathered in this Chapter indicates the predictable result of the first: a recycled content obligation introduced in a fragmented market, with an unaddressed price gap and without parity of standards at the borders, generates demand that is met by capacity located outside the Union. **It increases the formal circularity of European products and reduces the European industrial base** - the outcome that the crisis of the plastics segment is already documenting, and that photovoltaics produced in an adjacent value chain.

Before outlining the new operating model for the sector and the related industrial policy priorities, however, it is necessary to measure the **value of the European recycling value chain and the benefits it delivers to**

society and citizens. These values are at stake today, and risk being dissipated if the critical issues are not properly understood and the window of opportunity is not seized to mark a significant change of pace and paradigm and to **align Europe's regulatory, industrial and financial frameworks**.

CHAPTER 2

THE STRATEGIC VALUE OF THE RECYCLING INDUSTRY FOR THE EUROPEAN ECONOMY, EMPLOYMENT AND SOCIETY

The scenario outlined in the previous Chapter presents a mixed picture, which makes it necessary to rethink, or at least update, the **operating model of the recycling sector and of the secondary raw materials market in the EU in the light of the most recent features of that scenario.**

The European Union has indeed built **the most ambitious regulatory framework in the world on recycling** - more than 35 legally binding targets spread across all the main waste streams[15] - and has mobilised significant resources over the past decade to support it. Yet the industrial system that should deliver that framework is not accelerating: **the circular material use rate** rose from 11.1% in 2014 to 12.2% in 2024, less than half the 24% target set for 2030; recycling targets remain out of reach in the main streams; and in the most exposed segments - plastics above all - Europe's industrial recycling capacity is contracting and investments in new technologies, such as chemical recycling, are being postponed or cancelled.

The gap between regulatory ambition and industrial trajectory makes it necessary to start from a quantification of the value generated by the European recycling system, before defining possible lines of reform. What is at stake in the next two years of the European legislative cycle concerns, in fact, not only the achievement of environmental targets, but also the **protection of an industrial, employment and social asset that already exists**. This is a value produced each year by the value chain and concretely measurable, which depends on the presence of infrastructure, industrial

[15] European Commission, European Union action plan for the circular economy, 2 December 2015.

capacity and *know-how*, as well as on markets able to absorb recovered materials.

The purpose of this chapter is therefore to **size that value**, in terms of the economic and social contribution generated by the recycling industry in Europe, of the support it provides to industrial value chains using secondary raw materials and, finally, of the net benefits (cost-benefit ratio) for European society and citizens.

2.1 The economic and employment value generated by the European recycling industry

The analysis takes as its subject **the European recycling industry**, defined for the purposes of the Study as "*core*", as at 2024, and identified on the basis of the Eurostat NACE Rev.2 classification in divisions **38** (waste collection, treatment and disposal activities; materials recovery) and **39** (remediation activities and other waste management services). It is the industrial core of the European circularity system: the enterprises that collect, sort, treat and transform waste into usable raw material. A proprietary TEHA **econometric *input-output* model** was applied to this segment of the industry, for the EU-27 aggregate, combining *Structural Business Statistics* - Eurostat data, the FIGARO symmetric *input-output* tables (European Commission) and national accounts employment data. The model breaks down the industry's economic contribution into three components: **direct impact**, namely the turnover, value added and employment generated by the industry itself; **indirect impact**, namely the activity activated along European supply chains through purchases of goods and services; and **induced impact**, namely the additional economic activity generated by household spending supported by direct and indirect wages.

Europe's *core* recycling industry comprises **53,440 private enterprises** active in the Union, generating **direct turnover of €218 billion** and employing **1.1 million people**[16]. In terms of the number of enterprises and

[16] TEHA Group on SBS – Eurostat data, 2026.

their territorial distribution, it is one of the most widespread industrial bases on the continent: recycling is by its nature an activity rooted in local areas, because the collection and initial sorting of materials cannot be relocated.

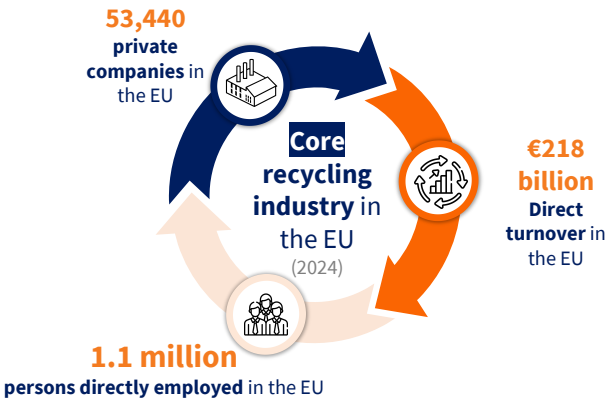


Figure 11. The recycling industry in the EU: number of enterprises, direct turnover and direct employment (absolute values), 2024. *Source: TEHA Group elaboration on Eurostat Structural Business Statistics (SBS) data, 2026.*

Considering the entire chain of activated effects, the *core* recycling industry generates in the Union's economy a **total turnover impact of €555 billion**, resulting from €218 billion in direct turnover, **€225 billion in indirect turnover** activated along European supply chains and **€112 billion in induced turnover** generated by household consumption.

The **economic multiplier is 2.54**[17]: for every Euro of turnover generated directly by the recycling industry, a further **€1.54** of turnover is generated in the rest of the European economy through value chain linkages and household consumption. It is a high value, pointing to an industry deeply integrated into Europe's production fabric and with a high domestic purchasing content - a profile which, as will be seen, makes it a particularly effective multiplier of domestic economic activity.

[17] Value rounded to two decimal places.

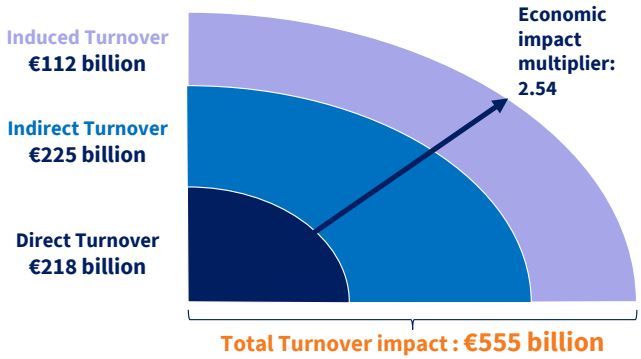


Figure 12. Direct, indirect and induced impact on turnover generated in the EU-27 by the recycling industry (€billion), 2024. *Source: TEHA Group proprietary model on Eurostat Structural Business Statistics (SBS), Eurostat, JRC data and FIGARO input-output tables, 2026.*

To grasp the order of magnitude of this result, a comparison with other European industrial aggregates and investment programmes is useful. The €555 billion of annual impact generated by the recycling industry is equivalent to **1.04 times the value of the Union's agricultural output** (€531 billion in 2024)[18].

Turnover measures the volume of economic activity activated, but not the wealth actually produced. Applying the same model to **gross value added**, the *core* recycling industry generates in the Union a **total impact of €222 billion**, equivalent to around **1.2% of European Union GDP**. The result is made up of €73 billion of direct value added, €96 billion of indirect value added and €53 billion of induced value added.

[18] TEHA Group on Eurostat, Economic Accounts for Agriculture, 2024, data for the value of the Union's agricultural output.

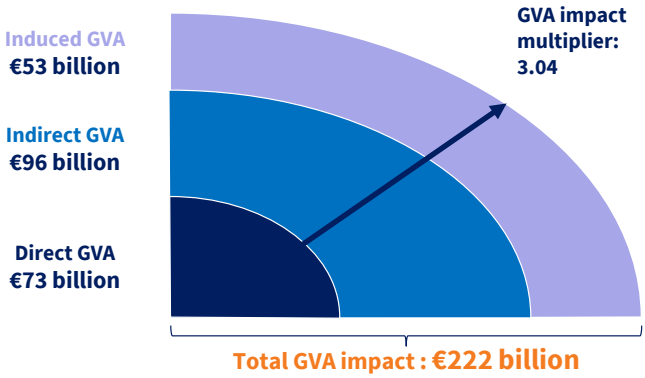


Figure 13. Direct, indirect and induced impact on gross value added generated in the EU-27 by the recycling industry (€billion), 2024. *TEHA Group proprietary model on Eurostat Structural Business Statistics (SBS), Eurostat, JRC data and FIGARO input-output tables, 2026.*

The **value added multiplier is 3.04**: for every Euro of value added generated directly by the industry, a further €2.04 is generated in the rest of the European economy. This figure deserves close reading, because the value added multiplier is **appreciably higher than the turnover multiplier** (3.04 against 2.54). This means that the value chains activated by the recycling industry are, on average, **more value-added intensive than the industry itself**: the sector's activity does not merely move volumes, but triggers upstream and downstream activities with a higher content of skilled labour, technical services and industrial transformation.

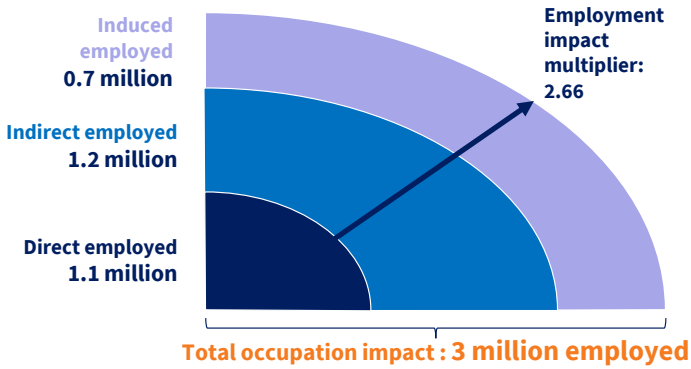


Figure 14. Direct, indirect and induced employment impact generated in the EU-27 by the recycling industry (millions of jobs), 2024. *TEHA Group proprietary model on Eurostat Structural Business Statistics (SBS), Eurostat, JRC data and FIGARO input-output tables, 2026.*

The employment dimension is the one that conveys most immediately the sector's social relevance. The *core* recycling industry supports in the European Union **more than 3 million jobs**: 1.1 million direct jobs, 1.2 million indirect jobs along supply chains and 0.7 million jobs induced by household spending. The **employment multiplier is 2.66**: every job created directly by the industry supports a further 1.66 in the rest of the European economy.

Read together, the three multipliers - **2.54 on turnover, 3.04 on value added, 2.66 on employment** - outline the profile of an industry that is not an environmental service downstream of the production system, but a **fully fledged manufacturing sector**, labour-intensive, strongly integrated into European supply chains and, in its initial stages, impossible to relocate. This is the first element of the value to be safeguarded.

2.2 THE IMPACTS OF THE RECYCLING INDUSTRY ON STRATEGIC VALUE CHAINS AND ON RAW MATERIAL SUPPLY

The value of the recycling is not confined to the industry itself. Its most significant economic function is in fact another: **to provide an *industrial* input**. Every tonne of secondary raw material placed on the market can be used in the production processes of *steel*, *aluminium*, *paper*, *plastics*, *glass* and *wood*, contributing to the manufacture of **semi-finished goods**,

products and packaging and reducing recourse to virgin raw materials, largely imported. From this perspective, recycling is not an end-of-cycle service, but a **strategic link in European industrial supply**.

To measure this function the Study developed a second model, distinct from the previous one, aimed at estimating the **catalysed impact**: the downstream industrial activity made possible by the supply of secondary raw materials. For each material, the methodology combines first-tier industrial activity, the recycled *input* rate and the share actually supplied by the *core* recycling industry; the resulting activity is then propagated through a Type I *input-output* model to estimate the turnover, value added and employment enabled in the wider economy.

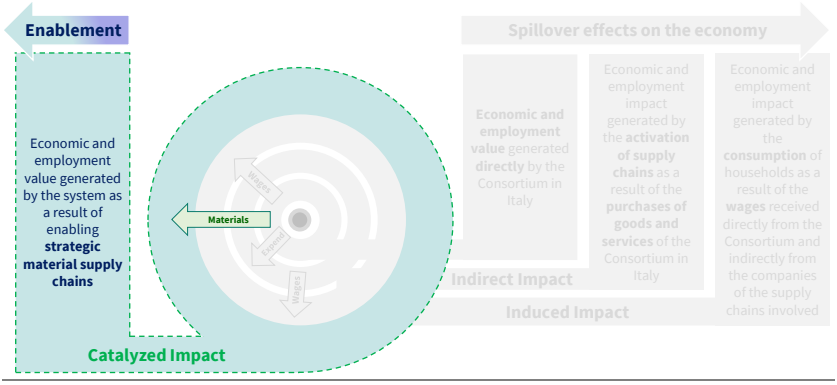


Figure 15. Methodology for turnover catalysed by the EU recycling industry across the seven strategic value chains (illustrative), 2024. Source: TEHA Group, 2026.

Catalysed impacts **are presented separately and are not added to direct, indirect and induced impacts**. They measure a different dimension: **the value of the industrial activity that is reactivated when secondary raw materials re-enter production processes, once again feeding the production of semi-finished goods, products and packaging**. Catalysed impact therefore represents the industrial value enabled by material circularity, and not a further component to be added to the economic impact of the recycling industry.

The analysis focuses on the **seven material streams identified as strategic for industry**: **steel, aluminium, paper, conventional plastics,**

biodegradable and compostable plastics[19], glass and wood. The analysis covers **industrial value chains as a whole**[20], thus including the uses of these materials across the various manufacturing sectors and **not limited to packaging alone**. The selection responds to three main criteria: the scale of volumes handled, economic relevance and the central role of these materials in European production processes.

The supply of secondary raw materials by the *core* recycling industry enables in the European Union **catalysed turnover of around €325 billion per year**.

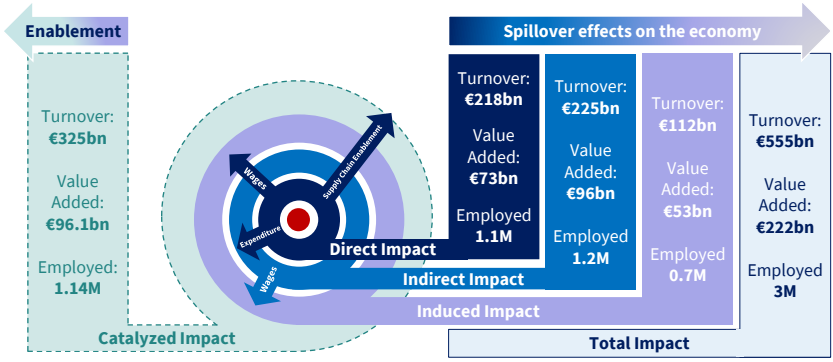


Figure 16. Turnover catalysed by the EU recycling industry across the seven strategic value chains (€ billion and millions of jobs), 2024. TEHA Group proprietary model on Eurostat Structural Business Statistics (SBS, *dataset sbs_sc_ovw*), Eurostat, JRC data and FIGARO input-output tables, 2026.

The composition by value chain is highly concentrated: the **steel value chain** absorbs €110.1 billion (34% of the total), **aluminium** €77.4 billion (24%) and **paper** €69.2 billion (21%). Together the three value chains account for **79% of total catalysed turnover**. They are followed, at a distance, by plastics with €26.7 billion (8%), wood with €21.1 billion (6%) and glass with €20.4 billion (6%).

[19] Bioplastics are excluded from the analysis because of the specific features of the value chain, characterised by management models that are not uniform across Member States and, in many cases, by collection and treatment circuits integrated with the organic fraction and with locally managed composting systems.
[20] Overall, the associated value chains generate aggregate turnover estimated at between €1,100 and €1,300 billion and employ more than 5 million people, making them one of the continent's main industrial value chains.

In terms of wealth produced, the activity enabled by the supply of secondary raw materials generates **catalysed value added of €96.1 billion**. The ranking by value chain shifts compared with turnover: **steel** remains first with €29.6 billion, but **paper** (€21.9 billion) overtakes **aluminium** (€21.0 billion); these are followed by plastics (€8.2 billion), glass (€7.8 billion) and wood (€7.6 billion). The figures reveal a difference in **value added intensity** between value chains: glass and wood retain 38% and 36% respectively of enabled turnover as value added, against 27% for steel and aluminium. The smaller value chains are, for every Euro generated, those that produce the most wealth within Europe.

In employment terms, the supply of secondary raw materials enables **1.14 million jobs** across the seven strategic value chains: 346,800 in steel, 255,500 in paper, 231,600 in aluminium, 125,100 in wood, 98,300 in glass and 82,200 in plastics. Here too intensity varies: wood and glass support respectively around **5.9 and 4.8 jobs per million Euro of enabled turnover**, against 3.0-3.2 for the metallurgical value chains. It is therefore the apparently smaller value chains that show the highest employment content per unit of economic activity - an element to bear in mind when setting industrial policy priorities.

Beyond economic accounting, catalysed impact measures a second variable, non-monetary but no less relevant: the **degree of dependence of European manufacturing on materials recovered within its own territory**. It is at this point that the value of the recycling industry connects with the question of European strategic autonomy.

The terms of the problem are well known. **The Union's trade deficit in raw materials reached €29 billion in 2023**, with imports up 30% between 2013 and 2023: a structural dependence on external supply that the main European policy documents - the 2024 Draghi Report and the Letta Report - have identified among the key risks to the continent's competitiveness. Against this dependence, the Union feeds back into the economy as secondary raw material only a still limited share of the materials it uses, and **40% of its imports of secondary raw materials comes from non-EU**

markets - introducing external dependence even on the channel whose purpose would be to reduce it.

Against this background, **every tonne of secondary raw material produced in Europe is a tonne of virgin raw material that is not imported**. The catalysed value quantified in this section does not measure economic activity alone: it measures the **share of European manufacturing that is today fed by materials recovered within the Union's borders**, and which, in the absence of that supply, would have to be fed from abroad or would not exist at all.

A mention is warranted, albeit not one of the seven materials analysed in this section, of **organic recycling** and of the Italian **compostable bioplastic packaging** value chain, which forms part of it. In Italy the system for collecting and treating the organic fraction currently handles around **5 million tonnes of food and garden waste per year**, within which certified compostable bioplastic packaging (EN 13432 standard) accounts for around 80,000 tonnes, little more than 1% of the flow. It is an industrial value chain of still modest size, with turnover that did not exceed €1 billion in 2023, but which performs an economic function distinct from that of the seven materials analysed: it does not supply an input to a secondary raw material market, but **protects the purity of the other fractions collected, reducing contamination of dry streams**. It is a complementary rather than a substitute function, whose still missing regulatory recognition at European level is discussed in Chapter 4.

2.3 THE ANALYSIS OF THE COSTS AND BENEFITS GENERATED BY THE PACKAGING RECYCLING SYSTEM FOR EUROPEAN SOCIETY

Narrowing the analysis to **packaging waste alone at European level**, rather than to the entire industrial value chain of materials considered in the previous section, the starting point is the size of the system: every year in the European Union almost **80 million tonnes of packaging waste** are

generated from the materials within the Study's scope, of which more than **50 million tonnes are recycled**[21].

Separate collection is one of the few environmental services that European citizens experience every day and whose cost they perceive directly, both through the waste management levy in local taxation and through the time and domestic space devoted to separating materials. To these are added the costs borne by enterprises subject to extended producer responsibility, which contribute to financing the system. The resulting benefits, by contrast, follow the opposite logic: they are **diffuse, indirect and largely invisible** - a tonne of material that re-enters the production cycle in place of virgin raw material, a landfill that is not filled, emissions that are not released, jobs that exist along the entire value chain.

It is from this asymmetry that the perception of recycling as a pure cost centre arises, and hence the need to quantify clearly the real cost-benefit balance of the recycling system for European society.

The methodology for assessing the social value of the system

The Study adopts a **social cost-benefit analysis** perspective. Beyond operators' private costs and revenues, it adds two further dimensions. The first is positive environmental externalities, such as avoided CO_2 emissions, valued at the ETS market price. [22] The second is negative externalities, such as the social costs of road transport (congestion, accidents, noise and pollution[23]. To these are added the induced effects on the economy, estimated by applying a Type II multiplier consistent with the analyses set out in the previous chapter on the value of the value chain[24].

The scope is the **EU-27** aggregate and concerns exclusively **packaging waste**, broken down into the seven reference value chains: *paper and*

[21] Eurostat: Packaging waste by waste management operations, 2026.
[22]Carbon price: ICAP (International Carbon Action Partnership), average EU ETS market quotation, 2025.
[23] International Union of Railways (UIC) estimates the external costs of road transport, 2022.
[24]Type II multiplier: TEHA Group proprietary elaboration on national and European input-output tables.

board, plastics, compostable bioplastics, glass, wood, steel and aluminium[25]. Physical flows are those of the latest accounting year available (2023)[26], while prices and unit parameters are updated to 2025.

The sources are predominantly **institutional**: *Eurostat* for physical flows and for the FIGARO input-output tables, a national system benchmark for estimating the **reference unit cost** (see below), **ICAP** and the **EEA** for the carbon price and disposal charges[27], the OECD for international benchmarks on **EPR system governance**[28], and the **UIC** for the external costs of transport[21].

One final clarification: **the analysis is a snapshot of the system as it is today**, at the recycling rates currently achieved. It does not incorporate the improvements that European legislation will make mandatory in the years ahead.

How the cost of the system is estimated

The cost of the system reflects everything required to make the value chain work: separate collection, sorting operations, sent to recycling and treatment of the residual fraction, and the governance of the system. To these is added, as a component different in nature from the others, the social cost of transport: a real cost to society that nonetheless appears in no set of accounts, and that only an analysis from a social perspective can bring to light.

To estimate the system's operating cost, the analysis anchors the calculation to a verifiable reference: the **full cost of a mature national system, of significant scale and with transparent financial accounting across all the operational components of the system**. The choice falls on Italy, recognised by Eurostat as one of only seven Member States to have already reached the 2030 recycling target, and the leading EU country for

[25]Compostable bioplastic is not included analytically in this quantitative estimate, in the absence of a dedicated statistical category in the Eurostat datasets used.
[26] Eurostat, "Packaging waste by waste management operations", updated May 2026.
[27] European Environment Agency (EEA), disposal charges for EU Member States.
[28] OECD (2016), "Extended Producer Responsibility: Updated Guidance for Efficient Waste Management".

kilograms of packaging recycled per inhabitant[29] - a system that also stands out for the density of its collection network, extending to almost 7,400 municipalities[30].

The calculation logic is as follows: the full cost of the reference system, related to the volumes that system manages, yields a **national unit cost** (€per tonne). The system used as a benchmark (Italy) is characterised by a **high level of territorial coverage and a particularly well-developed collection and management structure**, features that may result in a higher unit cost than the European average, where systems coexist with different levels of territorial coverage, recycling capacity and industrial scale of operators. For this reason, a **prudential downward correction of 5%** is applied to the national unit cost, so as to obtain an average value more representative of the EU-27 context and to avoid overstating European costs as a result of using the national benchmark. This value, multiplied by the packaging volumes managed overall at EU-27 level for each value chain (according to the official Eurostat categories of repair, recycling and recovery), yields the system cost at European level:

Reference unit cost (€/t) =

[Full cost of the reference national system ÷ Volumes managed by that system] × prudential correction factor

System cost, EU-27 (€) =

Reference unit cost × EU-27 volumes managed

Cost item	€mln
System management cost (collection, sorting, recycling, energy recovery, governance)	18,352
Social costs of transport to recycling	398

[29] Eurostat, "Packaging waste statistics", Statistics Explained, 2023 data: Italy is among the seven Member States that have already reached the 2030 recycling target (75.6%) and recycles the largest quantity of packaging per inhabitant in the EU (162.2 kg/inhabitant).
[30] CONAI, General Report, figure relating to the municipalities under agreement with the consortium system.

Cost item	€mln
Social costs of transport to energy recovery	88
Total system costs	**18,838**

Table 2. Costs of the EU-27 system for the collection, sorting and recycling of packaging (€million and % values), 2025. *Source: TEHA Group elaboration on Eurostat, ISPRA, OECD, JASPERS-EIB/JRC and International Union of Railways (UIC) data, 2026.*

The benefit side is more complex, and can be traced back to **four main components**. The first is the **industrial value of the recovered material**: the secondary raw materials that the system places on the market in lieu of virgin material - the single largest benefit component, equal to €10,447 million. The second is **avoided costs**: the disposal charges and taxes that are not paid because those tonnes do not end up in landfill. The third is the **environmental benefit**, in its various components: the CO_2 avoided by recycling instead of producing from virgin material, the electricity and heat generated by energy recovery, and the lower climate impact of energy recovery compared with landfill. The fourth is the **induced effects on the economy** - the value added and employment generated along the value chain and its supplier network when system spending becomes wages, supplies and consumption that recirculate in the European economy: €13,024 million in total, almost 42% of the total benefit.

Benefit item	€mln
Induced effects on the economy	13,024
Value of the secondary raw materials generated	10,447
Avoided disposal costs*	4,420
Value of CO2 avoided by recycling compared with virgin production **	2,840
Other environmental and avoided disposal benefits***	474
Total benefits for society	**31,205**

Table 3. Benefits generated by the EU-27 system for the collection, sorting and recycling of packaging (€million and % values), 2025. *Source: TEHA Group elaboration on Eurostat, ISPRA, OECD, JASPERS-EIB/JRC and International Union of Railways (UIC) data, 2026. (*) on landfill taxes and charges not paid thanks to recycling and recovery. (**) valued at the ETS carbon price. (***) Sum of the items "Benefits from energy generated" and "Lower emissions from energy recovery (vs landfill)".*

The fact that almost half of the total benefit is not revenue that someone collects, but economic activity and employment generated along the value chain, is worth making explicit: the system produces value not only for those selling secondary raw materials, but **supports an industrial and employment fabric spread across the whole of Europe**.

Every euro invested in recycling returns €1.66 to European society

The comparison between the two sides of the balance produces the central result of the analysis. Against €18.8 billion of total costs, the EU-27 system for the collection, sorting and recycling of **packaging** generates **€31.2 billion of benefits for European society**. The net balance is €12.4 billion per year, equivalent to around **€27 per European citizen** and to **€231 per tonne recycled**.

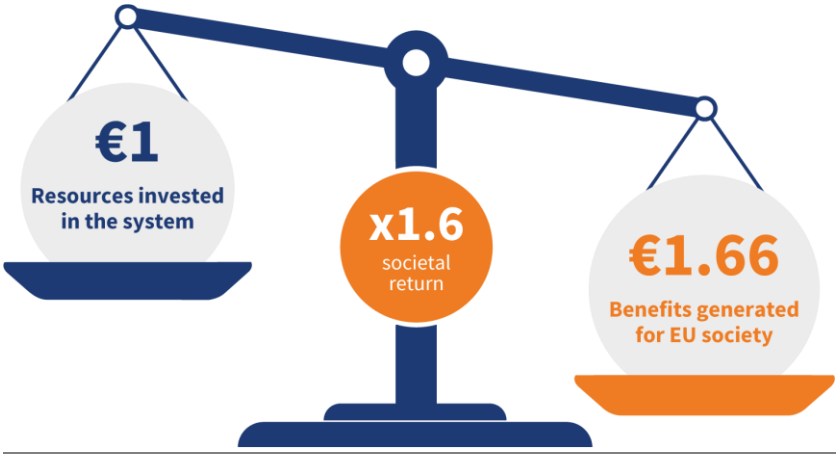


Figure 17. Costs and benefits of the EU-27 system for the collection, sorting and recycling of packaging for European society (Euro), 2025. *Source: TEHA Group elaboration on Eurostat, ISPRA, OECD, JASPERS-EIB/JRC and International Union of Railways (UIC) data, 2026.*

Put in the most immediate terms: **for every euro invested in the system, European society receives €1.66 in benefits**. This is a social return: a Euro of collective spending that returns almost two thirds more in the form of recovered raw material, avoided disposal, emissions not released and economic activity generated. It is the figure that overturns the premise from which this section started: what is perceived as a cost is, in measurable economic terms, **one of the highest-return collective investments Europe has**.

2.4 The economic, industrial and environmental risks arising from a weakening of the European recycling system

The results set out in the preceding sections describe a value that exists **today**. It is essential to make clear that this is neither an acquired endowment nor a benefit guaranteed by legislation: that value exists because there is a dense collection infrastructure, industrial sorting and recycling capacity installed across Europe, a market that absorbs secondary raw materials and a governance system that holds the parts together. **Each of these preconditions is currently under pressure**. The €12.4 billion per year of net benefit to society, the €555 billion of turnover impact, the 3 million jobs and the €325 billion of activity enabled in the strategic value chains are, symmetrically, **a measure of what Europe risks losing**. This section sets out that risk on three levels: industrial, economic-strategic and environmental.

European recycling capacity is not at risk: it is already contracting

The first risk is not prospective: it is under way. The contraction of European recycling capacity is already measurable and finds its most visible pressure point in plastics. Over the past three years Europe has lost **almost 1 million tonnes of recycling capacity**; preliminary 2025 data indicate a **50% increase in plant closures** compared with the previous year. In 2024 installed plastics recycling capacity stood at 13.5 million tonnes[31], but the

[31] Plastics Recyclers Europe, «Plastics Recycling Industry Figures 2024», 2025; summary in «2024 Data Reveals a Deepening Crisis of the European Plastics Recycling Industry», press release, 12 November 2025.

Union remains well below the annual growth rate of around **5-6%** needed to meet the targets of the Packaging Regulation (PPWR)[32]. The phenomenon, moreover, is not confined to plastics: paper, metals and glass are also subject to ever more ambitious recycling targets.

The causes converge and reinforce one another. Recycling is an **energy-intensive** activity - sorting, grinding, washing and reprocessing require significant heat and electricity inputs - and European industrial electricity prices remain structurally higher than pre-crisis levels: in the first quarter of 2025 they were **2.8 times higher than US prices**. To this is added a price gap with virgin material that the market is unable to close: in plastics, the premium of R-PET over virgin PET in Europe stands at **USD 723 per tonne, 2.9 times the US level[33]**. The result is a compression of margins that has already produced reductions in capacity utilisation rates, significant financial losses and, in some cases, operator insolvencies.

The structural fragility of operators amplifies these effects. The sector has an **average company size** of around €4 million in turnover, with marked differences between Member States - from €20.4 million in **average production value per operator in France** to **€6.8 million in Italy[34]**. Such a fragmented fabric has limited capacity to absorb margin shocks and to access the capital needed for investment in energy efficiency and technological innovation: the conditions that would make the sector competitive are precisely those that the sector, under current conditions, is unable to finance. To this is added the commercial risk associated with those same investments: improving the quality of recycled materials requires significant resources, without however guaranteeing an adequate market outlet if industrial users are unwilling to pay the price differential

[32] PPWR: Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste. The Regulation, generally applicable from 12 August 2026, sets among other things a minimum 2030 recycling target of 55% for plastic packaging, 30% for wood, 80% for ferrous metals, 60% for aluminium, 75% for glass and 85% for paper and board (Art. 52). For plastic packaging it also introduces specific minimum post-consumer recycled content requirements, differentiated by packaging type, from 2030 (Art. 7). See Regulation (EU) 2025/40, Arts. 7 and 52.
[33] TEHA Group on European Parliament and S&P Global sources, 2026
[34] TEHA Group elaboration on Orbis (Bureau van Dijk) data, 2026.

relative to virgin material or are able to source recycled materials with similar characteristics at lower prices from non-EU countries.

Prices that swing twelve times more than demand: why no one invests in a market like this

The second order of risk concerns **the functioning of the market**. As explored in section 3.1, the dynamics of industrial demand and those of secondary raw material prices are strongly misaligned, generating **high volatility and poor predictability of margins**. Under these conditions, medium- to long-term industrial planning becomes more difficult and investments are hard to finance, hampering the expansion of production capacity and innovation in the sector.

Added to this volatility is a fragmentation that prevents the European market from functioning as a single market. Price dispersion between Member States ranges from **4.1% for paper to 18.2% for plastic waste**, with differences that for nominally identical materials reach **30% from one country to another**[35]. The problem is accentuated by the fact that the virgin raw materials with which secondary raw materials compete are predominantly **commodities characterised by strong global production capacity, particularly in Asia**, and by limited differentiation between producers: users therefore tend to favour **spot purchases over long-term agreements**, taking advantage of the most favourable price conditions. In this context, secondary raw materials risk becoming competitive mainly in periods of crisis or supply difficulty; conversely, where **minimum recycled content obligations** are in place, European demand may also attract non-EU material and operators. To this is added the absence of harmonised end-of-waste criteria (*end of waste*), which entails, for the European plastics

[35] TEHA Group elaboration on Eurostat/Comext data, 2026. *Price dispersion between countries is calculated on the unit values of bilateral trade (aggregate imports and exports; weighted average across 10 EU countries) over the 2011-2024 period, using the coefficient of variation (CoV%). The results were verified against Fastmarkets, UNIRIMA, Assorimap and the Eurostat Secondary Material Price Indicator.*

recycling sector alone, an **additional cost estimated at around €120 million per year**[36].

The combination of volatility and fragmentation has its most serious effect on investment. Against current annual investment in the circular economy estimated at around **€120 billion**, the additional requirement is around **€82 billion per year through to 2040** - for an implicit total requirement of around €202 billion per year. The largest gaps are concentrated in circular design and end-of-life infrastructure. In the absence of stronger demand, regulatory certainty and effective risk-sharing mechanisms, volatility will continue to translate into plant closures and the postponement of new capacity.

There is, finally, a dimension of **value leakage** that works against the Union's industrial objectives. Europe remains a **net exporter of waste**, with steel, wood and paper making up the largest outbound flows: strategic materials that leave the continent instead of feeding its manufacturing base. The precedent of 2018 shows how risky this exposure is. China's *National Sword* policy caused a structural collapse in European exports - **-96% for plastic waste and -52% for paper waste between 2011 and 2018** - without, however, reducing dependence: exports of recovered paper to India rose from USD 140 million in 2017 to USD 326 million in 2024 (**+132%**), while those to China collapsed from USD 924 million to USD 71.6 million (**-92%**)[37]. Dependence has simply shifted from one destination to another. The waste export figures, however, describe only one component of European trade exposure.

That this exposure is not an isolated episode but a structural feature of European trade corridors is confirmed by **the Geographic Exposure Index** developed in the Study, which measures the extent to which European imports and exports depend on a narrow number of geographical areas: the **Middle East** ranks clearly above all other corridors, at almost twice the level of the second-placed one. This evidence bears directly on secondary raw

[36] European Commission, Accelerating the transition to a circular economy: measures for the plastics sector, COM(2025) 805 final, 2025.
[37] TEHA Group elaboration on Comext data, 2026.

materials, because those corridors carry both imports of recycled materials and exports of Europe's surplus waste: a new shock of similar scale to that of 2018 would today produce market dislocations of comparable intensity. Chapter 3, section 3.5 presents the Index in full, together with its methodology and an analysis of the maritime corridors through which these flows pass.

The climate benefit is not an acquired right: it exists only if the tonnes are recycled in Europe

The third order of risk is the one that public debate tends to take for granted, and is instead the most directly conditioned by the industrial resilience of the system. The environmental benefit of recycling is not a legal attribute of European targets: it is the product of the tonnes that are **actually recycled within the Union**. The €2.8 billion of avoided CO_2 quantified in the cost-benefit analysis[38] exists because the industrial capacity that processes those tonnes exists. If capacity contracts, the benefit shrinks in the same proportion.

The room for manoeuvre is already limited today. In 2024, of around **7.70 billion tonnes** of materials processed in the Union, only **14%** (1.04 billion tonnes) came from **recycling** and **backfilling**, while **67%** (5.17 billion tonnes) derived from **the extraction of virgin natural resources**; domestic material consumption remains close to 14 tonnes per inhabitant[39]. In this context, a contraction in recycling capacity does not translate into lower material consumption: it translates into an **increase in the share met by imported virgin raw material**, with a corresponding increase in embedded emissions.

A central consequence follows. The European objective of raising the circular material use rate to 24% by 2030[40], from the current 12.2%, depends not only on regulatory ambition but **on the resilience and development of**

[38] TEHA Group, 2026. Calculation based on the volumes sent for recycling, the avoided emission factors per tonne recycled and the price of CO_2 in the EU ETS: total benefit estimated at around €2.84 billion.
[39] European Environment Agency, *Europe's Environment and Climate: Knowledge for Resilience, Prosperity and Sustainability*, 2025.
[40] Target not binding as at the date of drafting of this Report (August 2026).

the industrial base needed to turn targets into tonnes actually recycled. If rising standards and obligations are not accompanied by adequate competitive conditions, there is also a growing risk that part of the activity and investment will move outside the Union. In that scenario, **Europe would risk displacing rather than reducing part of its emissions, while at the same time losing industrial capacity, economic value and strategic autonomy**.

What Europe risks losing, in figures

Bringing together the evidence from the four sections, what is at stake can be stated in explicit quantitative terms. A weakening of the European recycling system puts at risk:

- **€555 billion** of annual turnover impact, **€222 billion** of value added (around 1.2% of the Union's GDP) and **more than 3 million jobs** linked directly and indirectly to the *core* recycling industry;
- **€325 billion** of turnover, **€96.1 billion** of value added and **1.14 million jobs** enabled in the seven strategic manufacturing value chains that depend on secondary raw materials;
- **€12.4 billion per year** of net benefit to European society, equivalent to around **€62 per household per year**[41] and to **€231 per tonne recycled**, and a social return of **€1.66 for every euro invested**;
- the share of European industrial supply currently met by materials recovered within the Union's territory, in a context that already shows a raw materials trade deficit of **€29 billion** and a dependence on non-EU markets for 40% of imports of secondary raw materials.

This is a substantial difference from the way the cost of inaction is usually presented. **These are not potential benefits that a future policy might generate, but the current value of a system already in operation**. The cost of inaction, in this case, is not a missed opportunity: it is a loss.

[41] TEHA estimate assuming an average household size of 2.3 members.

CHAPTER 3

A NEW OPERATING MODEL FOR THE EUROPEAN SECONDARY RAW MATERIALS MARKET TO DRIVE THE GROWTH AND COMPETITIVENESS OF THE VALUE CHAIN

Chapter 1 reconstructed the European scenario and Chapter 2 measured the value at stake: **€555 billion** of annual **economic impact, €222 billion** of **value added,** more than **3 million jobs**; to these are added **€325 billion of enabled economic activity** in the strategic value chains associated with the seven reference materials of the Study, **through the reintroduction of secondary raw materials into production processes**, and a **social return** of **€1.66 for every euro invested** in the collection, sorting and recycling system for packaging alone[42].

This value is not guaranteed by regulatory targets, but **produced each year by installed industrial capacity, by a functioning market and by governance that holds the parts together**. It is a conditional value, and the condition - as section 2.2 documented - is not the ambition of the targets, but the functioning of the market. The question this Chapter answers therefore remains open: *under what conditions can the value measured be not only preserved, but increased?*

The evidence emerging from the Study converges on the definition of an **operating model for the European secondary raw materials market**.

[42] The results reported refer to three distinct scopes of analysis. The €555 billion of economic impact, €222 billion of value added and more than 3 million jobs refer to the European recycling industry as a whole, irrespective of the materials considered in the rest of the Study. The €325 billion instead measures the industrial activity enabled by the reintroduction of secondary raw materials into the production processes of the strategic value chains associated with the Study's reference materials and is not limited to the packaging segment alone. The benefit/cost ratio of 1.66 relates exclusively to the European system for managing and recycling packaging waste.



Figure 18. The five pillars needed to define a European single market for SRM. *Source: TEHA Group elaboration.*

The model comprises **five functional blocks** - or *building blocks* - alongside a cross-cutting layer of **enabling factors**.

The five blocks are neither thematic areas nor chapters of a table of contents: they are the dimensions a market must have in order to function, ordered according to the logic by which a market is constituted:

- **Market design, demand and supply** (section 3.1) concerns the basic mechanism by which supply and demand meet at a price both sides can sustain.
- **Governance and the regulatory framework** (section 3.2) concerns the rules that make that mechanism uniform at continental scale rather than fragmented into twenty-seven national markets.
- **Standards, quality and trust** (section 3.3) concern the condition without which no industrial transaction is possible: that the buyer can verify that the material is what it claims to be.
- **Industrial scale, finance and investment** (section 3.4) concerns the physical capacity to produce the material the market requires.
- **Strategic autonomy and trade** (section 3.5) concerns the relationship between this system and the rest of the world.

The **enabling factors** - affordable energy, innovation and data, skills and workforce, social acceptance - do not constitute a sixth block, but the ground on which the five rest: conditions that are shaped in public policy spheres distinct from that of the recycling value chain and for which the Study recognises an enabling function without entering into the merits of the choices that belong to them.

Each functional block couples two elements: **a problem that the European market presents today and the property it should have in order no longer to present it**.

The model also has two features that define its scope: it is calibrated on the present and it does not assume that materials behave in the same way.

3.1 European Market Design and the instruments to stimulate demand and secure supply

The first functional block of the model concerns the most basic function a market must perform, and which Europe's secondary raw materials market today performs only in part: **connecting, in a stable and predictable way, those who produce secondary raw materials and those who use them.**

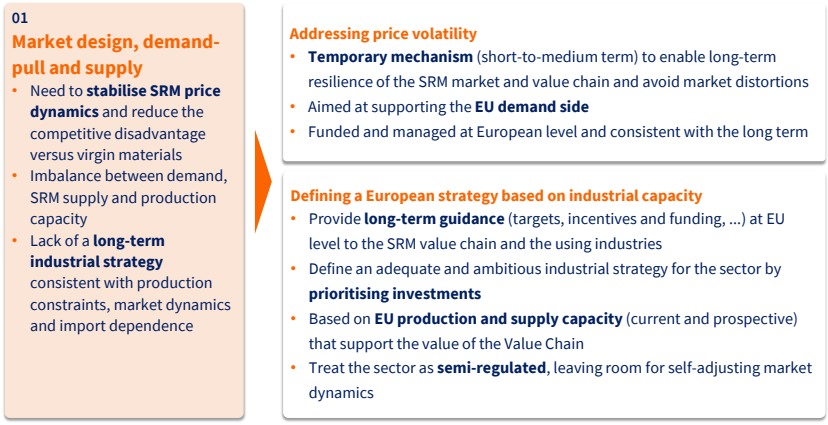


Figure 19. The main lines of action for the first pillar. *Source: TEHA Group elaboration.*

The diagram above summarises its architecture. On the left-hand side are the **three weaknesses** that the European market presents today:

- the need to stabilise the price dynamics of secondary raw materials and to avoid their direct competition with virgin materials;
- the imbalance between demand, supply and European production capacity;
- the absence of a long-term EU strategy consistent with production constraints and market dynamics.

On the right-hand side are the **two pillars of the model** that describe the properties the system should have for those weaknesses to be overcome:

- managing price volatility;
- defining a European strategy anchored in industrial capacity.

With a view to creating a single EU market for secondary raw materials (hereinafter also SRM) obtained from recycling processes, it is of fundamental importance to **balance their supply and demand within the EU**. Today this does not always happen, or does not happen fully. Each national market is in fact a framework in its own right, producing different situations, with the risk of creating imbalances in competition between operators from different countries.

SRM markets, which over the years have increasingly taken on the role of genuine *commodities*, need to reduce material price volatility and to ensure that prices are not higher than those of the virgin raw materials they aim to replace in the production of new goods. Moreover, their use would make it possible to reduce the use of virgin materials, limiting the extraction, processing and transport of natural resources, and reducing energy consumption and environmental impacts.

The recycled plastics case study

Some materials currently show an imbalance between SRM demand, the availability of recycled materials with adequate technical characteristics and European production capacity. A telling case is that

of recycled plastics. The ambitious targets set by Directive (EU) 2019/904 (Art. 6)[43] on recycled content in beverage bottles placed on the EU consumer market are increasing demand for high-value recycled materials.

It is **above all a question of price competitiveness**. Virgin PET is a *commodity* characterised by limited differentiation between producers, so that, for the same required technical characteristics, users tend to favour the most advantageous commercial terms, both in contracts and in *spot* purchases. **A similar dynamic currently affects recycled PET**: minimum content obligations have increased demand for rPET of adequate quality, but they do not guarantee that this demand will be met by European supply. For the same technical and regulatory requirements, users can in fact turn to the material available at the most competitive price, including material of non-EU origin. **Greater competitive pressure has thus contributed to compressing the margins of European recyclers**, to the point of some plant closures, while import flows have increased not only from Asia but also from neighbouring countries such as Türkiye, Morocco and Egypt.

To remedy this, the European Commission has established, in the delegated act setting the rules for calculating recycled content for the purposes of Directive (EU) 2019/904, that **until November 2027 only material obtained from the recycling of European waste may be counted**. This is a transitional measure, pending the definition of more incisive equivalence criteria - the so-called "equivalent conditions" - between recycled material produced in Europe and that imported from third countries, as well as **dedicated customs codes** to make it possible to track imports.

It is the demonstration of a general principle running through the entire model: **the market complies with obligations at the lowest possible cost, and third countries are ready to seize the opportunity**. A demand

[43] Article 6 of the Directive states: "With regard to beverage bottles listed in Part F of the Annex, each Member State shall ensure that: (a) from 2025, beverage bottles listed in Part F of the Annex manufactured with polyethylene terephthalate as the major component ('PET bottles') contain at least 25% recycled plastic, calculated as an average for all PET bottles placed on the market on the territory of that Member State; and (b) from 2030, beverage bottles listed in Part F of the Annex contain at least 30% recycled plastic, calculated as an average for all such beverage bottles placed on the market on the territory of that Member State.

obligation introduced without ensuring that European supply can meet it, or be given priority in meeting it, does not strengthen the domestic value chain; it replaces it.

The price volatility question

Secondary raw materials markets, which over the years have increasingly taken on the role of genuine *commodities*, need to reduce material price volatility and to ensure that prices are not higher than those of the virgin raw materials they aim to replace.

Between 2011 and 2024 industrial demand remained broadly stable, with average variability of **34 index points**, while secondary raw material prices fluctuated by **394 index points: almost twelve times as much**[44]. The misalignment makes margins unpredictable and investments unfinanceable, because no multi-year industrial plan can be built on revenue that varies by this order of magnitude.

The case of plastics shows the mechanism with particular clarity. **Glass and paper have structurally high recycling rates and secondary raw material markets characterised by well-established industrial demand**, although they are not immune to cyclical swings. In 2024 the paper recycling rate in Europe stood at **75.1%**, while in glass the demand for cullet remains structurally supported by industry, which uses it as one of the main raw materials in its production processes[45]. In Italy, for example, the recycling rate for glass packaging reached **80.3% in 2024**, despite variations in prices and cullet flows[46].

Plastics, by contrast, show a different dynamic: the average price of secondary plastics rose to **€472 per tonne in 2022** before falling to **€321 in 2024**, a decline of **32% in two years**[47]. This dynamic highlights a difficulty in the absorption of secondary raw material by industrial demand: recycling

[44] TEHA Group elaboration on Eurostat-Comext, UN Comtrade, OECD, EUROFER and European Aluminium Association data, 2026.
[45] European Paper Recycling Council (EPRC) and CEPI, Monitoring Report 2024, 2025; FEVE, Decarbonisation Report 2024 and Circular Economy Act: FEVE shares its position on packaging circularity and cullet uptake, 2026.
[46] CoReVe, Specific Prevention Plan 2025 – 2024 data and 2024 Sustainability Report, 2025.
[47] Eurostat, Recycling – secondary material price indicator, 2025.

capacity that is already available is not always matched by demand stable enough to sustain its value over time.

The competitive challenge does not arise from recycled materials being systematically more expensive, but from an asymmetry in the cost structure: the price of virgin material can react quickly to *commodity* cycles and global supply conditions, while a significant share of recycling costs – collection, sorting, energy and treatment – is more rigid. In the European plastics sector, the combination of weak demand, rising production and energy costs and competition from imported materials at lower prices has already led to a reduction in plant utilisation and production capacity[48].

To this is added a characteristic of the materials with which secondary raw materials compete. Virgin raw materials *are* often in global production overcapacity, particularly in Asia. Price fluctuations in recent years have been caused more by geopolitical issues than by a lack of global production capacity. Differentiation between one producer and another is limited, so users are reluctant to enter long-term agreements, preferring *spot* purchases and taking advantage of momentary bargains. This scenario also has a strong impact on secondary raw materials, which become attractive only in times of crisis or supply difficulty and which, where minimum recycled content obligations exist, make the European market attractive to non-EU recyclers.

The properties the market must have

Addressing price volatility could require a temporary mechanism, generally short- to medium-term, to support demand for European SRM, financed and managed at EU level. An important aspect to consider is that this must make it possible to achieve long-term resilience of the secondary raw materials market and value chain, while avoiding market distortions.

Against this background, the EU suffers from the lack of a shared, long-term strategy consistent with production constraints, market dynamics and industrial capacity. **Such a strategy requires:**

[48] Plastics Recyclers Europe, Plastics Recycling Industry Statistics 2024, 2025.

- taking into account the EU's current and future production and supply capacity, in order to support SRM value chains;
- leaving room for self-adjusting market dynamics, without intervening intrusively;
- providing long-term guidance on, for example, targets, incentives and funding for secondary raw material industrial value chains;
- defining an industrial roadmap suited to the sector, with a focus on attracting investment.

An interesting reference point for possible measures is that of **Contracts for Difference** (*Contracts for Difference, CfD*), already used in the renewable energy sector to **reduce the exposure of investments to price volatility**. In Italy, for example, the European Commission approved in 2024 a scheme worth around €9.7 billion to support new onshore wind, photovoltaic, hydroelectric and sewage-gas-fired plants, through two-way CfDs with a 20-year duration[49]. The mechanism provides for a *strike price*: when the market price is below the reference value, the State pays the producer the difference; when it is above, the beneficiary returns the surplus, thereby stabilising expected revenues and reducing investment risk. In June 2026, the Commission also approved a new Italian scheme worth €23 billion to support renewable electricity generation, confirming the use of twenty-year two-way CfDs as an instrument to support investment in renewable technologies[50].

The same logic could be applied to certain secondary raw materials, guaranteeing operators a minimum price should market prices fall below a given threshold (to be defined on the basis of standard parameters) for a given period. This would make investments in new production capacity

[49] European Commission, Commission approves an Italian State aid scheme to support renewable electricity production to foster the transition to a net-zero economy, 17 December 2024.
[50] European Commission, Commission approves €23 billion Italian State aid scheme to support renewable electricity production, 8 June 2026.

more bankable and reduce exposure to the volatile prices of virgin raw materials.

The French case: EPR incentives for the use of recycled plastic

A case of particular interest, which has also drawn comment from operators and Trade Association, is the introduction in France of an **incentive for incorporating recycled plastics into new products**. The mechanism is embedded in the *Extended Producer Responsibility* (EPR) system and does not fall on general taxation: the funding of the bonuses is secured by the contributions and related modulations applied to plastic materials or to predominantly plastic products belonging to the same EPR value chain[51].

From **1 January 2026**, the eco-organisations of eight EPR value chains pay an incentive for every tonne of recycled plastic incorporated into products placed on the market. The mechanism provides for **€450/t** when the recycled material comes from a different EPR value chain and **€550/t** when it comes from the same value chain. For certain resins considered more difficult to reuse in contact-sensitive packaging, the bonus is **€550/t in 2026 and 2027** and will rise to **€1,000/t from 2028**[52].

Access to the incentive is also subject to a **proximity principle**: the collection, sorting, recycling and incorporation stages must take place within a maximum radius of **1,500 km from the centre of metropolitan France**, within the European Union or in third countries guaranteeing standards equivalent to those laid down by the applicable European legislation[53].

The mechanism is formally operational from 2026, but the first payments may take place in the following year, once the procedures for declaring, tracing and verifying the quantities incorporated have been completed[54].

The measure has drawn comment from operators and Trade Association, particularly regarding its possible effects on the functioning of the Single Market. The main concerns raised include:

[51] République Française, Arrêté du 5 septembre 2025, art. 7, Journal officiel de la République française, 7 September 2025.
[52] République Française, Arrêté du 5 septembre 2025; Ministère de la Transition écologique, FAQ – Prime à l'incorporation de matière plastique recyclée (IMPR), April 2026.
[53] République Française, Arrêté du 5 septembre 2025…, art. 8; Ministère de la Transition écologique, FAQ – Prime à l'incorporation de matière plastique recyclée (IMPR), April 2026.
[54] Valobat, Notice explicative des éco-modulations 2026, 2026.

- the risk that the 1,500 km geographical criterion introduces new fragmentation in the European secondary raw materials market;
- possible competitive distortions between operators located in different Member States;
- the need to accompany the incentive with stable, long-term demand signals capable of supporting investment;
- the need to monitor the effects of the measure on prices, material availability and the economic balance of EPR systems[55].

The European secondary raw materials sector, like that of renewable energy, is facing a race to the bottom driven by non-EU operators. The photovoltaic case is emblematic. Europe has a target of reaching at least 30 GW of operational production capacity in the photovoltaic sector by 2030, at every stage of the value chain. European manufacturers, however, are in crisis because of strong Chinese competition, reflected in falling prices for photovoltaic components. This situation has led to a series of closures and insolvencies, including those of *Meyer Burger, NorSun, Exasun and Energetic Industries.*

In 2025, producing a photovoltaic module in Europe using cells manufactured in the EU cost around 10.3 euro cents per watt-peak (c€/Wp) more than producing the same module in China. The difference is due to higher costs for equipment (+40%), buildings and plant (+110%), labour (+280%) and materials (+50%).

China currently supplies around 81–93% of photovoltaic components along the EU value chain, while European production capacity is below 10 GWp per year. There is no guaranteed or reserved demand for European photovoltaic products and the market is driven mainly by price. Competing with China is therefore extremely difficult.

The EU supported demand for photovoltaic technology without generating sufficient demand for photovoltaic panels produced within

[55] Ministère de la Transition écologique, Consultation publique sur le projet d'arrêté fixant les modulations applicables aux contributions financières versées par les producteurs lorsqu'ils incorporent des matières plastiques recyclées, 2025

the Union. As a result, much of that demand was captured by cheaper Chinese modules.

3.2 VALUE CHAIN GOVERNANCE AND THE REGULATORY FRAMEWORK FOR THE DEVELOPMENT OF THE EUROPEAN MARKET

If the first functional block concerns the mechanism by which supply and demand meet, the second concerns the rules that make that mechanism uniform at continental scale.

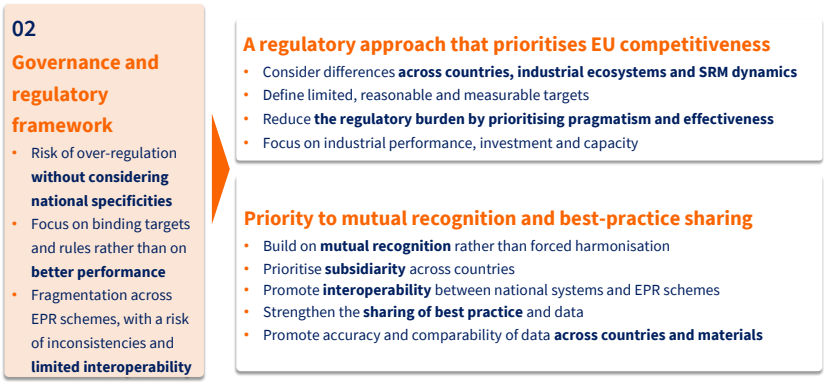


Figure 20. The main lines of action for the second pillar. *Source: TEHA Group elaboration.*

The concept of extended producer responsibility (*Extended Producer Responsibility*, EPR) is today one of the European Union's main instruments in the field of the circular economy. It underpins the main EU directives and regulations in this area. Directive 2008/98/EC on waste, subsequently supplemented by Directive 2018/851, which sets out the general framework for the shift from a linear to a circular economy, identified extended producer responsibility as the principal instrument "to strengthen the re-use, prevention, recycling and other recovery of waste". The implementation of EPR was then set out in various sectoral pieces of legislation, which made it mandatory for specific value chains, including packaging, electrical and electronic equipment, batteries, end-of-life vehicles, single-use plastics, textiles and footwear. For packaging, Regulation (EU) 2025/40 aims, in the coming years, to harmonise the rather varied application of EPR across European countries.

Under this principle, producers are required to assume financial responsibility for their goods once they have become waste, and may fulfil this obligation by joining a collective scheme - known as a management system, in English a *compliance scheme* - or individually.

The heterogeneity observed between countries is not an implementation flaw, but the result of a historical process: it is **the product of the transposition of European directives into the economic, social and political context of each country and of the changes that have occurred over time as a result of national legislators' choices**. In the case of packaging in particular, the first European EPR systems date back to the mid-1990s: thirty years of independent evolution have produced architectures that share the principle but not the structure.

The comparative analysis across the twenty-seven Member States

To facilitate comparison between countries and to guide the subsequent *policy* proposals, an analysis was carried out with the aim of highlighting the main features of existing EPR systems, the open questions and the prevailing development trends.

The analysis relates **exclusively to packaging**, the sector in which CONAI operates. This clarification matters for reading the data: if all waste subject to extended producer responsibility were considered, the number of schemes would be considerably higher, with France at the top, as the country that has applied the instrument to the largest number of products.

The **sources** used include Member States' national legislation, data and information made available by environmental agencies and national systems, and sector articles and reports.

A methodological clarification should be stated before proceeding with the comparison, because it defines its scope. Extended producer responsibility systems **here mean exclusively those made up of private entities**, which perform a task of public interest under State supervision but remain outside the public apparatus - the model on which the entire European framework for this instrument was built from the outset. Excluded are the so-called *State-run PROs*, the state-controlled producer responsibility organisations:

when the management of the system is directly attributable to the State, the instrument changes legal nature, from a private entity given responsibility to a public agency administering what elsewhere is entrusted to the market. It is a distinction that the comparative analysis explicitly recalls where relevant - in particular in the Hungarian profile, the only one of the five examined in this section to fall into this category - because the two models respond to different incentive logics and are not directly comparable.

The **first element of differentiation** between national systems is the **number of active entities**: some countries have a single system, others see competition between several organisations. In most cases - twenty countries out of twenty-seven, or 74% of the total - EPR systems are non-profit organisations, whose objective is to provide collection, sorting, recycling and reporting services at the lowest possible cost for producers. The remaining seven countries instead allow for-profit systems, on the premise that competition and profit can stimulate efficiency, innovation and differentiation in the services offered.

Significant differences also exist in the **definition of the EPR Fee "environmental contribution"**, paid by producers to cover the costs of their packaging once it has become waste. Modulating the contribution according to the characteristics of the packaging is one of the main levers for encouraging greater sustainability: producers are incentivised to design and market products with better environmental performance, so as to benefit from lower contributions. In two thirds of Member States, EPR systems apply detailed modulation criteria; nine countries - *Cyprus, Estonia, Lithuania, Luxembourg, Poland, Romania, Slovakia, Slovenia and Hungary* - apply instead a still rudimentary modulation, by material type alone.

Modulation approaches, moreover, **are not equivalent to one another even when they produce similar outcomes.** In the French system, modulation is based on a *bonus-malus criterion;* in the Italian one it is based on the management costs - the value chain deficit - associated with each type of packaging. The result tends to coincide, since the packaging that is easiest to recycle is generally that with the smallest value chain deficit, but

the bonus-malus approach is detached from actual costs, whereas the approach based on the value chain deficit ensures that each type covers its own costs.

In some countries EPR systems are distinguished by waste generation channel - typically household and commerce/industry - as in Austria, Belgium, France, Portugal and Spain. In Belgium in particular, two separate schemes operate: Fost Plus for household packaging and Valipac for commerce and industry. Italy also has a system dedicated to bioplastics, to date unique in the Union.

A further distinguishing factor is the **presence or absence of a deposit return system** (*Deposit Return System, DRS*), in which consumers pay a deposit when purchasing beverage bottles - single-use or refillable, generally in PET, glass or aluminium - which is refunded when the container is returned at dedicated collection points. To date sixteen countries, equal to 60% of the total, have a mandatory system in operation, and three have announced its adoption; Belgium, Bulgaria, Estonia, France, Italy, Luxembourg, the Czech Republic and Slovakia still have none.

Their spread is set to increase, since *Regulation (EU) 2025/40* requires their introduction for single-use beverage containers of up to three litres in plastic and metal by **1 January 2029**, unless a Member State demonstrates that it achieved, in 2026, a separate collection rate of at least 80% for those fractions - a threshold currently difficult to reach with traditional collection systems.

Four cross-cutting areas for action

The analysis identified four recurring areas on which countries' improvement efforts should concentrate.



Figure 21. The main areas for improvement identified in the analysis, 2026. *Source: TEHA Group elaboration on national legislation, national environmental agencies and EPR systems, 2026.*

Data quality. The existence of parallel data collection - by EPR systems and by national agencies - prevents full comparability of *datasets*, an issue on which, for packaging, the European reporting framework has already intervened by **strengthening verification, control and data quality requirements, with validation by Eurostat**[56]. The difficulty is greater for imported goods, particularly those purchased online from third countries: in Germany the Zentrale Stelle encounters difficulties in verifying data on imports from Asia, because of the number of registered entities - more than one million from China alone.

***Free-riding*.** This is the presence of producers who, despite having EPR obligations, do not take part in the system, do not declare the quantities placed on the market and do not pay the related EPR Fee "environmental contribution". The causes vary, including limited knowledge of European rules and the difficulty of identifying and monitoring the entities obliged for a given good. The phenomenon in turn compromises data quality and accuracy, as well as the economic sustainability of the system, and is one of

[56] Eurostat, Packaging waste by waste management operations – Metadata, 2025; European Commission, Implementing Decision (EU) 2019/665.

the reasons why the strengthening of controls mentioned in the previous point is considered a priority by several Member States.

Harmonised action on specific value chains. One relevant case concerns plastics, including their biodegradable and compostable variants - the latter often not managed in Member States with the same rigour applied to organic recycling. Several countries, even those performing well in recycling other materials, record plastics recycling rates still far from European or national targets: in 2023 France had a packaging recycling rate of 69% but only 25.7% for plastics alone; Sweden stood at 31% against a national target of 50%. Both values remain far from the European targets of 50% by 2025 and 55% by 2030. The reasons are partly technical - mixed formats, films, trays and multi-material packaging are harder to sort - and partly market-related, following the dynamic described in the previous section.

Harmonised action for waste management across territories. In some countries, such as Italy, a gap persists in collection performance and in available plant capacity. In others, such as Hungary, separate collection could be improved through greater public involvement, via communication campaigns and the extension of *pay-as-you-throw* charging systems. This is a relevant point, because the quality of secondary raw materials obtainable from sorting and recycling depends directly on the quality of collection.

Five national models compared

By way of example, the packaging EPR models of five countries are examined here: **France**, which distinguishes between waste generation channels and invests heavily in re-use; **Germany**, with a competitive and well-established system; **Italy**, with a principal EPR system and high performance; **Sweden**, a pioneer on several fronts, including the world's first deposit system in 1984; and **Hungary**, which has yet to consolidate its waste management and entrusts the system to an organisation belonging to an oil and gas group - the case, as already noted, of a *State-run PRO*.

FRANCE

The packaging EPR model distinguishes between **household packaging**, **food service and catering** packaging and **professional and B2B**

packaging. For household packaging the system has existed since **1992** and was then expanded in **2024**, to include packaging intended for the food service and catering sector, and will cover all professional packaging from **1 July 2026**. In general, the French system pays close attention to **the modulation of EPR Fee "environmental contribution", to re-use and to prevention**.

The **active EPR schemes** are **Citeo, Adelphe and Léko** for household packaging, divided between paper and board, plastics, aluminium, steel, glass and graphic paper, and **Citeo Pro** for food service and catering packaging.

From **1 July 2026**, French legislation has made it mandatory for all enterprises placing **professional packaging on the French market** to register and pay an **eco-contribution** to collective recycling organisations. At present there are **three authorised systems** covering this packaging: **Citeo Pro, Léko Pro and Twiice**.

The main open issues are the **plastics recycling rate**, which stood at between **26% and 29% in 2024**, and can still be improved, particularly as regards **mixed and complex formats**.

France also shows **the absence of a deposit system for beverage containers**.

GERMANY

The German system was introduced in **1991** by the Packaging Ordinance (*VerpackV*), now replaced by the **VerpackG**. Initially based on a single non-profit system, the *Duales System Deutschland*, it has been revised over the years and today features **competition between several EPR systems**. These are for-profit organisations and include **BellandVision, Der Grüne Punkt – Duales System Deutschland, EKO-PUNKT, Interseroh+, Landbell, PreZero Dual, Reclay Systems, Recycling Dual and Zentek**. The system is supervised by the **Central Agency Packaging Register (Zentrale Stelle Verpackungsregister, ZSVR)**, which manages the **LUCID Producer**

Register, monitors declared packaging volumes, calculates operators' market shares and publishes recycling rate values.

The German packaging EPR system is based on a **competitive model**, in which several collective schemes (*dual systems*) operate in competition with one another and producers are **free to choose which to join** in order to fulfil their extended producer responsibility obligations. This approach has fostered a **market open to private for-profit operators as well**, promoting competition and encouraging economic efficiency in the management of EPR obligations.

Among the main strengths of the German model is indeed its ability to **stimulate competition between operators**, with positive effects on **cost containment** and on the pursuit of greater efficiency in collection, sorting and recycling services. In addition, the presence of a **particularly well-developed industrial value chain** and, in some cases, of plants directly controlled by the EPR systems makes it possible to keep the costs of separate collection and sorting relatively low compared with other European models.

Alongside these positive aspects, however, the model presents certain weaknesses. The **for-profit nature of operators** and strong commercial competition reduce **transparency in the setting of EPR fees**, which do not always reflect solely the actual costs of managing packaging at end of life, but may incorporate market considerations, competitive strategies and profitability objectives. As a result, it is more difficult to assess the **actual level of cost coverage** and to compare the contributions applied by the different systems.

Finally, **free riding** is significant above all for certain material types.

Germany also has a **deposit system (*Pfand*)**, which has a **return rate of more than 96%** and covers three different streams: single-use plastic bottles and cans (*Einweg*) with a deposit of **€0.25 per container**, refillable glass and PET bottles (*Mehrweg*) with a deposit generally between **€0.08 and €0.15**, and bottle crates (*Kasten*).

Overall, the German system has a **competitive and heavily regulated structure**, in which supervision by the **ZSVR**, the **LUCID** register and the annual updating of recyclability standards aim to ensure transparency, control of flows and incentives for sustainable design, while the **deposit system is now well established and delivers high performance**. The main weakness therefore lies not in governance, but in the **destination of materials**: a significant share of the composite packaging sorted is recovered **outside national borders**, making collection performance only partly indicative of domestic industrial capacity. Weaknesses also persist in relation to **sorting quality, the loss of recyclable materials, data quality and free riding**.

ITALY

The Italian EPR system is centred on the CONAI EPR Organization, which coordinates seven Packaging Material Consortia: Comieco for paper and board, COREPLA for plastics, RICREA for steel, CIAL for aluminium, COREVE for glass, Rilegno for wood and Biorepack for bioplastics. The latter, established in 2018, is the first and still the only EPR system for that stream in Europe, **recently recognised at European level as well**.

Relations between EPR systems and Italian municipalities are governed by a multi-year National Framework Programme Agreement between ANCI, UPI and all the national EPR systems, with specific technical annexes for each material setting out deliveries ANCI CONAI and the compensations.

Besides CONAI, several other EPR systems are also authorised to operate, known as “Self compliance EPR Organizations”: CONIP, PARI, CORIPET and Erion Packaging. The term “Self compliance EPR Organizations” refers to the fact that producers may “organise the management of their own packaging waste independently throughout the national territory” (Art. 221(3)(a) of Legislative Decree 152/2006 as amended) or set up “a system for the return of their own packaging” (Art. 221(3)(c) of Legislative Decree 152/2006 as amended).

The CONAI system describes itself as an **“all-in circularity system”**, since it **covers all types of packaging placed on the consumer market (all materials) from all generation channels (household, commercial and industrial), and for all uses (single-use, reusable)**.

The Italian extended producer responsibility system for packaging is therefore based on a complex structure in which CONAI plays a coordinating role together with the Packaging Material Consortia, alongside the possibility for enterprises to fulfil EPR obligations through recognised independent systems. The model is characterised by close collaboration between producers, users, recycling operators, waste management enterprises and local authorities, with the aim of ensuring the achievement of environmental objectives through a shared approach oriented towards the general interest.

One of the main strengths of the Italian system is transparency in the setting of EPR Fee “environmental contribution”. The EPR Fee are defined according to explicit criteria and are increasingly oriented towards fee modulation, rewarding packaging that is more recyclable, reusable or characterised by a lower life-cycle impact.

A further strength is the growing attention to prevention and ecodesign. Through the modulation of the EPR Fee “environmental contribution” and numerous initiatives to support enterprises, the system encourages the design of more easily recyclable packaging, the use of recycled material and, more generally, the adoption of solutions consistent with circular economy principles.

The model has also enabled Italy to achieve some of the highest recycling levels in Europe across the 7 material value chains. A distinctive element is the principle of subsidiarity with respect to the market: the consortia intervene mainly where the market is unable on its own to guarantee the collection and sent to recycling of materials, helping to stabilise the system and to ensure continuity of management even in the most critical phases. Over time this approach has fostered the construction of a solid network of partnerships with the local authorities responsible for separate collection

and with private enterprises active in sorting, treatment and recovery, creating a collaborative ecosystem capable of supporting the development of the entire recycling value chain.

The most critical aspect, by contrast, is the **territorial heterogeneity of the system**. Separate collection performance, the quality of the materials collected and the availability of infrastructure vary significantly between different areas of the country, resulting in differing levels of operational efficiency.

A second weakness is the limited vertical integration of the value chain. Unlike other European models, the consortium system generally does not own sorting and recycling plants, but operates mainly through agreements and contractual relationships with third parties. This makes it possible to maintain an open, market-oriented structure, but it also creates greater dependence on the availability and capacity of existing plants, as well as on the economic dynamics of the treatment and recovery sectors.

SWEDEN

Sweden has a competitive model for packaging, with two active EPR systems: Näringslivets Producentansvar i Sverige AB (NPA) and TMResponsibility AB (TMR). The main law governing the system, Ordinance 2022:1274 on extended producer responsibility for packaging, sets annual recycling targets and broader *targets*, including: single-use PET bottles with a capacity of less than 3 litres and not intended for specific medical purposes must contain at least **25% recycled plastic by 2024** and at least **30% by 2030**; a **50% reduction by 2030** is also foreseen, relative to 2023 levels, in the release of plastic packaging into the environment.

The Ordinance establishes that, from 1 January 2024, the EPR system with the largest market share must provide collection points for packaging waste generated by commercial and industrial activities, with the material collected subsequently allocated among the active schemes on the basis of their respective shares. In addition, from 1 January 2027, every municipality must have introduced door-to-door collection for household packaging.

The main weaknesses of the system are the recycling of plastic packaging, which in 2024 stood at **31%** against a target of 50%, and data quality, adversely affected by *free-riding*.

The Swedish deposit system has existed since **1984** and was the first in the world. Returpack Svenska AB, operating under the public brand Pantamera, manages the DRS, which covers plastic beverage containers and cans: in 2025 the overall return rate was **88.4%**.

Overall, the Swedish EPR system has a competitive structure, with national targets often more ambitious than European ones, while the deposit system is well established. The Swedish model therefore owes its performance more to the maturity of collection than to its governance architecture, and it shows that not even a pioneering system guarantees uniform results across materials: the main weaknesses concern the recycling of plastic packaging and data quality, which is affected by *free-riding*.

HUNGARY

The EPR system was introduced in 2023 and covers household and non-household waste. The only active EPR system is MOHU (MOHU MOL Hulladékgazdálkodási Zrt.), a for-profit organisation belonging to the Hungarian MOL group, which operates in the oil, gas, petrochemical and energy distribution sectors, and which was granted the concession to manage the EPR system for **35 years**. Exemptions from payment of the EPR Fee "environmental contribution" are provided for, for example where a company demonstrates that its packaging has been reused and that the contribution was already paid the first time it was placed on the market, or where at least 60% of its packaged goods have been exported.

The main weaknesses of the system are:

- **separate collection is still not very efficient**, with an absence of door-to-door systems, while recycling rates still show ample room for improvement;
- **the lack of advanced fee modulation**;
- **landfilling is still high**, accounting for 55% of waste generated in 2022;

- inefficient separate collection and the high landfill rate **adversely affect the quantity and quality of recyclable waste**.

Hungary introduced a DRS from 2024, also managed by MOHU, for single-use plastic and glass beverage containers, cans and refillable containers. The deposit amount is fixed, around €0.14, irrespective of container type. In 2025 the system's return rate stood at 88.8%.

The Hungarian system is highly centralised. Weaknesses persist in relation to the efficiency of separate collection, the high recourse to landfill and the limited modulation of contributions.

Overall, the implementation of European directives on packaging EPR has produced an extremely varied picture from country to country. A heterogeneity that Regulation 40/2025 aims to reduce in the coming years. There is no shortage of good examples, however, with countries achieving excellent collection and recycling results, often ahead of or beyond EU targets, or adopting systems to promote greater product sustainability (e.g. fee modulation, annual incentives, etc.) or, again, already implementing well-structured deposit systems.

The European Union should therefore aim for greater uniformity across its territory, but without damaging those national EPR systems that already have well-established value chains and high performance.

The properties governance must have

Overall, the implementation of European directives on packaging EPR has produced an extremely varied picture from country to country, a heterogeneity that Regulation (EU) 2025/40 aims to reduce in the coming years. There is no shortage of good examples, however, with countries achieving excellent collection and recycling results, often ahead of or beyond EU *targets*, or adopting systems to promote greater product sustainability, or again already implementing well-structured deposit systems.

The European Union should therefore aim for greater uniformity in the environmental services provided across its territory, **but without**

compromising those national EPR systems that already have well-established value chains and high performance.

The comparison between the five cases in fact leads to a conclusion that guides the entire set of proposals in the Study: **no EPR governance structure is structurally superior to the others**. Italy and Germany both achieve high performance through opposing institutional architectures, while Hungary shows that a monopoly system can work where collection is efficient and underperform where it is not. The factor that discriminates between results is not the presence or absence of competition between schemes, but **the quality of separate collection and of the plant infrastructure supporting it**. EPR, in other words, does not operate in isolation: its incentives interact with national infrastructure, industrial value chains and the outlet markets for recycled materials, and the same instrument applied to different ecosystems produces different outcomes.

From this stem the properties required by the second functional block.

The first pillar concerns **a regulatory approach that gives priority to European competitiveness**. Four properties define it: taking into account the differences between countries, industrial ecosystems and material dynamics, rather than assuming uniformity; setting limited, reasonable and measurable objectives; reducing the regulatory burden by giving priority to pragmatism and effectiveness; and focusing on industrial performance, investment and capacity rather than on formal compliance with *targets* alone. The need is not theoretical: between 2019 and 2024 the Union adopted around **13,000 legislative acts**, more than twice the 5,500 measures approved at federal level in the United States. The volume testifies to the attention devoted to these issues, but it creates a complex and fragmented framework that blurs the clarity of the rules and freezes investment, to the point that legislation risks turning from a driver of the transition into a brake on it. This is already recognised by the institutions: on 26 February 2025 the Commission presented the *Omnibus* simplification package.

The second pillar requires the system to be founded on **mutual recognition and the sharing of best practices**, and not on forced harmonisation. Four properties follow from this:

- the use of mutual recognition instead of standardisation, which makes it possible to achieve cross-border circulation without first having to agree on a common definition;
- priority for a subsidiarity-based approach between countries;
- the promotion of interoperability between Member States and EPR systems;
- stronger sharing of information and good practices, with particular attention to the accuracy and comparability of data between countries and between materials.

The mutual recognition agreement between the European Union and Switzerland on conformity assessment shows that this property is achievable: in force since 2002 and renewed in 2024-2025, it allows a single assessment to open both markets for around twenty industrial sectors, equal to **66%** of the value of bilateral industrial trade, without any legislative harmonisation.

The resulting priority is therefore not structural uniformity, but **comparability, accountability and fair competition**: making systems that remain different comparable, rather than making them identical. This is the direction that section 4.2 translates into concrete actions.

3.3 Standards, quality and certification systems to strengthen trust in the secondary raw materials market

The third functional block concerns the condition that makes the first two operational: an industrial buyer can direct its demand towards secondary raw materials, and a governance system can function, only if there is a shared and verifiable way of **attesting that a recycled material is what it claims to be**.



Figure 22. The main lines of action for the third pillar. *Source: TEHA Group elaboration.*

A single market for secondary raw materials should have shared requirements, or national criteria recognised at European level, in relation to standards, quality and accredited certification. The aim is to avoid difficulties in intra-European trade or possible asymmetric or unfair competition between Member States, instead facilitating trade and reducing external dependence for certain materials.

The *End of Waste* question: when waste ceases to be waste

The **end-of-waste criteria** (*End of Waste*, EoW) define the conditions that allow a company to establish when waste ceases to be waste and becomes a tradable secondary raw material. It is the legal step that determines whether a material may circulate as a product, and in the absence of a common European framework **the same material leaving treatment plants may be considered a secondary raw material by one country and waste by another**.

Harmonisation, however, presents a difficulty of its own, which conditions its design. European ***End of Waste*** criteria must be harmonised upwards: for reasons of environmental and human health protection they must tend towards the most stringent requirements in force in Member States. Once approved they become binding and, if too generic - for example a single contamination limit for all polymers and all applications - and at the same time too stringent, they may jeopardise well-established recycling value chains in some Member States, where less stringent criteria, or criteria

differentiated by type of end application, were in place. This is the case in Italy with the UNI 10666 series of standards, which define *End of Waste* criteria for plastics according to the type of application.

A non-obvious methodological implication follows: **harmonising end-of-waste criteria is not an exercise in aligning to an average, but a choice about calibration between environmental protection and the industrial sustainability of existing value chains**. A single criterion undifferentiated by application would risk producing, in market terms, the opposite effect to the one intended, and blocking innovation in a sector where technological innovation still carries significant weight.

Traceability: without customs codes there is neither control nor price

The traceability of material flows, virgin and recycled, currently shows several gaps. **The absence of specific customs codes makes it difficult to distinguish between imports of virgin materials and imports of recycled materials, encouraging illegality and undermining the confidence of industrial buyers.** All this also adversely affects price transparency, blurring the distinction between virgin and recycled materials and **preventing the development of a reliable, publicly available price and volume index** for the EU market.

To this is added a technical obstacle that the debate tends to underestimate. **For example, to date there are no reliable laboratory techniques able to distinguish a recycled polymer from a virgin one or to establish the percentage of recycled content in a blend or an article.** Projects are under way to develop methods, but there is no certainty that they can translate into reliable routine procedures; in the case of chemical recycling in particular, the resulting polymer is entirely indistinguishable from virgin material. It follows that **recycled content can be verified only through a certified chain of custody**, for mechanical recycling, **or through a certified mass balance**, for chemical recycling.

This observation has a direct consequence for the design of the system: since analytical verification of the final product is not feasible, traceability **cannot be a downstream check but must be a documentary infrastructure along the entire chain**. The value of an instrument such as

the Digital Product Passport, referred to in section 4.2, lies precisely here: it converts environmental quality into commercial trust where statistical and customs codes do not reach.

Certification: excessive fragmentation and the spread of non-accredited certification

The certification of materials obtained from waste recycling is an important instrument for guaranteeing their traceability and for attesting that they have been obtained through processes compliant with the European rules in force. This in turn makes it possible to promote transparent communication and to find wider outlet markets for secondary raw materials obtained in a more virtuous way.

Here too, however, the European situation is fragmented. **The European Commission counts 230 sustainability certifications and 100 green energy certifications across the EU, of which around half offer weak or non-existent independent verification.** The *Green Claims* Directive, which should have imposed common reliability criteria on environmental claims, was suspended in 2025, leaving the narrower Consumer *Empowerment* Directive - applicable from 27 September 2026, which provides initial guidance on the independence and impartiality of certification schemes from certification bodies and aims at a first reliability screening among existing schemes, which are often not accredited and yet treated on a par with accredited ones. Today, **the abundance of certification schemes produces the opposite effect to the one declared**: an industrial buyer having to distinguish between dozens of labels is unable to understand their differing levels of rigour.

Schemes such as FSC Recycled, Recyclass, Remade and Plastica Seconda Vita for calculating recycled content help to verify traceability and recycled content, but they do not replace common end-of-waste rules at European level, leaving recyclers, and small and medium-sized enterprises in particular, exposed to fragmented compliance requirements.

The role of **voluntary standardisation by industry** should also be acknowledged, aimed at communicating in a common language. Both at European level (CEN) and at national level - DIN in Germany, UNI in Italy -

there are numerous standards covering waste, secondary raw materials and, more recently, packaging recyclability, facilitating dialogue between actors in the value chain. For plastics, mention may be made of the **EN 18120 series** on packaging recyclability and the aforementioned **EN 15343** on the traceability of recycling and of recycled content. This is why mutual recognition becomes important, rather than far-reaching harmonisation that would risk compromising the supply chains that have been built up.

On this ground a clarification arises that changes the very way quality is understood. **Quality should not be read solely as a set of characteristics resembling virgin material, but as a descriptor: having detailed information on a batch of secondary raw material allows the converting company to assess whether it is compatible with its application or not, and therefore to purchase it with confidence.** In the case of recycled plastics, the EN standards go precisely in this direction, defining quality controls on *inputs* - EN 15347 and EN 15343 - and on *outputs* - EN 15342, EN 15344, EN 15345, EN 15346 and EN 15348.

This is a decisive distinction for the functioning of the market: if quality is understood as similarity to virgin material, recycled material is by definition inferior and competes only on price; if it is understood as a verifiable description of properties, it becomes possible to match each batch to the application for which it is suitable, and the transaction rests on data rather than on presumption.

Key factors for the proper development of certification are therefore knowledge of markets and the availability of comparable data along the entire secondary raw materials value chain, as well as greater clarity regarding the validity of schemes, narrowing the field to accredited ones, which guarantee transparency and impartiality.

The ReMade case: from national certification to European recognition

An interesting case in this landscape is that of **ReMade**, the certification scheme of the ReMade Foundation, managed with CONAI's support.

The non-profit organisation ReMade was set up in 2009 to promote and support products derived from waste recycling and, in 2013, became the owner of the **first**

accredited certification scheme in Italy for verifying the content of recycled and recovered material and by-products, applicable to materials, semi-finished goods and finished products in any sector, including those made up of several components. Led and supported by CONAI, ReMade became the ReMade Foundation, with the objectives of protecting and consolidating the value created over the years and of becoming a centre for promoting and stimulating recycling-related policies. **The certification has recently been recognised at European level as well.**

Its function goes beyond technical attestation. **Recycled content certifications such as ReMade, accredited and recognised by public authorities, can be an instrument of facilitation and simplification: by guaranteeing recycled content equal to or higher than that required, they spare enterprises bidding for public contracts from having to submit additional ad hoc documentation, and contracting authorities from having to carry out their own checks.** It is accepted as means of proof of recycled content in public tenders, within the framework of *Green Public Procurement* and the Minimum Environmental Criteria, and it enables access to the incentives and tax relief provided by legislation for products with recycled content, as in the case of the *Plastic Tax*. As of July 2026, **more than 400 enterprises had used ReMade certification for over 8,000 products**: a scale of adoption which, in a market still lacking a common European reference, points to the availability of an already tested standard.

Source: TEHA Group elaboration on CONAI and ReMade Foundation data, 2026.

The properties the system must have

Creating a European single market for secondary raw materials requires a common framework able to integrate standards, traceability and reliable certification. The third functional block articulates this requirement in **three pillars**.

The first pillar concerns the **introduction of common standards**, and defines four properties for it. The approach must be based on:

- **mutual recognition**, including the definition of equivalent national end-of-waste criteria, so as to eliminate possible conflicts without waiting for full harmonisation.

- European ***End of Waste*** **criteria must be extended to specific strategic materials** to be identified at Union level, with the calibration by end application discussed above.
- Common **minimum quality and environmental performance requirements** must be defined.
- And **the principles of eco-design and design for recycling must be strengthened**, because actual recyclability is determined upstream, at the product design stage.

The second pillar concerns the **strengthening of traceability and verification**, and requires them to operate **along the entire value chain** of secondary raw materials; **through digitalisation and interoperable verification systems**, inspired by the logic of the Digital Product Passport; **on the basis of reliable information** on the origin of the material, its composition and its recycled content; and **by ensuring high-quality recycling** that preserves the material's properties.

The third pillar concerns the **centrality of comparable data and of market *intelligence***. It requires improving the **statistical classification** of virgin and recycled materials - starting with the dedicated customs codes whose absence was described above -; developing **comparable data at European scale** along the entire value chain; and strengthening **the monitoring of production, trade and material flows**, in support of evidence-based policy decisions. Alongside these three properties is a fourth, which operators identify as a precondition for the others: **transparency**, understood as effective accessibility of data to actors in the value chain and not only to the authorities.

Harmonising end-of-waste criteria, digitalising monitoring systems and ensuring the availability of comparable data are essential to reduce regulatory fragmentation, prevent distortions of competition and increase the confidence of industrial users. At the same time, accredited certification schemes subject to independent verification can enhance the quality and recycled content of products, facilitating their access to the market, to public procurement and to incentives. **This is the operational translation of a principle running through the entire block: in a market where**

analytical verification of the product is not technically possible, commercial trust is built on documentary evidence, and documentary evidence has value only if it is common, verified and accessible. The concrete actions that follow are the subject of section 4.2.

3.4 Industrial scale, access to finance and the investments required for the growth of the value chain

The three *building blocks* described so far share an implicit assumption: that industrial capacity exists to respond to the signals they generate. It is an assumption that the current system does not guarantee. A market may be well designed, its governance coherent and its standards reliable, and yet produce no result if the plants that should turn demand into volumes are not built.

The fourth *building block* of the model therefore defines the conditions under which the European recycling value chain can reach the **industrial scale and financing capacity** needed to support the targets the Union has set itself.



Figure 23. The main lines of action for the fourth pillar. *Source: TEHA Group elaboration.*

The starting point is the observation that the current system presents, on this front, three interconnected structural weaknesses:

- industrial capacity **at risk** and, in some segments, already contracting;

- an **investment requirement that lacks a solid *business case***, in a context of scenario uncertainty; and
- public-private intervention **lagging behind** that mobilised in other strategic sectors. In a functioning system, each of these weaknesses corresponds to a condition to be met.

The first condition: a value chain able to sustain industrial-scale investment

The size of operators is not a neutral variable with respect to European targets. The average production value per waste and recycling operator currently ranges from **€20.4 million in France** and €18.6 million in Germany to €8.8 million in Spain and **€6.8 million in Italy**: a French operator is worth, on average, three times an Italian one[57]. This is not an efficiency gap, but a difference in industrial history - in consolidation, vertical integration, relationships with *utilities* and with capital - which translates directly into differentiated competitive capacity within the same market.

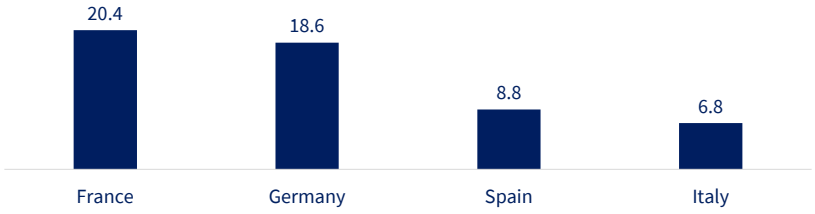


Figure 24. Average production value *(Average production value)* of waste and recycling operators in the main European countries (€million), 2025 or latest available data. *Source: TEHA Group elaboration on Orbis data, 2026.*

The consequence is that the European value chain finds itself in the paradoxical position of being made up predominantly of small and medium-sized enterprises while having to deliver an investment programme typical of a large process industry. The technologies that will determine the sector's competitiveness over the next decade - advanced optical sorting, chemical recycling, polymer refining, recovery of critical raw materials from WEEE, digitalisation of traceability - are **capital-intensive,**

[57] TEHA Group elaboration on Orbis data, 2026.

with long payback periods and high minimum scale thresholds, as well as uncertainty about the future market for secondary raw materials. A functioning system therefore requires the value chain's growth path to be an integral part of regulatory design, and not a hoped-for outcome of it: **a target that fails to take into account the size of the operators expected to deliver it is not an ambitious target, it is a poorly calibrated one**.

The second condition: closing an investment gap of €82 billion per year

The capital requirement can be quantified. According to estimates by the European Investment Bank and the European Commission, annual investment currently directed to the circular economy in the Union stands at around **€120 billion**, against an additional requirement of some **€82 billion per year through to 2040**: an implicit total requirement close to **€202 billion per year**, almost twice what the system mobilises today. The gaps are not evenly distributed but concentrate at two precise points in the chain: **circular design** upstream, where *design* choices determine actual recyclability, and **end-of-life infrastructure** downstream, where it is decided how much of the material collected actually becomes secondary raw material of industrial quality.

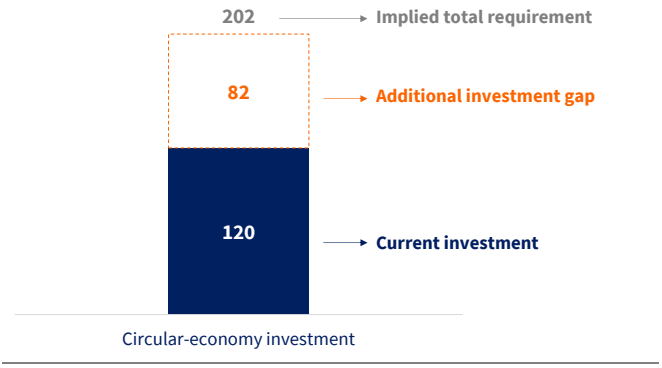


Figure 25. Annual investment in the circular economy in the EU and estimated investment gap (€billion), 2025-2040. *Source: TEHA Group elaboration on European Commission and European Investment Bank data, 2026.*

The nature of this gap must be interpreted precisely, because the appropriate type of response depends on it. **It is not a scarcity of capital**:

Europe has the largest *stock* of private savings in the world and its financial system has shown considerable capacity in recent years to allocate funds to the energy transition. It is a **scarcity of bankable projects**, and its causes can be identified one by one. On the revenue side, the price of secondary raw materials shows a range of fluctuation that no industrial plan can absorb. On the cost side, exposure to energy prices introduces a second source of variability beyond the operator's control. On the regulatory horizon, binding targets set without reference to available capacity generate a risk of *stranded assets* in both directions, through over- and under-investment.

To these three factors is added a fourth, less visible and more decisive: **the benefits that make recycling strategic for society do not enter into the financial appraisal of projects**. Security of supply, avoided carbon and industrial resilience are real values, quantified in Chapter 2, which nonetheless appear in no discounted cash flow. The result is a systematic misalignment between the private profitability and the collective value of the same projects: the technical definition of a market failure, and the justification - economic rather than ideological - for corrective intervention.

The third condition: regulation that enables investment rather than presupposing it

From the analysis of the causes follow the four properties that a functioning system must have on this front. They describe not instruments but requirements: their translation into concrete measures is the subject of Chapter 4.

- **Targets and regulation commensurate with the Union's industrial capacity**. Legislation must be designed as an instrument that enables investment - because it guarantees predictability and clarity - rather than as a constraint that presupposes it. This implies that every new obligation should be accompanied by a check on the recycling and supply capacity actually available and in prospect.
- **Risk sharing where private returns diverge from collective value**. Where market failure makes purely private investment too risky or unbankable,

the public sector and the European level must be able to intervene in partnership with the private sector, performing a *de-risking* function for sound projects along the entire value chain.

- **Access to long-term European capital not segmented by Member State**. The cost of capital for a recycling operator currently depends to an excessive degree on the country in which it is based: a financial fragmentation that replicates, and amplifies, the regulatory one.
- **Recognition of intangible value in appraisal criteria**. For the misalignment between private profitability and collective value to narrow, the sector-specific intangible benefits must be capable of being calculated, verified and taken into account in investment appraisals and financing criteria.

These four properties have one feature in common: none of them concerns the ambition of environmental targets. They concern the way targets are designed, financed and verified. It is in this sense that the fourth *building block* marks the shift of recycling from the domain of environmental policy to that of **industrial policy**: not because environmental objectives become secondary, but because their achievement depends on instruments belonging to the other domain.

3.5 THE CONTRIBUTION OF INTERNATIONAL TRADE TO EUROPEAN COMPETITIVENESS AND STRATEGIC AUTONOMY

The fifth *building block* addresses the dimension that the previous four presuppose without being able to govern it: the relationship between the European secondary raw materials market and the rest of the world. It is the dimension in which the current system shows its starkest contradiction. The Union **imports virgin raw materials with a structural deficit, exports secondary raw materials that could replace them**, and meanwhile allows in recycled materials produced to standards that it would not itself permit its own operators to apply. The result is a system that, for the same declared environmental ambition, transfers industrial value and employment abroad without reducing its own dependence.

The most emblematic case of this asymmetry concerns China itself: **the use of recycled plastic in contact with food is prohibited by Chinese legislation** - albeit with some recent openings under way - while the same material, exported to the Union, is declared compliant with the relevant European legislation (Regulation (EU) 2022/1616). It is a regulatory asymmetry that allows a non-EU producer to access an outlet market - the European market for food-contact materials - that its own national legal system denies it.

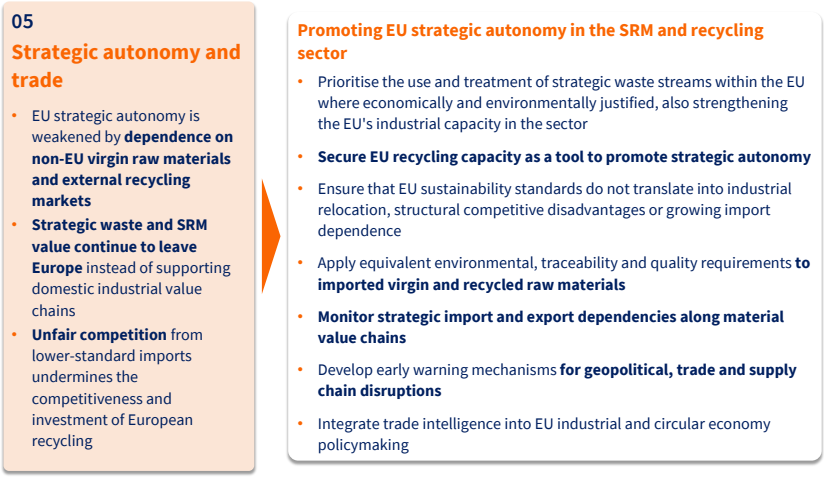


Figure 26. The main lines of action for the fifth pillar. *Source: TEHA Group elaboration.*

A twofold dependence: €29 billion of raw materials deficit and 40% of recycled material arriving from outside

The Union's trade deficit in raw materials reached **€29 billion in 2023**, with imports up **30% between 2013 and 2023** - from €74 billion to €97 billion, with a peak of €125 billion in 2022 at the time of the energy shock. This dynamic reflects Europe's heavy dependence on raw material imports, identified by the Letta (2024) and Draghi (2024) Reports as a structural

vulnerability for the Union's competitiveness and industrial resilience, which the circular economy and recycling can help to mitigate[58].

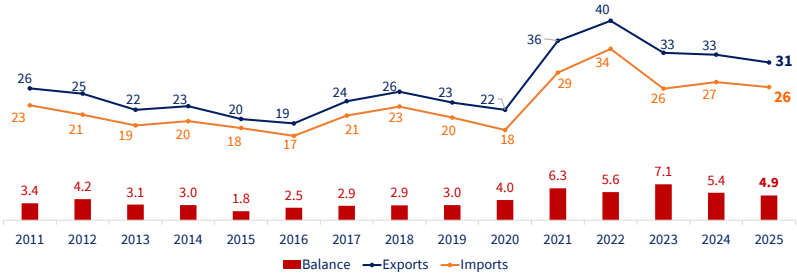


Figure 27. EU trade in raw materials: imports, exports and balance (€billion), 2013-2023. *Source: TEHA Group elaboration on Eurostat data, 2026.* N.B.: Raw materials include primary inputs to the economy such as biomass, metals, minerals and wood-based materials.

The figure that qualifies the problem, however, is another, and it concerns the channel that should reduce dependence. Of around **57.6 million tonnes** of secondary raw materials imported by the Union, **40% comes from non-EU markets**[59], with the United States, Switzerland, Norway and Ukraine among the main suppliers - while the remaining 60% moves within the Single Market. The high dependence on non-EU suppliers of secondary raw materials reduces recycling's ability to perform fully its role in mitigating the Union's strategic dependence.

The persistence of this dependence has a simple economic explanation. The import cost of secondary raw materials is systematically lower when the origin is outside the EU, and the gap is particularly marked for plastics: imports from third countries were cheaper than intra-EU imports in eleven of the twelve years between 2013 and 2024, with differences exceeding **€130 per tonne** in the first part of the period.

[58] Source: Enrico Letta, Much More Than a Market (2024); Mario Draghi, The Future of European Competitiveness (2024). Both reports highlight Europe's dependence on imports of raw materials and strategic materials as a significant vulnerability for the Union's competitiveness, industrial resilience and economic security.
[59] Source: TEHA Group elaboration on Eurostat-Comext data, 2026.

This mechanism allows materials from countries with less stringent standards to be more competitive, compressing demand directed to European recyclers. The price advantage in fact derives mainly from regulatory differences rather than from superior levels of efficiency.

The condition the model requires is therefore precise: that the relative price of materials reflect differences in efficiency and not differences in obligations.

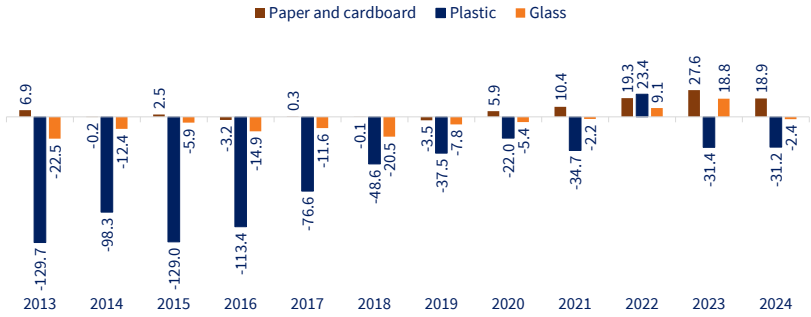


Figure 28. Price differential between secondary raw materials imported from non-EU and intra-EU markets, by material (€per tonne), 2013-2024. *Source: TEHA Group elaboration on Comext and Eurostat data, 2026.* N.B.: negative values indicate a non-EU import price higher than the intra-EU one.

Concentrated and unstable trade corridors: the geography of European vulnerability

Vulnerability depends not only on the volume of trade, but on its **geographical concentration**. The Geographic Exposure Index developed in the Study - which combines import and export shares, Herfindahl-Hirschman concentration indices and flow growth rates on a scale from 0 to 100 - places the **Middle East at 85.6**, **North America at 49.6** and **South Asia at 49.3**, with East Asia at 48.8, North Africa at 35.0 and Latin America at 33.6. South-East Asia, although growing rapidly, stands at 19.9. The distribution of scores reveals a significant structural feature: the Middle East stands clearly apart from the leading group, at almost twice the value of the areas that follow, confirming a concentration that has no equivalent in the other corridors.



Figure 29. EU geographic exposure index by macro-region (scale 0–100). The index is a composite score measuring the EU's structural dependence on each non-European geographical area, jointly considering: the weight in the value of non-EU trade of imports of virgin raw materials and exports of scrap and waste for the six materials analysed (steel, aluminium, paper, wood, plastics, glass); and the degree of geographical concentration of trade within the macro-region (HHI index). Cumulative values 2011–2026, non-EU flows. *Source: TEHA elaboration on Eurostat Comext data, 2026. Note: Countries excluded from the index: neighbouring non-EU Europe (Switzerland, Norway, Iceland, Liechtenstein, United Kingdom); the CIS area and Eastern Europe (Russia, Ukraine, Belarus, Georgia, Armenia, Azerbaijan, Kazakhstan, Uzbekistan, Kyrgyzstan, Tajikistan, Turkmenistan); the Western Balkans (Serbia, Bosnia and Herzegovina, Albania, North Macedonia, Montenegro, Moldova).*

Breaking the index down by flow and by material reveals the distinct logics operating behind each score. In almost all macro-regions, **virgin plastic dominates the import flow**: it is the material with the greatest weight in import exposure for the Middle East, North America, East Asia, North Africa and Latin America, with cumulative 2011–2026 values exceeding **€23 billion** in the North American corridor alone and **€41 billion** in the Middle Eastern one. On the opposite side, **ferrous scrap dominates exports** to the Middle East, North Africa and North America, while scrap paper is the predominant material towards East Asia and South-East Asia, following China's National Sword policy and the restrictions introduced between 2017 and 2018 on

imports of recyclable waste, and the subsequent reorientation towards India, Vietnam and Indonesia. South Asia, by contrast, shows a rare symmetry: both virgin imports and scrap exports are driven by steel, with India featuring as the leading partner in both flows and accumulating aggregate exposure of almost **€25 billion** over the period considered.

The Middle East warrants further analysis, because its high score reflects not a homogeneous dependence but the overlap of **two structurally distinct dependencies**. The scrap export component (score 49.4 out of a total of 85.6) is almost entirely attributable to Türkiye, which absorbs European ferrous scrap worth **€41.6 billion** cumulatively between 2011 and 2026, with an annual average of **€3.8 billion** over the 2022–2024 period and volumes exceeding **143 million tonnes** over the whole period, highlighting Ankara's central role as the main external outlet for European ferrous scrap and, at the same time, the European system's dependence on a single destination market. The virgin import component (score 36.3) is instead driven by the Gulf countries, with Saudi Arabia in a dominant position for plastics.

Saudi Arabia and Europe's dependence on virgin plastic from the Gulf

Saudi Arabia is the most emblematic case of structural dependence on imports of virgin raw materials in the entire non-EU trade geography.



Figure 30. EU-27 imports of virgin plastic from Saudi Arabia (€billion), 2011-2025. *Source: TEHA Group elaboration on Comext data, 2026.*

Between 2011 and 2026 the Union imported from Saudi Arabia alone €26.3 billion of virgin plastic, equal to 24.4 million tonnes, with an average of around €1.7 billion per year over the 2022-2024 period. Extending the analysis to the Gulf countries as a

whole - Saudi Arabia, Qatar, Kuwait, the United Arab Emirates, Oman, Bahrain, Iran and Iraq - cumulative volumes reach €35.9 billion and 33.2 million tonnes, with an annual average of €2.5 billion over the same three years. The dependence is not simply a matter of volume, but is structural for production reasons: Gulf petrochemical refineries produce virgin plastic resins as a by-product of hydrocarbon processing, at marginal costs that no European recycling plant can match. This is why the price differential between virgin material and secondary raw material, in this segment, does not narrow as European production scale increases: it depends on a cost structure formed elsewhere. In recent years non-EU competitiveness has extended to **semi-finished goods** as well, such as plastic film reels, made competitive by the lower conversion costs - particularly energy costs - borne by producers in those countries.

Source: TEHA Group elaboration on Eurostat-Comext data, 2026.

The trade concentration described by the exposure index does not, however, exhaust European vulnerability. The macro-regions with the highest scores - the Middle East first, followed by South Asia and East Asia - **coincide to a large extent with the geographical areas that have recorded the greatest geopolitical instability and the largest number of active conflicts in recent years**. Trade dependence and proximity to crisis theatres are not independent factors: they overlap and reinforce one another, producing a vulnerability that is at once economic and strategic.

The Institute for International Political Studies identifies two concentric bands of strategic interest for the European Union: a **primary area within 2,000 kilometres** of Europe's borders, which includes North Africa, the Middle East, the Black Sea and the South Caucasus, and a **secondary area within 4,000 kilometres**, extending towards the Sahel, the Horn of Africa, Central Asia and the Persian Gulf. Both bands currently host active conflicts or situations of structural instability with direct repercussions on European trade flows.

In the primary area, the Russia-Ukraine conflict - which began in 2014 and escalated to full scale from February 2022 - has redrawn the continent's energy and trade corridors, significantly altered raw material flows from Eastern Europe and the Black Sea area and permanently changed the

geography of European supply of wood, steel and fertilisers. The conflict in Gaza and military operations in Lebanon have destabilised the Levant and contributed to raising tension across the entire eastern Mediterranean basin. In the Sahel, the chain of military coups between 2020 and 2023 in Mali, Burkina Faso and Niger has reduced European access to land corridors and mineral resources in sub-Saharan Africa.

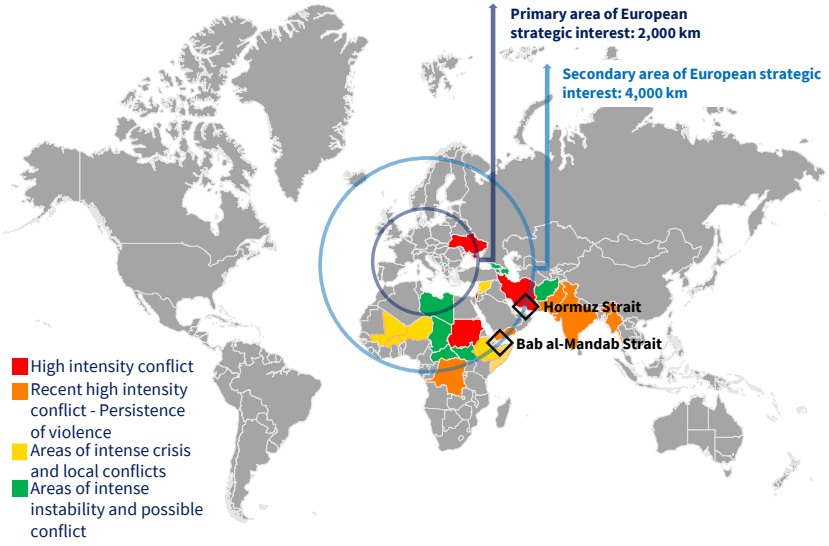


Figure 31. Main areas of conflict and geopolitical instability within the primary and secondary areas of European strategic interest, and location of the Straits of Hormuz and Bab al-Mandab (distance from the European Union: 2,000 and 4,000 km), 2026. *Source: TEHA Group elaboration on data from the Institute for International Political Studies, 2026.*

In the secondary area, the escalation between Iran and Israel in 2024–2025 and the operations of the Yemeni Houthis in the Red Sea from late 2023 have turned two maritime passages - the Strait of Bab al-Mandab and the Strait of Hormuz - from theoretical vulnerabilities into operational ones, with measurable effects on transits and on global logistics costs. Tensions in the South China Sea, finally, affect routes of fundamental importance for trade flows between Europe and East Asia, and directly involve the corridor which, in the analysis carried out in this Study, records the third-highest exposure score.

The map makes visible the overlap between the areas of **greatest European trade exposure and the main theatres of active geopolitical instability**. Vulnerability depends not only on the volume and concentration of flows, but also on the fact that the corridors through which those flows must physically pass run close to - or directly through - zones of conflict or structural tension. Among the most critical nodes are the Strait of Bab al-Mandab, which controls southern access to the Red Sea and the Suez Canal, and the Strait of Hormuz, an obligatory passage for energy and trade flows from the Persian Gulf.

The growing exposure of European maritime corridors

The strategic relevance of such passages stems from the structural role of maritime transport in world trade. More than **80% of goods traded globally, by volume, is moved by sea.** This share is concentrated in a relatively limited number of straits, canals and obligatory routes, whose disruption can produce effects that are rapidly transmitted to global supply chains.

Vulnerability therefore arises from the overlap of two different forms of concentration. To the geographical concentration of suppliers is added the infrastructural concentration of the corridors used to reach the European market. Even a value chain apparently diversified across several countries may remain exposed to a common risk if a significant share of flows continues to use the same strait, the same canal or the same maritime route.

The Red Sea crisis, which began at the end of 2023, provided a concrete demonstration of this mechanism. Attacks on ships pushed numerous shipping enterprises to avoid the Suez Canal and circumnavigate the African continent via the Cape of Good Hope. The detour can add around 12 days to the Asia-Europe route and cause an increase of close to 30% in transit times, while simultaneously increasing fuel consumption, the need for shipping capacity (and containers) and the risk of port congestion. Uncertainty over delivery times has a further effect on buyers' behaviour: **enterprises are forced to lengthen their procurement lead times**, bringing forward

purchases from non-EU suppliers - which have longer delivery times but more competitive prices - and reserving purchases from European suppliers for **sudden orders with urgent delivery** alone, needed to cope with demand peaks or supply chain delays. This is observed both for virgin and for recycled plastics.

The Strait of Hormuz performs a different but equally strategic function. Its relevance is linked mainly to oil and gas flows from the Persian Gulf: according to UNCTAD and the International Energy Agency, around a quarter of global seaborne oil trade passes through the Strait, rising to 38% for crude alone, and around one third of seaborne fertiliser trade[60]. A disruption therefore affects not only the goods that pass directly through the passage, but can be transmitted to the entire industrial system through the price of energy, marine fuels, freight rates and insurance cover.

For Europe, such vulnerabilities are particularly significant because they affect routes used both for the supply of energy, virgin raw materials and intermediate products essential to industrial value chains, and **for the export to third countries of the scrap and waste not absorbed by the internal market.**

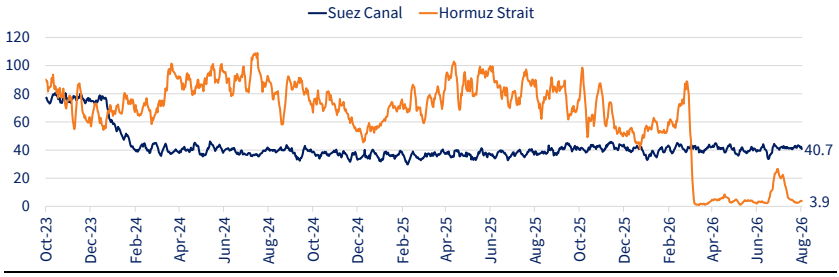


Figure 32. Trend in the average daily number of ships transiting the Suez Canal and the Strait of Hormuz (number of transits), October 2023-August 2026. *Source: TEHA Group elaboration on IMF PortWatch data, 2026.*

The trend in transits highlights the different nature of the shocks affecting the two corridors. In the Suez Canal, daily transits fell rapidly

[60] UNCTAD, «Strait of Hormuz disruptions: Implications for global trade and development», 2026, and the International Energy Agency, Strait of Hormuz», 2026. The one-third share refers to seaborne trade in fertilisers (mainly urea) and not to oil, for which estimates converge on around one quarter of total seaborne trade and on 38% of crude alone.

between the end of 2023 and the beginning of 2024, dropping from around 75-80 ships a day to close to 40. Traffic subsequently stabilised at levels structurally lower than before the crisis, standing at 40.7 daily transits in August 2026. Even more than two years after the start of the attacks in the Red Sea, traffic through the Bab al-Mandab area remained at around half of pre-crisis levels.

In the case of the Strait of Hormuz, by contrast, the series shows high volatility until the early months of 2026, followed by a sudden collapse in transits. After fluctuating mainly between 50 and 100 ships a day, **traffic fell almost to zero between March and April 2026**. The temporary recovery observed in July did not hold and, in August 2026, the average daily number of transits stood at just 3.9 ships.

The figure therefore shows that **the vulnerability of corridors should not be interpreted solely as the risk of a permanent closure**. Even temporary disruptions, threats to the safety of navigation or expectations of a deteriorating situation can lead shipping enterprises to reroute pre-emptively, reducing effectively available capacity and increasing transport times and costs.

The centrality of maritime corridors is of direct relevance for the seven materials covered by the Study. Elaborations on Eurostat-Comext data make it possible to measure, for each value chain, the share of non-EU trade volumes moved by sea. The indicator does not identify the complete route followed by the goods nor make it possible to establish whether the cargo crossed a specific chokepoint, but it measures the structural weight of maritime transport in the Union's supply and trade outlets.

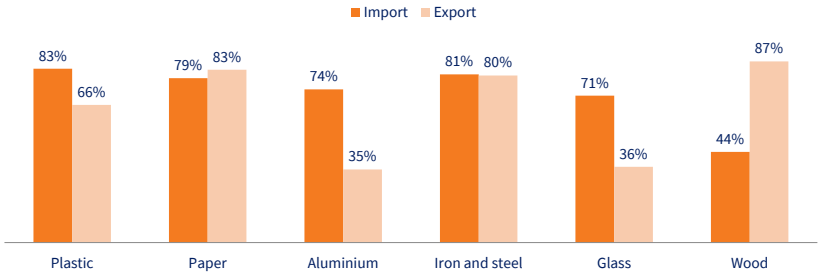


Figure 33. Share of EU-27 non-EU imports and exports of virgin raw materials moved by sea, by material and trade flow (% of volumes by weight), 2025. Source: TEHA Group elaboration on Eurostat-Comext data, 2025. (*) Shares are calculated as the ratio between the net quantity, expressed in kilograms, moved by sea and the total net quantity imported or exported by the EU-27 across all recorded modes of transport. The mode of transport indicates the active means at the time of crossing the Union's statistical border and does not allow the entire itinerary of the goods to be reconstructed. For the purposes of the analysis, the category "virgin raw materials" is defined on the basis of the HS codes selected for primary materials not classified as waste and may also include primary products and semi-finished goods. Compostable bioplastics are not included in the analysis as they cannot be uniquely identified through dedicated HS customs codes.

Across the seven materials analysed, **maritime transport accounts for 78.6% of the volumes of non-EU imports of virgin raw materials and 79.9% of export volumes.** The closeness of the two aggregate percentages nonetheless conceals significant differences between individual value chains.

On the import side, the highest dependence is recorded for plastics, with 83% of volumes moved by sea, and for iron and steel, with 81%. These are followed by paper, at 79%, aluminium, at 74%, and glass, at 71%. Wood shows a lower but still significant share, at 44%.

On the export side, the picture is more mixed. Maritime transport accounts for 87% of the volumes of wood exported to non-EU countries, 83% of paper and 80% of iron and steel. The share falls to 66% for plastics, 36% for glass and 35% for aluminium.

For four of the seven materials, therefore, at least seven tonnes in every ten imported from non-EU countries reach the European market by sea. **Security of supply depends not only on the production availability of**

supplier countries, but also on the operational continuity of the routes, ports and maritime passages used to connect those countries to European industry.

The high incidence of maritime transport is particularly relevant for materials with a relatively low unit value. In these cases, rising logistics costs can represent a significant share of the final price of the material and can rapidly change the economics of supply, even in the absence of any physical reduction in availability.

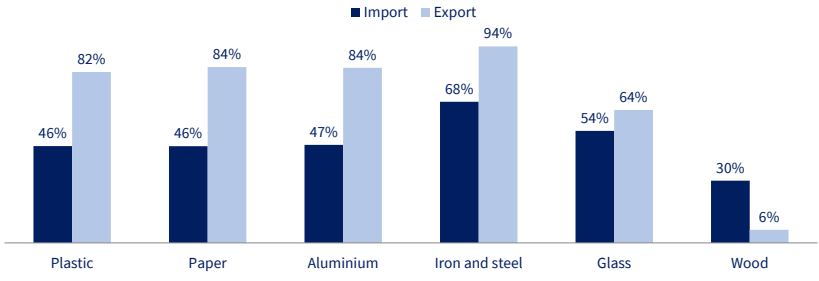


Figure 34. Share of EU-27 non-EU imports and exports of scrap and waste moved by sea, by material and trade flow (% of volumes by weight), 2025. Source: TEHA Group elaboration on Eurostat-Comext data, 2025. (*) Shares are calculated as the ratio between the net quantity, expressed in kilograms, moved by sea and the total net quantity imported or exported by the EU-27 across all recorded modes of transport. The mode of transport indicates the active means at the time of crossing the Union's statistical border and does not allow the entire itinerary of the goods to be reconstructed. Scrap and waste are identified on the basis of the specific HS codes selected for each material. Compostable bioplastics are not included in the analysis as they cannot be uniquely identified through dedicated HS customs codes.

Maritime dependence is even more marked for exports of scrap and waste. Taking the seven materials together, the sea carries 55.0% of the volumes imported into the Union, but 88.4% of the volumes exported to non-EU countries.

Exports show particularly high shares for iron and steel scrap, moved by sea for 94% of volumes, and for paper and aluminium scrap, both around 84%. These are followed by plastics, at 82%, and glass, at 64%. Wood is an exception, with a maritime share of exports of 6%, indicating greater concentration on destinations reachable by land.

On the import side, the weight of the sea reaches 68% for ferrous scrap, 54% for glass and values of between 46% and 47% for plastics, paper and aluminium. For wood the share stands at 30%.

The results highlight a **vulnerability distinct from that affecting virgin raw material supply.** Maritime disruptions can in fact impede not only the inflow of secondary materials needed by European industry, but also the outflow of the scrap that the internal production and recycling system is unable to absorb.

A reduction in export capacity can generate an excess of supply on the European market, compress the price of secondary raw materials and weaken the economic sustainability of collection, sorting and treatment activities. Dependence on seaborne waste exports is therefore also an indicator of the still insufficient capacity of European industrial value chains to valorise recovered materials internally.

Stress on corridors is passed through to logistics costs

Geopolitical **disruptions not only reduce transits, but also increase the volatility of transport costs**. Route deviations, longer voyages, higher demand for shipping capacity, additional fuel consumption and rising insurance premiums are progressively passed through to the freight rates borne by enterprises.

Between 24 July 2025 and 30 July 2026, Drewry's World Container Index rose from USD 2,517 to USD 4,255 per 40-foot container, an overall increase of 69.1%. The acceleration was concentrated mainly from the end of May 2026: compared with the level of around USD 2,800 recorded before the phase of sharpest growth, the final level is 52% higher.

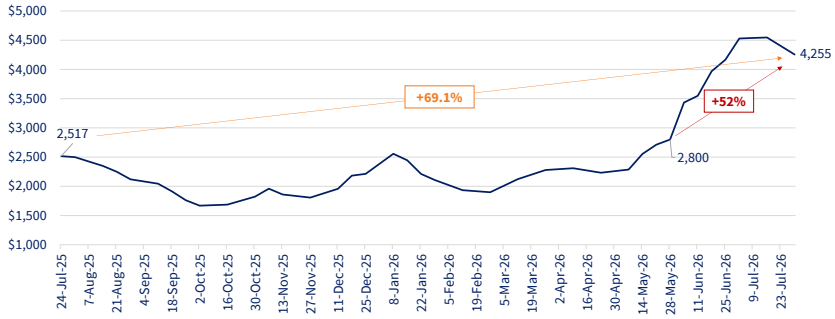


Figure 35. Trend in the World Container Index and related changes in the cost of containerised maritime transport (USD per 40-foot container – FEU – and percentage changes), 24 July 2025-30 July 2026. *Source: TEHA Group elaboration on Drewry data, 2026.*

The *World Container Index* does not directly represent the transport cost of all the materials considered in the Study. A significant share of flows of minerals, metals, wood and raw materials is in fact moved by bulk carriers, breakbulk vessels or other specialised ship types. The index is nonetheless a meaningful indicator of overall stress on the global logistics system, since route deviations, port congestion and rising energy and insurance costs tend to propagate across the different segments of maritime transport.

European vulnerability ultimately arises from the interaction of four factors: **the geographical concentration of trading partners, dependence on maritime transport**, **exposure to a limited number of chokepoints** and the **volatility of logistics costs**. These dimensions do not act separately, but can reinforce one another.

A localised crisis along a strategic corridor can disrupt or slow transits, raise the price of energy and transport and reduce, very rapidly, the availability or the economic viability of materials essential to industry. Diversifying supplier countries, while necessary, is therefore not sufficient if flows continue to depend on the same shipping routes or the same obligatory passages. For the seven materials covered by the Study, the question concerns not only which countries Europe imports from and which

markets it exports to, but also **through which corridors**, under what security conditions and at what cost such trade can take place.

European strategic autonomy should not be understood as self-sufficiency or trade closure, but as the ability to ensure the continuity of production value chains even in the presence of external shocks. The European economic security strategy itself identifies among its priority risks the threats to supply chains, infrastructure and strategic resources, as well as the possible weaponisation of economic dependencies.

Strengthening that capacity requires a **coordinated set of interventions**: diversification of suppliers and routes, enhanced security and capacity of European ports, timely monitoring of dependencies and chokepoints, long-term supply agreements, development of domestic production capacity and greater industrial use of secondary raw materials. Ports are indeed increasingly recognised by the European institutions as strategic assets for supply chain security and for the Union's autonomy.

European policy on circularity and secondary raw materials must therefore fully incorporate the geostrategic dimension of logistics. A shift is needed from a model oriented predominantly towards efficiency and cost minimisation to one able to attach explicit value to security, continuity and resilience of supply.

The paradox to be corrected: importing virgin material and exporting secondary material

The second element concerns the opposite direction of flows. Despite the deficit in virgin raw materials, **Europe remains a net exporter of waste**, with steel, wood and paper making up the largest outbound flows. This is the central paradox of the current set-up: the Union pays tens of billions every year to import virgin raw materials and at the same time hands over to third countries the secondary raw materials that could replace them, together with the value added and employment their processing would generate within Europe.

The experience of 2018 shows how fragile this arrangement is and how little it takes to disrupt it - and above all why a simple reduction in exports does not equate to a strengthening of European circularity. In the absence of adequate domestic treatment capacity, **an external trade shock does not produce circularity: it produces a forced reorganisation of flows towards an alternative destination**. This is why the model treats recycling capacity installed within the Union not as a desirable consequence of trade policy, but as its **precondition**.

China's 2018 restrictions: when dependence shifts instead of shrinking

In 2018 China introduced the "National Sword" policy, an almost total block on imports of waste destined for recycling. The effect on European trade was immediate and drastic: exports of plastic waste from the Union collapsed by 96% between 2011 and 2018, and those of paper waste by 52% over the same period.

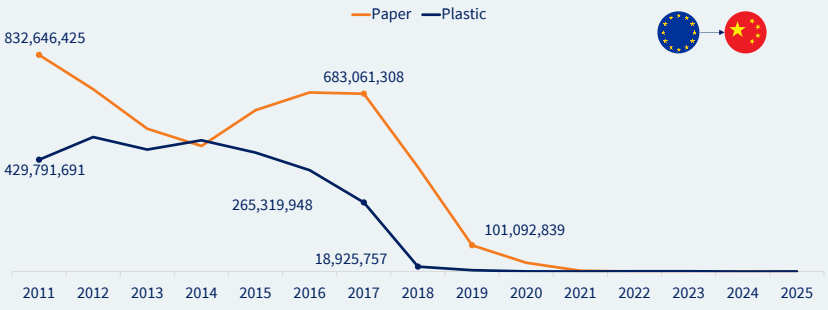


Figure 36. EU-27 exports of paper and plastic waste to China (€), 2011-2025. *Source: TEHA Group elaboration on Comext data, 2026.* N.B. From 2018, with the introduction of China's "National Sword" policy, China progressively restricted imports of numerous waste categories, including plastic waste and certain types of recovered paper, causing a sharp contraction in flows from the European Union.

The sudden loss of the Chinese outlet made clear how dependent Europe was on a single destination market for its surplus recyclable materials, but it did not reduce that dependence: it merely shifted it. European exports of recovered paper to India rose from USD 140 million in 2017 to USD 326 million in 2024, an increase of 132%, while those to China fell from USD 924 million to USD 71.6 million, a decline of 92%. The Geographic Exposure Index developed in this Study confirms that the concentration of the remaining trade corridors remains high: a new shock on a similar scale to that of 2018 would today produce market dislocations of comparable intensity.

Source: TEHA Group elaboration on Comtrade and Eurostat-Comext data, 2026.

The information gap at the border: without dedicated customs codes, control and market transparency remain limited

There is, finally, a technical obstacle that conditions any trade arrangement in the sector, and which must be stated because it is as elementary as it is solvable: European customs nomenclatures do not distinguish recycled materials from virgin ones. Comext data classify plastics according to polymer chemistry - PET, HDPE, PP - **not according to recycled content.** The consequence is twofold. On the one hand, the absence of dedicated codes makes it difficult to verify the compliance of imports and encourages irregularities, undermining the confidence of industrial buyers. On the other, and less obviously, it prevents the construction of a reliable, publicly available price and volume index: the European market lacks the basic informational signal on which every commodity market rests. This is not a statistical detail, but a precondition for every other measure. Upstream of the customs problem lies an even more elementary technical obstacle: **there are currently no reliable laboratory techniques able to distinguish a recycled polymer from a virgin one**, nor to establish precisely the percentage of recycled content in a blend or a finished article. In the case of chemical recycling the resulting polymer is chemically indistinguishable from virgin material. Recycled content can therefore be verified only through a certified chain of custody, for mechanical recycling, or a certified mass balance, for chemical recycling - not through an analysis of the finished product.

The conditions for a trade arrangement consistent with strategic autonomy

From this analysis follow the properties the model requires on the trade front, set out on two levels. The first concerns **safeguarding domestic capacity**:

- the **processing of strategic waste streams within the Union** must be the preferred option whenever this is justified from an economic and environmental standpoint, in line with the objective of strengthening the sector's industrial capacity;

- European **recycling capacity must be treated as a strategic autonomy asset**, with the same logic with which the Union safeguards access to critical raw materials;
- every new sustainability obligation must pass a **non-relocation test**: it must not result in the transfer of industrial activity, structural competitive disadvantage or increased dependence on imports.

The second level concerns **a level playing field and monitoring capacity**, both currently absent:

- equivalent **environmental and social requirements** - including working conditions in non-EU recycling plants**-, traceability and quality requirements** must apply to imported virgin and recycled materials;
- strategic **import and export dependencies** must be monitored along all material value chains, with **early warning mechanisms** for geopolitical, trade and supply chain disruptions;
- trade ***intelligence* must be integrated into the Union's industrial and circular economy policies**, overcoming the current separation between trade policy and waste policy - two areas which, in the case of secondary raw materials, describe the same object.

3.6 CROSS-CUTTING ENABLERS: THE FRAMEWORK CONDITIONS THAT DETERMINE THE EFFECTIVENESS OF THE MODEL

The five *building blocks* described in the preceding sections exhaust what can be governed within the scope of circular economy policy. Their effectiveness, however, depends on a set of conditions determined elsewhere: in the Union's energy policy, in education and labour policies, in research and industrial digitalisation policies, and in the relationship between plants and the communities that host them. These are the model's **four enabling factors**: **energy, innovation and data, skills and workforce, and social acceptance**.

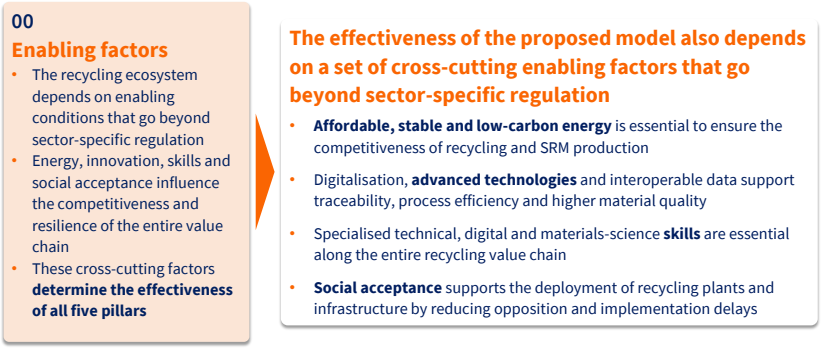


Figure 37. The main lines of action for the sixth pillar. *Source: TEHA Group elaboration.*

A methodological clarification is needed on this point, because the correct reading of the entire section depends on it. These four areas have their own legitimacy, their own debate, their own instruments and their own decision-making fora, and **the model proposed here does not take positions within them**: it does not propose an arrangement for European energy policy, it does not set out guidance on vocational training, and it does not enter into the merits of research industrial policy choices. The Study recognises their **enabling character** with respect to the recycling value chain and industry, and documents their measurable effect on the sector's competitive conditions. The conclusion it draws is one of coherence, not of competence: **regulatory decisions concerning the sector must be taken in awareness of these four constraints**, and the enabling conditions they define belong to a policy of industrial symbiosis broader than a sectoral one - that same integrated industrial policy of which the circular economy is one component, not the whole.

Energy: an energy-intensive sector exposed to a cost differential it cannot govern

Recycling is an **energy-intensive** activity. Collection - by its nature a discontinuous operation, whether it originates from households or from industrial users - sorting, grinding, washing and reprocessing all require significant heat and electricity inputs, and in the most demanding streams - plastics, glass, paper - the energy component weighs on production costs to an extent that determines a plant's economic viability. In the materials

collection and recovery sector, energy costs reach in some Member States **7.4% of total production costs**, with very wide dispersion between countries and an increase of more than one percentage point in the most recent period. It is not surprising that **75% of European enterprises identify energy costs as an obstacle to investment**.y

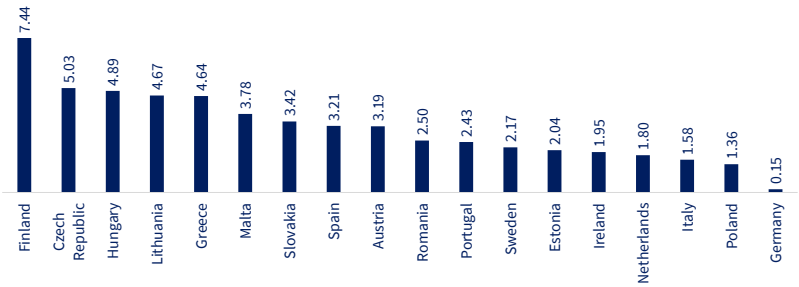


Figure 38. Energy costs as a share of total production costs in the waste collection and disposal and materials recovery sector, by country (% values), 2021. *Source: TEHA Group elaboration on European Commission, Dashboard on energy costs for EU industry and main trading partners, 2026.*

This weight combines with two features of the European energy system over which the sector has no leverage. The first is the **price level**: European industrial electricity has remained structurally higher than pre-crisis levels and in the first quarter of 2025 cost **2.8 times the US price**. The second is **import dependence**: in 2024 the Union's energy dependence stood at **57.2%**, with 97% of oil, 85% of natural gas and 34% of coal sourced abroad - values lower than the 2022 peak but in line with those of 2021, indicating that the reorganisation following the Russian invasion of Ukraine changed supply geographies without reducing overall exposure.

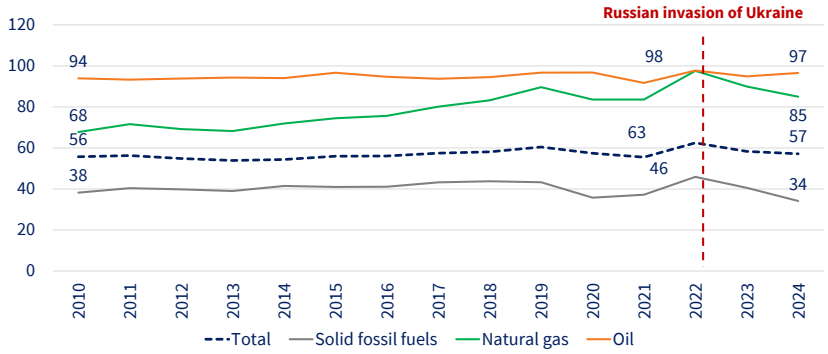


Figure 39. EU energy dependence by source (% values), 2010-2024. *Source: TEHA Group elaboration on Eurostat data, 2026.* N.B.: The indicator is calculated as the ratio between net imports and gross available energy.

The operational consequence of this dependence is **volatility that is transmitted directly to operators' margins**. Between February and April 2026 the price of oil rose by **37% year on year** and that of gas by **30%**, with the monthly average for Brent moving from USD 70.2 to more than USD 100 and that for TTF from €31.6 to more than €46 in two months. For a recycling plant, a swing of this magnitude within a quarter means the difference between a profit and a loss. And it is the reason why, from the model's perspective, **the cost of energy is not an exogenous factor simply to be noted, but a calibration parameter for targets**: recycled content targets set without considering the energy differential relative to non-European competitors produce, predictably, imports rather than capacity.

Innovation and data: a sector already becoming technological, and the risk that value migrates

The second enabling factor presents a different configuration from the other three, because the signal it returns is positive. Recycling and the production of secondary raw materials **are becoming a technology-intensive industry**, and patent trends document this clearly. The optical sorting market is a direct example: the three leading global operators - Tomra, Bühler-Sortex and Pellenc ST - control more than **70% of a global market worth USD 3.8 billion in 2025**, a share that rises to 80% including smaller European manufacturers, maintaining their position through continuous investment in research and development. The technology has

evolved from manual sorting, still widespread in some countries, to automatic sorting by polymer and colour using optical readers, with artificial intelligence and digital *watermark* systems as the most recent frontier.

Patents relating to plastic waste management grew **eighteenfold between 1990 and 2023**, around four times the average across all technology fields; patent families on battery circularity increased by **42% per year between 2017 and 2023**, against 2% for the average across all technologies. Private investment in Europe's circular economy sectors reached **€121.6 billion** in 2021, around 0.8% of the Union's GDP.

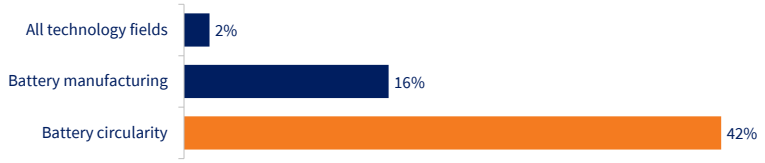


Figure 39. Annual patent growth in circularity sectors and comparison with the average across all technology fields (% values), 2017-2023. *Source: TEHA Group elaboration on EPO, IEA, Eurostat and European Commission data, 2026.*

There is also a correlation that deserves attention: **the higher a country's propensity to patent recycling technologies, the higher its circular material use rate**. Research and development in sorting, purification and chemical recycling increases the yield and quality of secondary materials, and therefore their substitutability for virgin material: innovation is not a complement to circularity, it is a determinant of it.

Hence the question relevant to the model, which is not how to stimulate innovation - the European research system is already producing it - but **where European innovation will find its application market**. A sorting or chemical recycling technology developed in Europe and installed elsewhere transfers the entire industrial value of the chain abroad, leaving the Union with intellectual property alone. It is the risk documented in sections 3.4 and 3.5 from the capital and trade sides, and which appears here from the technology side.

The second element of this enabling factor concerns **data**. Shared and interoperable information - patent databases, material flows, EPR registers, price indices - allows investors and innovators to identify where value lies and to direct capital towards it. Alongside this is the role of **industry voluntary standardisation** - at European (CEN) and national (DIN, UNI) level - in providing a common technical language on traceability and recyclability, explored in section 3.3. It is the same information infrastructure referred to in relation to standards and traceability, viewed here from a different angle: not as an instrument of commercial trust, but as a **condition for the efficient allocation of risk capital**. A market that does not produce comparable data also fails to produce the information on which innovation investments are decided.

Skills and the workforce: the constraint is not the number of workers, it is their qualifications

The third enabling factor is the one the debate most frequently underestimates, and which in business surveys emerges as the most binding of all. Europe's circular economy - recycling, repair and re-use - employs **4.4 million people**, around 2% of total Union employment, up **11% on 2015**, with associated value added of around €299 billion. Cedefop estimates indicate that the Green Deal could enable up to **2.5 million additional jobs by 2030** in the maximum potential scenario[61]. Recycling, repair and re-use are labour-intensive activities: the growth of the secondary raw materials market is, directly, a function of the availability of an adequate workforce.

[61] Eurostat, Private investment, jobs and gross value added related to circular economy sectors, Circular Economy Monitoring Framework, 2026; European Environment Agency, Scaling circular business models in Europe, 2026.

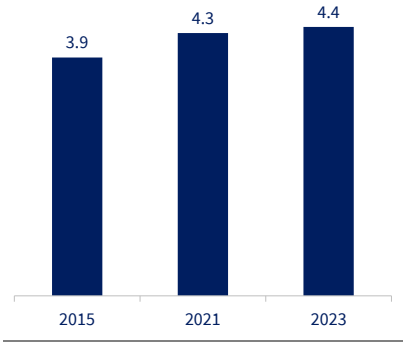


Figure 41. Employment in the circular economy in the EU (millions of people), 2015-2023. *Source: TEHA Group elaboration on Eurostat, European Commission, EEA and Cedefop data, 2026.*

The constraint, however, is not quantitative. **79% of European enterprises identify the availability of skilled workers as an obstacle to investment** - a higher share than that citing energy costs - and **26% already report serious difficulty in finding adequate skills**, with waste management among the most exposed sectors according to Cedefop projections to 2035. Expanding recycling capacity and introducing new technologies require profiles specialised in process engineering, plant management, digital technologies, materials science and quality control: profiles that the European education and training system does not currently produce in the quantities needed and that the twin green and digital transition - the main driver of European labour market transformation through to 2035 - will make even more contested.

Here too the Study does not put forward proposals on training policy, which belongs in a different forum. It does, however, note a direct implication for the model: **a trajectory of industrial capacity expansion that is not accompanied by a trajectory of training and requalification is not a feasible trajectory**, regardless of the availability of capital and the robustness of the regulatory framework. In the absence of targeted vocational training, of *upskilling* and *reskilling* pathways and of mechanisms for matching skills supply and demand, the capacity and quality of European recycling will not reach the levels required by the 2030 targets.

Social acceptance: environmental concern rises while willingness to pay declines

The fourth enabling factor concerns the conditions of public consent within which the value chain operates, and shows a dynamic worth reading carefully because it contradicts a widespread assumption. On the one hand, the environmental awareness of European citizens is growing: **96% of Europeans consider resource efficiency important** and concern about waste generation and material consumption rose from **27% in 2007 to 58% in 2024**, an increase of thirty-one percentage points. On the other, and in the opposite direction, the **stated willingness to pay more for sustainable products** - including those with higher secondary raw material content - fell from **75% in 2007 to 59% in 2024**.

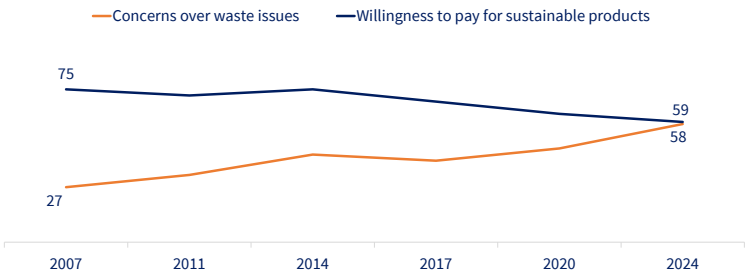


Figure 42. European citizens' perceptions and behaviours regarding the circular economy: concern about waste and willingness to pay for sustainable products (% values), 2007-2024. *Source: TEHA Group elaboration on EEA data, 2026.*

The divergence between the two curves is the relevant finding. **Environmental concerns are increasing while consumers' willingness to absorb the cost is weakening**, and in a context of compressed purchasing power there is no reason for the trend to reverse. A consequence follows that bears directly on policy design: **the overall cost of the circular transition is becoming the critical variable for social acceptance**, and measures that increase its perceived cost without making the corresponding benefit visible will meet growing resistance.

There is then a second dimension of social acceptance, more concrete and less examined: that concerning the **siting of plants**. Expanding recycling capacity requires physical infrastructure in specific places, and local

opposition to projects is today one of the main causes of permitting delays and of abandoned investment. Early community engagement and clear communication of the benefits - local employment, environmental benefits, economic value produced, and measures to mitigate and compensate unavoidable local impacts - are not ancillary activities but **conditions for project feasibility**, and must be treated as such when assessing the timelines and risks of any capacity development plan.

It is on this ground that the quantitative evidence presented in Chapter 2 acquires a function beyond the purely informative. The measure of the system's social return - **€1.66 of benefits for every euro invested** - does not serve only to inform decision-makers: it serves to make available, to citizens and local authorities, the other half of a balance sheet of which only the cost was previously known. Making that value visible is a precondition for trust, and therefore for acceptance.

Four framework conditions, one implication for the model

The four factors examined are not levers of the model. None of them can be operated by circular economy policy, and none falls within the scope of this Study. What the analysis shows is that **they determine the effectiveness of all five *building blocks***: energy determines the cost competitiveness of plants; innovation and data determine material quality and the allocation of capital; skills determine the feasibility of capacity expansion; and social acceptance determines the timing and locations in which that capacity can be installed.

The implication is therefore a single one, and it concerns the method by which sectoral policies are built. **A regulatory framework for secondary raw materials defined in isolation from these four conditions will produce targets that are formally coherent and industrially unachievable**. The model therefore requires that circularity targets be calibrated with knowledge of the energy differential, that capacity plans be built with knowledge of the skills constraint, that traceability obligations be designed with knowledge of the state of data interoperability, and that delivery timelines be estimated with knowledge of the state of public opinion.

This is the point at which the circular economy ceases to be an environmental *dossier* and becomes a component of European industrial policy, whose coordination with horizontal policies is the condition of its effectiveness. On this basis - five *building blocks* and four framework conditions - it is possible to move from describing the desired system to **selecting the measures with which to approach it**, the subject of the following Chapter.

CHAPTER 4

A NEW EUROPEAN INDUSTRIAL POLICY FOR THE CIRCULAR ECONOMY: STRATEGIC PRIORITIES AND ACTIONS TO BE LAUNCHED

The previous Chapter described the conditions under which the European secondary raw materials market could function. This Chapter takes a different step: it selects, among the many measures compatible with that model, those to be launched. It is an exercise not in completeness but in prioritisation, and for each proposed measure the text sets out the strategy chosen, the reason for that choice and the alternatives that were considered and discarded.

The need to make a selection stems from the context. Over the next two years the Union will address four legislative acts relevant to the value chain simultaneously, and a useful contribution to the debate cannot consist of a catalogue of recommendations: it must identify the few interventions that change the structure of the market rather than correcting its symptoms.

The structure of the Chapter follows a precise sequence, mirroring that of the model. From the **five functional blocks** described in Chapter 3 stem **three strategic priorities**; for each priority a **strategy** is defined, that is, the direction chosen among the available alternatives; and from each strategy stem the **specific actions** to be launched. It is a chain that makes it possible to trace every proposed action back to the market weakness it is intended to resolve.

4.1 FROM THE MAPPING OF EVIDENCE TO THE DEFINITION OF STRATEGIC PRIORITIES FOR EUROPE

The priorities presented in this Chapter derive from a structured process of gathering and synthesising evidence, organised in four steps: mapping the positions expressed by value chain actors through *position* papers and

institutional contributions; a programme of in-depth interviews with user enterprises, recycling operators, financial institutions, non-governmental organisations and former European decision-makers; the original quantitative analyses presented in the previous Chapters; and three discussion sessions with the Study's Scientific Committee and Advisory Board.

Six converging messages from the value chain: circularity as a matter of competitiveness and strategic security for EU manufacturing

The interview programme involved actors located at very different points of the value chain - from user enterprises in the food and beverage sectors to major European environmental services operators, from development finance institutions to civil society organisations, and including former European Commissioners and regulatory research centres.



Figure 43. Priorities emerging from the interview programme for building a more integrated and competitive European circularity market. *Source: TEHA Group, 2026.*

Despite the heterogeneity of perspectives, positions converged on six messages, which constitute the reasons why working to grow the EU circular economy is a priority.

- **From sustainability to industrial policy**: the circular economy emerges as a driver of competitiveness, strategic autonomy and security of supply. For investment to be mobilised, environmental objectives must be translated into solid *business cases* and integrated into industrial strategies, not treated as a parallel compliance exercise.
- **A still fragmented European market**: poor interoperability between EPR systems, standards, certification schemes and national models hinders the circulation of secondary raw materials. Greater European cooperation is

needed, while at the same time recognising the specificities of individual value chains and national systems.

- **Creating stable, sector-differentiated demand**: recycled content requirements can stimulate the market but must be calibrated on individual materials and accompanied by monitoring, incentives and European criteria. The PET case shows that demand generated by minimum recycled content targets, rather than driving the development of the European recycling value chain, can attract imports and destabilise other supply chains.
- **Strengthening supply, plants and processing capacity**: demand-side requirements are not enough without investment in collection, treatment, refining and industrial reintegration. The shortage of plants and of feedstock limits the sector's growth and requires financial instruments and public-private partnerships.
- **Competitiveness, prices and non-EU competition**: European recycled materials face high energy and processing costs, while imports may benefit from less stringent standards and from difficulties in verifying the equivalence of conditions. Greater traceability, a level competitive playing field and mechanisms capable of narrowing the gap with virgin raw materials are needed.
- **Security of supply**. Dependence on non-EU markets for a significant share of imported secondary raw materials exposes the value chain to supply shocks beyond European control. The enterprises interviewed ask that security of supply for recycled materials be treated with the same priority given to critical raw materials, through mechanisms for diversifying sources, monitoring strategic dependencies and rapid-response instruments in the event of trade flow disruptions.

From these messages stem **two criteria** by which the Study selected its priorities: the proposed measures must serve to keep manufacturing, employment and value in Europe; and they must be deliverable with the instruments the Union already has at its disposal.

From the structure of the model to the strategic priorities

Applying these criteria led to three strategic priorities, each of which implements part of the model described in the previous Chapter.

1. The priority **Governance, the Single Market and common rules** translates into action the **second and third functional blocks** - governance and the regulatory framework, standards and trust.

2. The priority **matching supply and demand and industrial symbiosis** implements the **first and fifth** - market design and the trade and strategic autonomy dimension.

3. The priority **finance for growth and competitiveness** develops the **fourth** - industrial scale, access to finance and investment.

A final clarification on scope. The breadth and level of ambition of each action require discussion with value chain actors and with the competent institutions: the Study does not propose legislative text but a contribution to an informed debate, in the awareness that the institutional process will provide the proper forum for mediating between different interests.

4.2 Governance, the Single Market and common rules for the consolidation of the European value chain

The first priority addresses the most pervasive and at the same time the least costly problem to correct: **Europe's recycling sector does not lack ambition, it lacks coherence**. The cost of this incoherence is measurable: for the European plastics recycling sector alone, the absence of harmonised end-of-waste criteria entails an additional burden estimated at **around €120 million per year**[62].

[62] Additional cost estimated for the European plastics recycling sector arising from the absence of harmonised end-of-waste criteria (€million/year). Source: TEHA Group elaboration on European Commission data and plastics recyclers, 2026. N.B.: The deficit is not attributable solely to the absence of harmonised criteria: high energy costs, low and volatile virgin plastic prices, competition from low-cost imports and insufficient demand for recycled plastic all contribute.

Faced with the scenario described in section 3.2 - in which, in terms of institutional model, eighteen Member States allow multiple competing EPR systems, six rely on a system **subsidiary to the market with a last-resort role** and three formally permit competition without it having materialised in practice - the apparently obvious answer would be harmonisation. The Study deliberately rejects this option.

The evidence gathered indicates that **there is no structurally superior EPR model**. The extended producer responsibility system does not operate in isolation: its incentives interact with national infrastructure, with industrial value chains and with the destination markets for materials, and the same instrument applied to different ecosystems produces different outcomes.

The strategy chosen is therefore that of **mutual recognition accompanied by the sharing of best practices**, centred on the principle of **subsidiarity**, and with a stated objective that is not structural uniformity but comparability, accountability, **transparency** and fair competition.

Alongside this strategy is a second, complementary one: **interoperability**. Even before mutually recognising different criteria, it is possible to make existing systems communicate along common formats. Experiences already in operation demonstrate this: the ***golden rules***[63] developed by producer responsibility organisations to harmonise definitions, reporting criteria and operational practices on a voluntary basis show that technical alignment can precede and prepare regulatory alignment, without requiring institutional negotiation. **It is the lowest negotiation-cost route of the entire priority**, and it already works on the current set-up without waiting for new legislative acts.

The EU-Switzerland mutual recognition agreement: how to open a market without standardising the rules

Since 2002 the European Union and Switzerland have applied a mutual recognition agreement on conformity assessment which allows a single assessment, carried out under Swiss or European rules by a recognised body, to open both markets without

[63] https://expra.eu/beliefs/

any legislative harmonisation having been undertaken between the two legal systems.

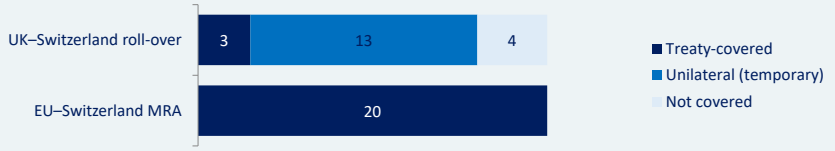


Figure 44. Sectoral coverage under mutual recognition: the EU-Switzerland agreement compared with the post-Brexit UK-Switzerland roll-over (number of industrial sectors), 2025. *Source: TEHA Group elaboration on EUR-Lex, 2026.*

The agreement currently covers around twenty industrial sectors - including machinery, medical devices, electrical equipment, construction products, lifts and biocidal products - equal to around 66% of the value of bilateral industrial trade, and it was renewed in 2024-2025 as part of the "Bilaterals III" package. Its effectiveness is best appreciated by contrast, observing what happens when treaty coverage is reduced: after Brexit, the roll-over of the agreement between the United Kingdom and Switzerland maintained treaty coverage for only three of the original twenty sectors, leaving four with no coverage at all and the remaining thirteen subject to unilateral, temporary measures. It is a demonstration, in the negative, of the worth of a fully operational mutual recognition instrument: its absence immediately translates into regulatory uncertainty for operators.

Source: TEHA Group elaboration on EUR-Lex and the EC-Switzerland Agreement on mutual recognition in relation to conformity assessment, 2026.

The actions proposed for the first policy priority:

- **Establish a European dialogue platform, involving EPR systems, open to stakeholders, under a European institutional secretariat** (for example the Circular Economy Platform - DG GROW). The proposal is not the creation of a new body, but of a **consultation platform among value chain actors** - national EPR systems, recycling operators and producers - addressing in an integrated way the conditions needed to make the market work at European scale, with the aim of contributing to the regulatory momentum and to EU decision-making.

- From benchmarking performance and identifying the bottlenecks that hinder cross-border circulation, to disseminating the most effective

practices, the strategy chosen is that of a **technical rather than political** platform, consistent with the indication given by the value chain itself: not an authority with powers to direct national models, but an infrastructure for cooperation that implements European regulation.

- **Promote mutual recognition of national end-of-waste criteria.** This is the action with the most favourable ratio between impact and negotiation cost in the entire Chapter. The alternative - waiting for the adoption of harmonised European criteria material by material - has already been tried and has produced, in more than fifteen years, criteria for metal scrap and glass alone. The strategy chosen is to bypass the impasse rather than go through it: mutual recognition requires a verification of equivalence, not identical rules, and this is why it works where harmonisation stalls. As noted in section 3.3, full harmonisation would moreover raise a calibration problem, since criteria that are too generic and at the same time too stringent would risk jeopardising well-established recycling value chains in some Member States.

- **Give full recognition and harmonisation to organic recycling**. Organic waste currently suffers a regulatory asymmetry compared with the other streams analysed in this Study: mandatory since 2024 in all Member States, it is still not accompanied by any *target*, *milestone* or penalty - unlike the targets already in force for paper, plastics, glass, wood, steel and aluminium. Moreover, the EU does not currently recognise recycling through composting as a secondary raw material, an asymmetry that risks failing to give full value to organic recycling, despite the high quality profiles and the contribution to environmental objectives currently guaranteed and supported by the value chain, as well as the synergy in terms of improving the quality of collection of other materials, as the Italian case demonstrates. It is therefore proposed that organic recycling be given full and equal recognition alongside mechanical recycling.[64]

[64] Directive (EU) 2018/851 of the European Parliament and of the Council of 30 May 2018 amending Directive 2008/98/EC on waste.

- **Extend the Digital Product Passport to secondary raw materials.** The proposal is to guarantee traceability, transparency and consistent information on origin, composition, quality and recycled content across the Single Market by extending an instrument that already exists. The strategy chosen - extending rather than creating a dedicated certification system - already has an identified vehicle: the Passport *roadmap* provides for a **delegated act on recycled content**, a natural point of contact with secondary raw materials.

The Digital Product Passport and the EU Ecolabel: two instruments with two different functions

The Union already has two instruments designed to make product information reliable, but with opposing logics. The Digital Product Passport, mandatory under the Ecodesign Regulation (EU) 2024/1781, is a digital register that collects in machine-readable form the data on the composition, recycled content and recyclability of an item; the European register has been operational since July 2026, but the only legal obligation currently certain concerns batteries, from 18 February 2027, while for other sectors there is a roadmap already providing for a delegated act on recycled content. The EU Ecolabel, by contrast, is a voluntary label governed by Regulation (EC) 66/2010 under the ISO 14024 Type I standard, designed to guide the end consumer rather than the industrial buyer: it counts around 3,540 licences and 116,700 products and services on the European Economic Area market as of March 2026. It is precisely this difference in function that defines their respective limits: the Ecolabel communicates overall quality but not the granular per-material data that a recycler needs in order to trace and price a secondary raw material, while the Passport has the data but not yet, except for batteries, the obligation that would make its use universal.

Source: TEHA Group elaboration on Regulation (EU) 2024/1781 and Regulation (EC) 66/2010, 2026.

4.3 INSTRUMENTS TO MATCH SUPPLY AND DEMAND AND TO DEVELOP INDUSTRIAL SYMBIOSIS

The second priority addresses the **twofold market failure** that characterises secondary raw materials: weak and essentially flat conversion demand, and supply exposed to volatility that no operator can manage.

Price dispersion between Member States ranges from **4.1% for paper to 18.2% for plastic waste**, with differences for nominally identical materials reaching 30% from one country to another.

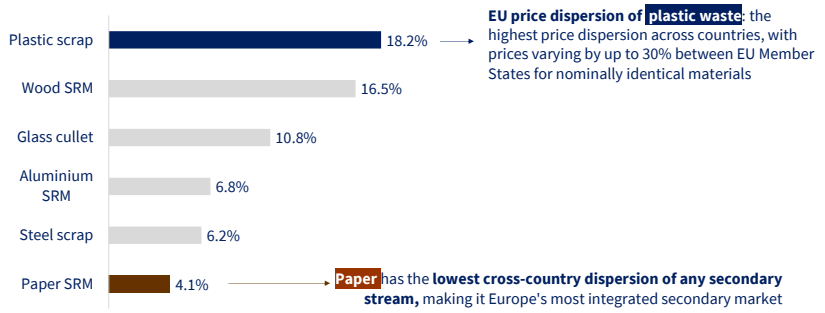


Figure 45. Price dispersion of the main secondary materials across European Union countries (coefficient of variation, %), average 2011-2024. *Source: TEHA Group elaboration on Eurostat-Comext data; values compared with Fastmarkets, UNIRIMA, Assorimap and the Eurostat Secondary Material Price Indicator, 2026.* (*) Price dispersion is measured through the coefficient of variation (CoV), calculated as the percentage ratio between the standard deviation and the mean of the unit values of bilateral import and export trade flows. The results represent the weighted average for the 2011-2024 period. Note: The differentials observed depend both on the characteristics of the material considered and on the conditions of its market, which may vary over time.

On the volume side the picture is equally telling. In an aggregate market of around 252 million tonnes per year across steel, paper, plastics and aluminium, secondary *inputs* still cover only a **partial share of demand**, and their penetration is growing at very different speeds from one material to another: from 72% to 76% for paper, from 43% to 42% for steel - essentially stable -, from 38% to 46% for aluminium, and from just 9% to 11% for plastics, which remain the stream with the widest gap between supply of and demand for recycled material.

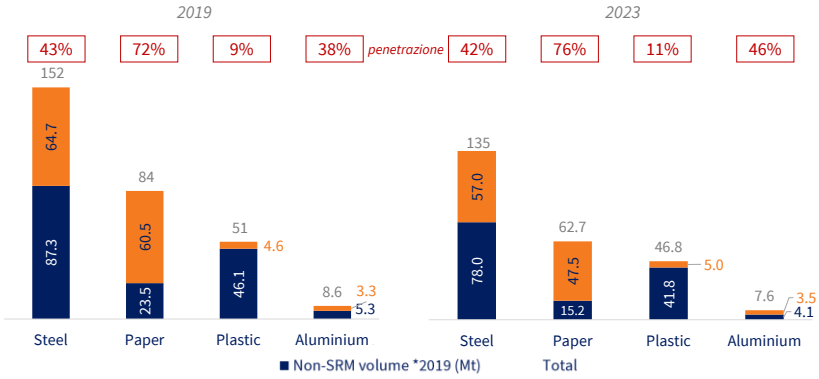


Figure 46. Industrial consumption of the main material streams and estimated volumes of secondary raw materials, with the related penetration rate (million tonnes and % values), 2019 and 2023. Source: TEHA Group elaboration on Eurofer, CEPI, PlasticsEurope, European Aluminium Association and BIR (Bureau of International Recycling) data, 2026. *N.B.: the volume of secondary raw material for 2019 is estimated by applying to 2019 consumption volumes the percentage changes reported by the respective sector sources between 2019 and the most recent year available. (*) The "non-SRM volume" includes the entire share of consumption not met by secondary raw material: virgin raw material, imports of non-recycled material and, for plastics, the component not traced as regenerated, and should not be understood as a synonym for virgin material alone.*

The actions proposed for the second policy priority:

- **Establish a single European marketplace for secondary raw materials.** The proposal is to create a reference venue for trading, capable of connecting public and private supply and demand on a single platform **to facilitate the matching of supply and demand**, guaranteeing three functions: traceability and certified material quality; a transparent and shared system for collecting price data; and the involvement of the sector's main actors from the design phase onwards. Management of the platform should be entrusted to a European technical body - a dedicated agency or an organisation such as the **Joint Research Centre** - to guarantee independence from operators and continuity of operation regardless of political cycles. In informational terms, the platform should include not only price data but a **structured profile of supply**: the recycler's registration details, type of industrial production and the main applications of the

secondary raw materials produced. And it is here that a decisive clarification about the notion of quality comes in. **Quality should not be read solely as a set of characteristics resembling virgin material, but as a descriptor: having detailed information on a batch of secondary raw material allows the converting company to assess whether it is compatible with its application or not, and therefore to purchase it with confidence.** In the case of recycled plastics, the EN standards go precisely in this direction, defining quality controls on *inputs* - EN 15347 and EN 15343 - and on *outputs* - EN 15342, EN 15344, EN 15345, EN 15346 and EN 15348. The strategy chosen is that of a market infrastructure and not of an administered allocation mechanism: the *marketplace* neither sets prices nor assigns volumes, but makes visible what today is not, because the problem documented is informational before it is allocative.

- **Make minimum thresholds of recycled content produced in the Union mandatory in public procurement.** The proposal is to promote the use of "Made in EU" secondary raw materials through the adoption of a minimum share in the revision of the Public Procurement Directive. The strategy chosen - mandatory thresholds rather than points-based criteria - is the most significant choice within this priority, and the reason is empirical: a reward criterion is systematically offset on price and produces an expectation, not a volume.

- **Recycled content certifications**, such as FSC Recycled, ReMade and Plastica Seconda Vita, accredited and recognised by public authorities, can be an instrument of facilitation and simplification: by guaranteeing recycled content equal to or higher than that required, they spare the bidding company from having to submit additional ad hoc documentation, and the contracting authority from having to carry out its own checks. In calibrating the thresholds, account must finally be taken of a **technical feasibility** constraint. Recycled content obligations are not equally applicable to all products: the plastic products that can most easily incorporate recycled material are often those with lower added value - sacks, bins, pipes, industrial applications - while for packaging the issue of food contact prevails.

Almost 50% of annual plastic packaging placed on the consumer market is *contact sensitive*, and for this share the possibilities of using recycled material are subject to stringent regulatory and technological constraints. A single, undifferentiated threshold would therefore risk being technically unachievable for a significant part of the market.

- **Effectively apply controls and compliance with European environmental standards to imported materials.** The proposal is to accompany the activation of public demand with border safeguards, following the adjustment logic already tested with the Carbon Border Adjustment Mechanism. The two measures are not complementary but inseparable: **steering European demand towards recycled content without ensuring parity of standards on imports does not strengthen the European value chain, it replaces it**. Such safeguards must also overcome the current limitation, since controls on imports today go no further than documentary checks, without verification of the equivalence of recycling conditions - in particular environmental standards and workers' conditions in non-EU plants - or of the origin of the waste.

European photovoltaics: an example of demand creation

The photovoltaic sector shares with secondary raw materials the same exposure to non-EU competition that the market, left to itself, is unable to contain. The Union has set itself the objective of reaching at least 30 GW of operational production capacity along the entire photovoltaic value chain by 2030; capacity actually installed today remains below 10 GWp per year, while China supplies between 81% and 93% of the components used in the European value chain. In 2025 a photovoltaic module produced in Europe with European cells cost around 10.3 euro cents per watt-peak more than the same module produced in China, a differential generated by higher costs for equipment, plant, labour and materials. The cause of this outcome was not the absence of European demand for photovoltaic technology, which the Union supported with conviction, but the absence of demand guaranteed specifically for modules produced in Europe: in a price-driven market, that demand was captured by non-EU manufacturers, with consequent closures and insolvencies among European producers, including Meyer Burger, NorSun, Exasun and Energetic Industries.

Source: TEHA Group elaboration on Solar Power Europe and Fraunhofer data, 2026.

The US precedent: trade policy and tax incentives as joint instruments

US experience shows, at two moments more than forty years apart, how trade policy can be combined with tax incentives to attract production onto one's own territory rather than merely excluding it. In 1981 the Economic Recovery Tax Act, combined with a voluntary export restraint negotiated with Japan, induced Japanese carmakers to build plants on US soil rather than give up the American market. In 2022 the Inflation Reduction Act applied the same logic to semiconductors and critical minerals through the "Foreign Entity of Concern" clause, which makes access to tax incentives conditional on the absence of components produced by entities linked to countries of concern: the clause led the Chinese battery manufacturer CATL to enter into a licensing agreement with a US-owned plant, rather than remain excluded from the market. In both cases the decisive element was not the restriction on access alone, but its combination with an incentive to locate production: a direct lesson for the Union, which must coordinate its trade policy with a strategy to support European production of secondary raw materials.

Source: TEHA Group elaboration, 2026.

- **Publish a European roadmap "Supply and demand of secondary raw materials to 2035".** The proposal is the adoption of a medium- to long-term strategy to balance supply and demand over time, published in the form of a reference trajectory. The strategy chosen is that of a programming instrument: the *roadmap* neither assigns quotas nor sets obligations, but provides operators with a parameter on which to build industrial plans and institutions with a benchmark for checking the consistency between regulatory targets and available capacity.

4.4 Finance and investment to support the growth and competitiveness of the European recycling industry

The third priority addresses the question that determines the outcome of all the others: **who finances the industrial capacity that Europe says it wants**. As documented in Chapter 3, the requirement is around **€82 billion per year** of additional investment through to 2040, against current flows estimated at €120 billion.

One contextual element helps to frame the scale of the intervention. Between 2014 and 2020 the Union allocated around **€10.6 billion** to the circular economy through its main programmes. Compared with an additional annual requirement of €82 billion, this figure clarifies the nature of the problem: it is not a matter of refinancing existing programmes on a larger scale, but of building a financing architecture of a different order of magnitude.

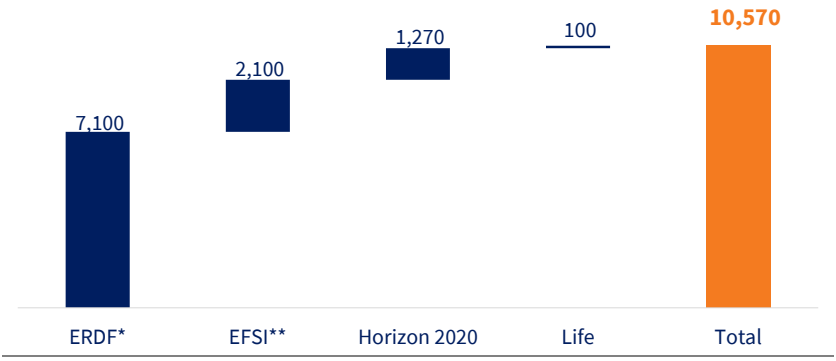


Figure 47. European Union funding allocated to the circular economy, by funding programme (€million, cumulative values), 2014-2020. *Source: TEHA Group elaboration on European Court of Auditors data, 2026.* (*) ERDF – European Regional Development Fund. (**) EFSI – European Fund for Strategic Investments. N.B. Horizon 2020 is the European Union framework programme for research and innovation for the 2014-2020 period; LIFE is the European programme dedicated to the environment and climate action. The total represents the sum of the funding attributable to the four programmes considered.

The actions proposed for the third policy priority:

- **Create a "net-zero recycling technologies" category modelled on the Net-Zero Industry Act.** The proposal is to make recycling technologies eligible for the same simplified permitting and the same forms of investment support provided for the manufacture of clean technologies. The strategy chosen - extending the scope of an existing instrument rather than creating a dedicated regime - responds to a feasibility assessment: the objective of the *Net-Zero Industry Act*, to bring European production capacity to at least 40% of annual installation needs by 2030, is conceptually identical to the one that would apply to recycling capacity. The most significant benefit is not financial but regulatory: **in most Member**

States the constraint that delays a recycling plant is not the cost of capital, it is permitting time.

The Net-Zero Industry Act: a category the Union has already built for clean technologies

The Net-Zero Industry Act is an initiative linked to the Green Deal Industrial Plan that seeks to promote, within the Union, the manufacture of the technologies needed for the energy transition. Its central mechanism is the simplification of the permitting framework for plants falling within a category of "net-zero strategic technologies", accompanied by improved conditions for access to investment; the stated objective is that European production capacity for these technologies should reach at least 40% of the Union's annual installation needs by 2030. The act also provides for a direct link with public demand, through preference criteria for net-zero technologies in green procurement, and has a national implementing precedent in Italy's FER-X decree for renewable energy plants. It is a precedent that this Study proposes to extend: the logic of a dedicated legal category, associated with faster permitting and easier access to investment, is directly transferable to recycling and secondary raw material production technologies, without requiring the construction of an entirely new regulatory regime.

Source: TEHA Group elaboration on European Commission data, 2026.

- **Define common rules for calculating and recognising the intangible value of secondary raw materials**. The proposal is to identify the intangible value factors - security of supply, avoided carbon, industrial resilience - and to establish common European rules on how they are calculated and recognised, **so that they can enter into bankability assessments, price formation and market dynamics**. It is the action that hinges with the third priority: without a shared and verifiable methodology, no financial institution can recognise those values in an appraisal without exposing itself to challenge. For this recognition to be

genuinely usable by financial operators, a preliminary condition is needed: **a calculation method that is uniform at European level**, applied in the same way in all Member States and for all material value chains. In the absence of a common criterion, the estimate of intangible value would remain discretionary and not comparable from one project to another - a financial institution might recognise the benefit calculated by one method in one country and reject it if calculated differently in another, defeating the objective of bringing it into bankability assessments at European scale. The uniformity of the method, even before its technical content, is therefore the condition that makes the entire proposal operational rather than purely declaratory.

- **Make operational the link between technologies included in the** "net-zero recycling" category and the **instruments for financing decarbonisation**, for example those funded by ETS resources. The intervention has a high ratio between potential impact and negotiation effort required, since it would not require the creation of a new financial instrument, but the extension and definition of eligibility criteria within instruments already provided for in the reform proposal. For this very reason, it is also one of the actions with the nearest intervention window.

  The reform of the Emissions Trading System (ETS) presented by the Commission on **17 July 2026**, which sets the legal framework for Phase 5 of the carbon market, is not an incidental circumstance but **the main financing channel currently available for the technology category just described**. Over the past twenty years the ETS market has generated revenues of **€260 billion**, of which only **10%** has been reinvested in industrial competitiveness.

  The reform introduces three relevant elements: the obligation for Member States to allocate **at least 50% of national auction revenues** to decarbonisation projects in ETS sectors; the conditionality of **80% of free allowances** on the publication of annual decarbonisation plans and of the remaining 20% on their implementation; and the

establishment of an **Industrial Decarbonisation Bank worth €100 billion**, preceded by an *ETS Investment Booster* worth €30 billion.

For the recycling value chain, however, the interesting point concerns the **link between the extension of the ETS scope and the new instruments for financing industrial decarbonisation**. The revision proposal in fact provides for progressively including in the system, from 2031, **the incineration and co-incineration of non-hazardous waste, including energy recovery**, thereby introducing a price signal also intended to strengthen incentives for prevention, sorting and recycling. In parallel, the reform strengthens the instruments funded by ETS resources, through the Innovation Fund and the new Industrial Decarbonisation Bank.

- **Reduce projects' exposure to price volatility through Contracts for Difference**. The proposal is to apply to recycling the two-way mechanism that in renewables guarantees fifteen or twenty years of revenue certainty. The strategy chosen is an intervention on the risk profile rather than on the level of return: the Contract for Difference does not increase the project's expected profitability, it reduces its variance - and since the cost of capital depends on variance, the effect on financing is more effective than a direct grant of equal present value. **The applicability of the instrument is not, however, uniform across value chains, and this point must be addressed openly**. The mechanism requires the definition of a reference price, and this presupposes three conditions that not all materials satisfy to the same degree: the existence of a reliable, publicly observable quotation, currently absent for several streams; a degree of material standardisation sufficient to make the price representative of a homogeneous product - a condition met by paper and metal scrap, much less so by plastics, where specification variability is high; and market liquidity sufficient to make the reference price non-manipulable.

  The **instrument is immediately applicable to streams with mature markets and integrated prices, while for the others it requires as a**

prerequisite the construction of a price index - which may be one of the functions of the European Marketplace proposed under the second priority, and which in turn presupposes the introduction of dedicated customs codes or derives directly from regulatory mechanisms linked to the costs borne by enterprises. The Contract for Difference is therefore not an alternative to the actions of the second priority: it is their natural temporal consequence. The feasibility check finally requires economic simulations on individual value chains, making it possible to estimate the cost of the mechanism, its optimal duration and the width of the activation band before any operational proposal. The design must also ensure that support is conditional on investment and not on production alone, to prevent producers, able to count on a guaranteed minimum price, from giving up innovating to improve their competitiveness.

The Contract for Difference: how a volatile market is turned into a bankable investment case

A two-way Contract for Difference bridges the gap between a fixed strike price, negotiated in advance, and the actual market price, guaranteeing the investor fifteen to twenty years of revenue certainty: if the market price falls below the strike price the State makes up the difference, if it rises the operator returns the surplus. It is the mechanism which, applied to offshore wind in the United Kingdom since 2014, has made it possible to attract 8.4 GW of capacity and GBP 22 billion of investment in the latest auction alone; in Italy the FER-X scheme applies the same logic with twenty-year Contracts for Difference, for a potential of 37.15 GW and €23 billion of investment. Since the 2024 electricity market reform, the Contract for Difference has become the default support scheme in the Union for new renewables. The figure that confirms its effectiveness is the revenue stability guaranteed regardless of the performance of the underlying market: over the period observed the market price fluctuated between 62 and 188 against a strike price set at 110, without the investor being exposed to it. It is the predictability of revenue, not its level, that makes bankable an investment otherwise too risky.

Source: TEHA Group elaboration, 2026.

CBAM: how a border price restores competitiveness to stricter standards

The Carbon Border Adjustment Mechanism, in force under Regulation (EU) 2023/956 as part of the "Fit for 55" package, applies a carbon price to the CO_2 embedded in goods imported from non-EU countries, so that a stricter climate standard does not simply translate into the transfer of production - and of the related emissions - outside the Union's borders.

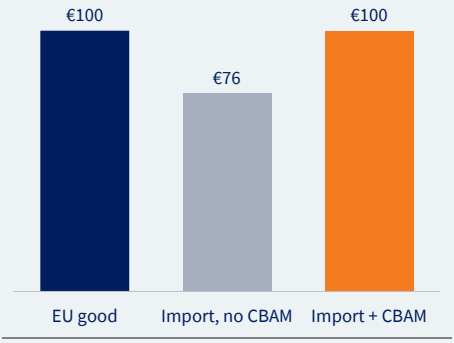


Figure 48. Value-for-money of a European good compared with a carbon-intensive non-EU import, with and without application of CBAM (illustrative, example values), 2026. *Source: TEHA Group elaboration, 2026.*

The mechanism clearly shows the problem it solves: without border adjustment, a European good that already bears the cost of carbon competes with a carbon-intensive import whose relative price stands at around 76 against a reference value of 100; applying CBAM brings that value back to 100, restoring competitive parity. It is exactly the logic that this Study proposes to transfer to secondary raw materials: applying to imports of recycled material environmental and traceability requirements equivalent to European ones, so that the price gap observed with non-EU supply reflects real differences in efficiency and not simply differences in rules.

- **Establish a European platform dedicated to public financing of the sector.** The proposal is a platform combining short-term capital - needed to unlock immediate investment at a time when capacity is contracting - with a defined medium- to long-term commitment, mirroring the way other economic systems support their strategic industries. The strategy chosen is that of a dedicated platform rather than an increase in the budgets of existing programmes: European funding for the circular economy has historically been spread across a few generalist programmes, with criteria not built around the characteristics of the sector.

- **Anchor the financing architecture to the proposed Savings and Investments Union.** The proposal is to use the mobilisation of European private savings as a structural channel for financing industrial strategies, along the lines put forward in the Letta Report. Positioning secondary raw materials and circular economy infrastructure as a flagship use case for the capital markets union offers a major European project a concrete testing ground.

- **Develop a common European Industrial Plan for recycling and secondary raw materials.** The proposal is a plan with European-level calls for projects and shared financing instruments, capable of strengthening industrial capacity and competitiveness **while avoiding the proliferation of fragmented national incentives**. This is the point on which the Study takes its clearest position: national measures accompanied by proximity criteria and state eligibility conditions inherently lead to market fragmentation. In a market intended to be single, support for industrial capacity cannot be the instrument through which Member States compete with one another.

The European Chips Act: a model of integrated industrial policy

The European Chips Act, in force since September 2023, is an integrated industrial policy designed to strengthen Europe's semiconductor ecosystem, reduce external dependencies and improve supply chain resilience. The measure operates simultaneously on several fronts - research and innovation, support for first-of-a-kind facilities, competence centres, incentives for manufacturing and advanced packaging, supply chain monitoring and crisis response mechanisms - and is expected to mobilise more than €43 billion of public investment, and more than €100 billion in total between public and private sources by 2030, with the objective of raising Europe's share of global semiconductor production to 20%. Among the precedents analysed in this Study, it is the most complete reference model for a recycling industrial policy that does not confine itself to a single instrument but simultaneously integrates research, production capacity, skills and security of supply.

Source: TEHA Group elaboration on European Commission data, 2026.

Three priorities and one objective: that the value generated remains in Europe

The three priorities presented are neither alternatives nor hierarchically ordered: they are **complementary and interdependent**, and omitting one compromises the other two. Common rules without a functioning market produce compliance without volumes. A functioning market without capital for plants produces demand that is met by imports. Capital without common rules produces investment that remains confined within national markets.

The criterion set out in section 4.1 remains the yardstick for the choices the Union will make over the next two years, and it makes it possible to distinguish between measures that appear equivalent in terms of environmental ambition but produce opposite industrial outcomes. The four legislative acts under preparation will define the structure of the European secondary raw materials market for the coming decade: it is a narrow window, and it will not reopen soon.

CONCLUDING REMARKS

This Study began with an asymmetry and closes on a responsibility. The asymmetry is the one described in Chapter 1. Over the span of two decades, the European Union has built **the most comprehensive regulatory framework on recycling in the world**: five regulatory pillars and more than thirty-five legally binding targets, covering the main waste streams, specific sectors, economic instruments and systemic strategies. Over the same period the circular material use rate rose from 11.1% in 2014 to 12.2% in 2024, against a target of 24% set for 2030. It is real progress, but equal to less than half the distance separating Europe from the goal it has set itself.

Chapter 1 also showed how this asymmetry is accompanied by a shift in perspective that the European institutions have recognised only recently. For some two decades the circular economy was treated mainly as an environmental issue; the Letta Report and the Draghi Report, and with them the Competitiveness Compass and the *Clean Industrial Deal*, have progressively brought it into the field of industrial policy. The signal was in any case already legible in the legislation: the Critical Raw Materials Act sets at 25% the share of European needs to be met through recycling, and does so explicitly in the name of security of supply.

Chapter 2 measured why this issue concerns Europe as a whole. The European recycling industry generates €555 billion of annual economic impact, €222 billion of value added - around 1.2% of the Union's gross domestic product - and supports more than three million jobs, an employment base comparable to 97% of that of the entire European automotive manufacturing sector. The supply of secondary raw materials further enables around €325 billion of industrial activity in strategic manufacturing value chains. And the cost-benefit analysis of the packaging management system indicates that every euro invested in collection, sorting and recycling generates €1.66 of economic, environmental and social benefits, for a net balance of €12.4 billion per year, equal to around €27 per citizen.

These are figures that place European recycling in the field of industrial policy rather than in the narrower field of environmental policy. And they are figures that Chapter 2 acenterprises with a caveat: **that value is not an acquired endowment but a flow**, and a flow exists only as long as the conditions that produce it exist - a dense collection infrastructure, installed industrial capacity and a market that absorbs recovered materials.

Chapter 3 translated this observation into an operating model, built on five functional blocks and a cross-cutting layer of enabling factors. For each block, the model sets the weaknesses that the European market presents today alongside the properties it should have for those weaknesses to disappear. A reading emerges that is worth recalling, because it guides the entire set of proposals: where the secondary market functions continuously - in steel, aluminium and paper - the value enabled is large and accounts for 79% of the total; where there is room for improvement, as in plastics, it remains limited despite the size of the underlying industry. **The difference appears to depend not on the ambition of the targets, but on the functioning of the market and on the technological context.**

The same Chapter also made clear that the model presupposes homogeneity neither between national systems nor between materials. The comparative analysis across the twenty-seven Member States indicates that no governance structure is structurally superior to the others: Italy and Germany, two of Europe's largest **manufacturing economies with high demand** for raw materials, achieve high performance - 162.2 and 149.3 kilograms of packaging recycled per inhabitant - albeit through opposing institutional architectures, and the factor that discriminates between results appears to be the quality of separate collection and of plant infrastructure rather than the competitive set-up. It is from this evidence that the choice follows to base the model on mutual recognition and the interoperability of existing systems rather than on standardisation.

Chapter 4, finally, translated the model into three strategic priorities and a limited number of actions, following a sequence that runs from the functional blocks to the priorities, from the priorities to the strategies and from these to specific actions. The three priorities - governance and

common rules, the connection between supply and industrial demand, and the bankability of investment - are neither alternatives nor hierarchically ordered, and their interdependence is itself a result of the analysis: common rules without a functioning market produce compliance without volumes; a functioning market without capital for plants generates demand met by imports; capital without common rules produces investment that remains confined within national markets.

The proposed actions share a feature that defines their feasibility: **they build on instruments that the Union has already negotiated and made operational in other sectors**. Mutual recognition, the Digital Product Passport, Contracts for Difference, the border adjustment logic, the categories of the *Net-Zero Industry Act* and the architecture of the Savings and Investments Union are existing mechanisms, whose extension to a new new area entails a considerably lower negotiation cost than the creation of entirely new instruments. Within a narrow legislative window, this difference is not marginal.

There remains the criterion running through the entire Study, which is worth leaving as the last word. **Circularity is not an objective to be maximised in the abstract: it is the instrument with which Europe decides whether the manufacturing, value and employment it generates will remain within its own borders.** It is a demanding criterion, because it makes it possible to distinguish between measures that appear equivalent in terms of environmental ambition but produce opposite industrial outcomes. The PET case illustrates this clearly: a recycled content obligation introduced without ensuring that European supply was competitive on equal operating terms led to an increase in imports rather than in the use of European secondary raw materials, and made corrective intervention by the Commission necessary. European photovoltaics shows the same outcome in an adjacent value chain.

The responsibility on which this Study closes is therefore circumscribed and precise. It is not for research to write European legislation, nor to substitute itself for the dialogue between institutions and value chain *stakeholders* that such legislation will have to mediate. It is for research to **make visible**

what is at stake, with the same quantitative rigour so far reserved for the system's costs alone, and to offer the actors in the debate - public decision-makers, businesses, investors - a common starting point against which to measure their respective proposals.

It is in this spirit that the results of the Study are presented. The decisions the Union takes over the next twenty-four months will define the structure of the European secondary raw materials market for the coming decade. Their quality will determine whether Europe will have built, not only the world's most ambitious regulatory framework, but also the **industrial capacity needed to deliver on it**.

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