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ERION VISION 2050

Past, present, and future of Extended Producer Responsibility Systems

Positioning EPR as a vital tool to bridge the gaps between the EU's sustainability and resource security goals and the effective implementation of circularity models is increasingly recognized as the way forward.

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Index

Executive Summary Pag. 4

01 Reflections with the founders of EPR inception and evolution Pag. 6

Origins of EPR Pag. 6
Persisting challenges Pag. 6
The future of EPR Pag. 7

02 Review of EPR in the EU and its role in advancing the EU's Green Deal objectives Pag. 8

Growth in material consumption and resource scarcity Pag. 8
Circularity limitations Pag. 9
Vision of EPR to tackle these challenges Pag. 11

03 Review of EPR schemes case studies – discussing challenges and opportunities Pag. 12

A. Pioneering EPR solutions across multiple waste streams in Portugal: Electrão Pag. 12
Key insights from Electrão's journey so far Pag. 12
Vision for the future of EPR and ongoing challenges Pag. 13
B. Navigating the evolution of batteries EPR: insights from EUCOBAT and WEEE Ireland Pag. 14
Key insights and Discussions on the evolution of EPR for batteries Pag. 14
Vision for the future of EPR for batteries Pag. 14
C. Insights into EPR evolution for WEEE in UK: REPIC's journey and the road ahead Pag. 15
Key insights from REPIC's journey so far Pag. 15
Vision for the future of EPR and ongoing challenges Pag. 16
D. The rising challenges in textile sector: the viewpoints from the Federation of the European Sporting Goods Industry Pag. 17
Key insights regarding textiles EPR development Pag. 17
Vision for the future Pag. 18
E. The nexus between automotive and batteries: the new mobility challenge for Volkswagen Pag. 18
The future of ELV EPR policy development Pag. 18
Insights from Volkswagen's journey on ELV circularity as learnings for ELV EPR Pag. 18
Vision for the future Pag. 19

04 The future of EPR: Vision for 2050, and steps for adapting to future challenges and opportunities Pag. 20

Vision for the future Pag. 20
Actions to achieve the EPR 2050 vision Pag. 21
Policy changes needed for improved EPR framework: Pag. 22

Executive Summary

The 1980s marked a period of significant waste management challenges across Europe, with public entities struggling to cope with increasing consumption and the emergence of new materials. These challenges lead to the conceptualization of EPR as a framework to address both waste management and product design. Nowadays, EPR systems cover numerous waste streams across the EU, but variations exist in their features and performance, reflecting differences in responsibility types, competition dynamics and cost coverage.

Despite EPR's advancements in waste management, challenges persist, particularly in driving significant changes in product design to prevent waste. The current eco-modulation approach, aimed at incentivising design improvements, faces hurdles in implementation, with varying stakeholder interests and regulatory complexities. While EPR has successfully influenced packaging design, achieving similar outcomes for complex products remains challenging. Looking ahead, the future of EPR entails a shift towards better utilization of collected materials, with a growing emphasis on reuse, repair, and recycling to foster a truly circular economy. Stakeholder cooperation, balanced competition, and effective policy incentives will be essential in driving innovation and sustainability efforts forward.

The last decades witnessed in parallel a growing material consumption and resource scarcity in Europe, as well as circularity limitations in addressing these needs. Indeed, despite circular economy efforts, **more than 87% of resource consumption in the EU still relies on primary materials, and overall waste generation in the EU continues to rise**. The World Bank highlights that current "business-as-usual (BAU) policies will not suffice to achieve significant reductions in primary material use, which is expected to grow 2.5 times by 2050 compared to 2000". Moreover, securing of resources will also be an ever more pressing feat in relation to the EU's net zero goals, given the role of critical raw materials (CRMs) in the advancement of decarbonisation technologies. The International Energy Agency estimates that by 2030, in its Net Zero Emissions by 2050 Scenario, global Critical Raw Materials demand will grow by 3.5 times, at over 30 million tonnes.

In light of these resource challenges, the **posing of EPR as a potential tool to bridge these gaps between the EU's sustainability, resource security goals and the effective implementation of circularity models is seen as the way forward.**

Different viewpoints on the journey of EPR so far, and the vision on the future are presented through cases studies on six different actors across different value chains within the EU: **packaging and tobacco** product waste through Electrão's PRO in Portugal, **batteries** through Eucobat's broad vision and **WEEE** Ireland's work, household and professional WEEE in the UK through Repic, **textiles** waste through FESI, the Federation of the European Sporting Goods industry and finally **end-of-life vehicles (ELV)** management through Volkswagen Group Italia's circular economy initiatives.

Based on the learnings from case studies a vision for EPR in 2050 can be presented. The **key elements can be summarised as follow**:

- **EU-focused approach**: crucial for a holistic perspective and treatment efficiency across the continent, fostering a single market for recovery, high-tech treatment of materials and supply to key manufacturing sites;
- **PROs' expanded role**: beyond compliance to cultivating collaboration, innovation, and circular economy initiatives, promoting sustainable production, disposal and material recovery;
- **feedback loop for Producers**: optimising product lifecycles through design changes to enhance recyclability and stability, leveraging data analysis tools for recyclability and carbon impact. Further, offering **comprehensive compliance services** by PROs covering different product sectors, broadening their customer base and operational models for synergistic efficiencies.

Organisational takeaways for achieving the future EPR vision:

- **wide collection networks**: with dedicated outreach, ensuring comprehensive waste recovery, allowing PROs to complement local councils efforts when challenges arise;
- **holistic waste management vision**, including promotion of reuse and repair, standards on refurbishment, and promoting circular economy beyond recycling. **Promotion of reuse and repair** is crucial, extending focus beyond recycling to embrace other facets of the circular economy;
- **consumer engagement and incentivisation** strong engagement efforts and tailored mechanisms for certain products to encouraging proper disposal practices, particularly for products with longer lifecycles.

Policy actions needed for achieving the future EPR vision:

- **coherent and meaningful targets,** considering waste available for collection, material loops, and circular economy priorities, going beyond mere collection rate targets. Further, **more rigorous enforcement of collection and recycling standard is needed**, preventing material scavenging, and ensuring high-quality recycling;
- **market stimulation for recycled materials:** mandatory requirements for recycled content incorporation, prioritising quality over quantity in waste treatment processes;
- **sustainability and eco-design considerations** supporting innovation in design prioritising recyclability, sustainable production, and ease of material reintegration, navigating inherent trade-offs and harmonising design requirements.

01. Reflections with the founders of EPR inception and evolution

With the aim of designing a vision for the future of Extended Producer Responsibility (EPR), we interviewed Thomas Lindhqvist, widely recognised as the first introducer of the concept of EPR in the 1990s, and Naoko Tojo, Associate Professor in environmental product law and policy at the International Institute for Industrial Environmental Economics (IIIEE) at Lund University, Sweden. The interview explored the origins of EPR, its evolution and what both experts envisioned its future should look like.

Origins of EPR

n the 1980s, the waste management landscape faced significant challenges, with companies and organizations – mainly public – in charge of waste management struggling to deal with the overwhelming amount of incoming materials efficiently. This period was characterised a surge in consumption across Europe, leading to a saturation of the existing waste management systems, paired with the need to reduce space allocated to landfills. Municipalities found themselves **financially strained** and unable to cope with the increasing demand. Moreover, concerns emerged regarding the environmental impact of certain products, such as those containing hazardous chemicals or new, more complex materials.

"We had a few decades in Europe where we were just consuming more and more, and the old system managed by the municipalities was overwhelmed because it was both big quantities as well as new materials with increasing varieties of plastics"

Thomas Lindhqvist

These challenges prompted two key requirements: (i) attaining funding to tackle the pressing issues of waste management and (ii) advocating for the production of better-designed products conducive to recycling. These issues sparked discussions between Thomas Lindhqvist in collaboration with like-minded individuals across Europe, on the topics of prevention measures, wherein the conceptualisation of EPR emerged as a framework to tackle these dual challenges and incorporate responsibility of producers into waste management (and its corresponding funding source).

Nowadays, EPR systems – and we have more than few hundreds across EU covering ELV, WEEE, Batteries, Packaging but also new waste streams like tobacco products, textiles, fishing gears, construction, and demolition waste– can have many different features, resulting in potential performance differences across countries and waste streams. Key features of EPR systems[1] which vary include (i) the type of responsibility (financial vs organisational), (ii) individual vs collective, (iii) the nature of competition, (iv) the cost coverage and (v) the transparency as well as surveillance.

Persisting challenges

While EPR has helped greatly the advancement of more effective and efficient waste management, the most prevalent challenge in EPR lies in product design. **EPR implementation has fallen short in fully promoting prevention of waste through design**. the European context of implementation through collective schemes posed a unique challenge, as the cost of end-of-life management which producers paid was not directly linked to individual producers' product design. As such differentiated fees different producers should pay based on the sustainability product design within collectively managed organisations has proved difficult, despite efforts such as eco-modulation initiatives. Following the underwhelming outcomes of eco-design adjustments prompted by EPR in intricate waste streams, the introduction of the eco-modulation concept within the Waste Framework Directive aims to instigate an economic incentive for design change. However, its successful implementation proves to be challenging amidst varying stakeholder interests and regulatory complexities.

[1] *EPR organisations and their strategic role https://erion.it/en/studies-and-proposals/i-sistemi-di-responsabilita-estesa-del-produttore-e-il-loro-ruolo-strategico/*

Nonetheless, despite limitations in EPR's impact on product design, packaging stands out as a relatively successful area where EPR has stimulated design changes, for instance in dematerialisation, reduction of plastic types, thickness, and hazardous substances. By contrast, achieving the same for more complex products has been more challenging especially after the introduction period of EPR laws due to increasing design complications.

While progress has been made in waste collection across industries, achieving substantial design alterations remains a challenge, especially without adequate incentives or differentiated fees tied to design improvements. The current eco-modulation approach, which often involves low fee adjustments, lacks the necessary incentive for significant design changes. Thus, there's a need for more effective strategies to incentivise producers to invest in sustainable product design within the framework of EPR.

> *"You're modulating often a rather low fee, [which is] a small part of a price of product, so is that often a big enough incentive? I doubt it to be honest often those modulations don't even have anything to do with what the Producer Responsibility Organization (PRO) is doing (..)".*
>
> *Thomas Lindhqvist*

The future of EPR

The future of EPR must see a shift towards better utilisation of collected materials, addressing the downgrade and downcycling of recycled materials. Emphasis is placed on improving the quality of recycling, particularly for CRMs, aligning with the evolving supply chain dynamics. **EPR is transitioning from a waste prevention tool to a broader instrument for supply chain management and resource optimisation**. Key stakeholders supporting this transition include large companies recognising the value, and EU policymakers aiming to position Europe as a manufacturing hub wherein securing high quality materials through adequate recycling is fundamental given resource scarcity. Policies are being developed to establish standards for evaluating recycling achievements, with differentiated outcomes based on performance levels.

Moreover, there is a growing focus on reuse and repair alongside recycling, signifying a shift towards a more comprehensive circular economy approach.

"There could be much more to do in the reuse and repair areas, especially if the PROs and EPR want to be relevant for the circular economy, they cannot continue just for recycling, if we want to reduce the material input, we cannot avoid the other steps.".

Naoko Tojo

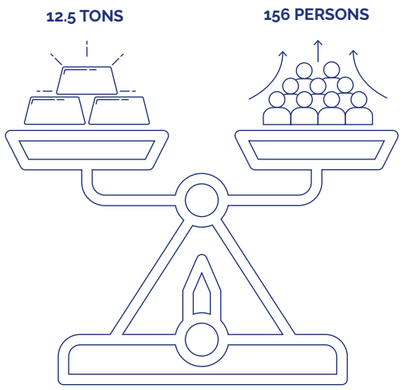
Finally, there is a recognition of the need for cooperation among stakeholders, balancing competition with collaboration to drive efficiency and innovation and promote a truly circular economy. Policymakers are urged to incentivise repair and refurbishment sectors to further promote circularity, with consumer engagement also playing a crucial role in shaping future sustainability efforts.

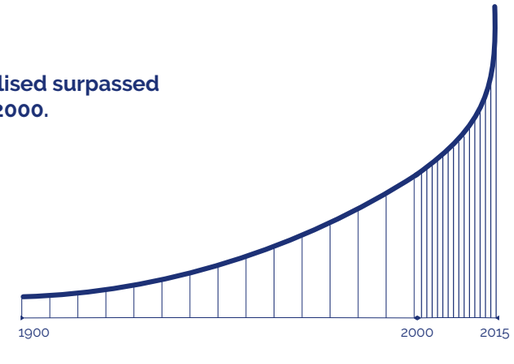
02. Review of EPR in the EU and its role in advancing the EU's Green Deal objectives

Growth in material consumption and resource scarcity

In the past century, due to extensive industrialisation and rapid economic expansion, there has been a significant increase in material extraction and utilisation globally.

Between 2000 and 2015, the total amount of materials utilised surpassed more than half of what was extracted between 1900 and 2000.





Global average per capita consumption of resources stands at roughly 12.5 tons per year according to the World Bank[2]. It is projected that by 2050, the global demand for virgin materials will double, if not more, indicating a continued upward trend in material consumption.

CRMs in particular stand out for the increased pressure on their usage, due the crucial role they play in the clean energy transition and the EU's abilities to meet its objectives for climate-neutrality by 2050. Further securing access to CRMs is essential to maintain EU citizen's high-tech lifestyle and secure the competitiveness of European firms.

This heightened need for CRMs has led to increased exploration activities and investments in mining and recycling infrastructure. The International Energy Agency (IEA) found that[3] investment in critical mineral mining rose by 30% in 2022, with demand for CRMs causing the market size of energy transition minerals to reach 320 billion USD in 2022, moving these minerals into the core part of the mining industry. In particular, the following key CRMs reached prominent highs in 2022:

[2] https://documents1.worldbank.org/curated/en/099425006222229520/pdf/P174596025fa8105a091c50fb22f0596fd1.pdf

[3] https://www.iea.org/reports/critical-minerals-market-review-2023

In the IEA's Net Zero Emissions by 2050 Scenario it is envisioned that by 2030, CRM demand will grow by 3.5 times, at over 30 million tonnes. This is to be mainly driven by EVs and battery storage demand however also by low-emissions power generation and electricity network, with the IEA finding that:

- Electric car sales saw a 60% increase in 2022 compared to 2021;
- Energy storage systems' capacity additions doubled in 2022 compared to 2021.

Additionally, the battery industry is experiencing significant transformations with the introduction of new technological alternatives. In 2022, global demand for batteries in clean energy applications surged by two-thirds, with energy storage constituting a larger portion of this demand. Those trends thereby **intensify the strain on critical mineral supply chains**.

Many companies are now directly investing in the CRM value chain, for instance, General Motors' investment of USD 650 million in Lithium Americas and Tesla's proposal to construct a new lithium refinery in the United States are indicative of this trend. According to the IEA, the top 10 EV makers accounted for around 70% market share in 2022 for strategic investment into the raw material supply chain, with investments centring around mining, refining and long-term offtake.

While mining exploration has been one of the increased activities for CRM security, **a blend of unpredictable price fluctuations, obstacles in the supply chain, and geopolitical tensions has introduced a complex set of challenges for ensuring supply of CRMs** and thus achieving the required energy transitions.

Circularity limitations

Considering uncertainties regarding securing CRMs, diverse policy measures have been initiated across different regions to strengthen the stability and availability of CRMs. In the EU's Critical Raw Materials (CRM) Act[4], the Commission proposes actions to make Europe less dependent on third countries, by diversifying supply from both primary and secondary sources of CRMs, while improving resource efficiency and circularity.

Part of this shift towards diversification of resources focuses on their circularity through recycling with the Act **requires 25% of annual consumption to be from recycled sources by 2030**, in line with the broader goals of the EU's Circular Economy Action Plan.

However significant limitations to circularity of the EU's materials prevail. Low collection rates, recycling efficiency and quality of materials remain a persisting issue. In the sector of Electrical and Electronical Equipment (EEE), different research projects found significant barriers to the recovery of CRMs including:

- lack of market drivers (and, therefore, lack of economic viability of CRM recycling);
- lack of information on where CRMs can be found;
- high volumes treated by the informal sector focused on common metals;
- absence of recycling and recovery technology in the case of some specific CRMs.

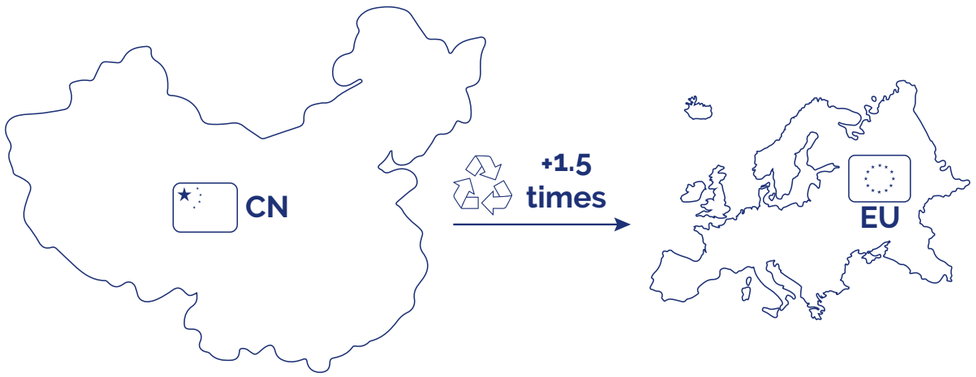
Furthermore, current EU regulations fail to play a facilitating role in the regulated market for CRM recovery, as proven by the fact that on average only 50% of the WEEE is collected and treated in the EU, while the target in the WEEE Directive since 2019 is set at 65%, is an indication that the policy circle is not functioning well.

In the case of batteries, while strides are expected to be brought with the EU's new Batteries Regulations, recycling limitations remain for the sector. China currently holds most of the recycling capacity, although there are ongoing developments of new facilities in Europe and the United States. The recycling capacity in China, estimated at around 230 kt per year, surpasses that of Europe by 1.5 times. Currently, most batteries undergoing recycling originate from consumer electronics and manufacturing waste. The recycling landscape is anticipated to undergo a significant transformation as approximately 150 GWh of used electric vehicle (EV) batteries are projected to reach the end of their initial lifespan by 2030.

[4] https://ec.europa.eu/commission/presscorner/detail/en/ip_23_1661.

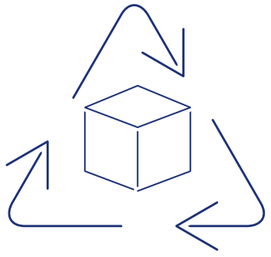
More broadly, the World Bank finds that innovative circular economy business models remain limited in scale and adoption, with average market penetration standing at currently only 5-10%; recycled materials currently represent only 8.6% of raw material input, and the share of remanufacturing products compared to new manufacturing is just 1.9%[5].

Ultimately, despite circular economy efforts**, more than 87% of resource consumption in the EU still relies on primary materials, and overall waste generation in the EU continues to rise**[6].

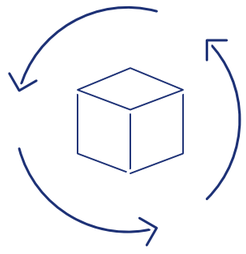


The World Bank highlights that "Business-as-usual (BAU) policies will not suffice to achieve significant reductions in primary material use, which is expected to grow 2.5 times by 2050 compared to 2000 - even as European economies become increasingly services based."

Recycling 8.6%



Remanufacturing 1.9%



Encouraging brands to incorporate recycled materials into their new products is needed to help close the material loop and reduce reliance on virgin resources. Embracing innovative business models, such as product-as-a-service, may also transform consumer behaviour and shift the economic focus from ownership to usage, further promoting sustainability in the evolving market landscape.

Finally there is a need for awareness of consumers through targeted education and engagement campaigns to enhance public participation in recycling initiatives and support for sustainable products, as well as knowledge on environmental impact of improper disposal of products (e.g. littering of cigarette filters). Circular business models and circularity principles alone cannot deliver the impact needed without the fundamental role of citizens and consumers.

[5] *https://www.worldbank.org/en/news/press-release/2022/12/06/world-bank-releases-its-first-report-on-the-circular-economy-says-decoupling-growth-from-resource-use-in-europe-achievab*
[6] *https://www.worldbank.org/en/news/press-release/2022/12/06/world-bank-releases-its-first-report-on-the-circular-economy-says-decoupling-growth-from-resource-use-in-europe-achievab*

Vision of EPR to tackle these challenges

While the existing EPR policies have made significant strides in the realm of waste management and recycling, there remains untapped potential to address material scarcity and drive sustainability comprehensively. It is crucial to re-think the role of EPR within the EU, particularly in response to the urgent demands for CRMs and the imperative to decarbonise the economy.

Key role of sustainable production and linkage with EPR policy

Central to advancing the circularity agenda is the integration of Eco-design for Sustainable Products Regulation (ESPR)[7] with EPR policies. The proposed ESPR framework offers a foundational basis to set eco-design requirements for a wide array of product categories, aiming to improve circularity, energy performance, and environmental sustainability. Establishing a robust linkage between eco-design principles and EPR policy frameworks can more holistically facilitate producers to adopt circular design strategies, minimising the environmental footprint of products throughout their lifecycle and eventually overcoming some of the limitations of current EPR policies and organizational implementations that were pointed out in the first chapter. Collaboration between policymakers, industry stakeholders, consumers and EPR schemes is needed to ensure the effective implementation of eco-design measures and maximise their impact on circularity goals. As the EU navigates the transition towards a circular economy, the harmonisation of EPR and eco-design represents a critical pathway to enhance resource efficiency, reduce waste generation and secure the availability of secondary materials and CRMs.

Through an examination of diverse case studies and insights gathered from experts working in EPR schemes as well as manufacturers and associations advancing circularity initiatives, this report explores the present landscape of EPR initiatives and envision a trajectory forward. By reviewing the achievements and constraints of current policies, our objective is to identify opportunities for EPR to overcome its traditional purpose as a mere waste management tool and emerge as a facilitator of circularity within the EU framework.

[7] *https://commission.europa.eu/energy-climate-change-environment/standards-tools-and-labels/products-labelling-rules-and-requirements/sustainable-products/ecodesign-sustainable-products-regulation_en.*

03. Review of EPR schemes case studies – discussing challenges and opportunities

In our process of assessing the journey of EPR so far and envisioning its future, Erion chose to review six different EPR systems within the EU:

packaging and tobacco product waste through Electrão's PRO in Portugal, **waste batteries** through Eucobat's broad vision and WEEE Ireland's work, **household and professional WEEE** in the UK through Repic, textiles waste through FESI, the Federation of the European Sporting Goods industry and finally **end-of-life vehicles (ELV)** management through Volkswagen Group's circular economy initiatives.

A. Pioneering EPR solutions across multiple waste streams in Portugal: Electrão

Electrão is the largest Portuguese PRO for EEE (household and professional), packaging, batteries, and accumulators, and is currently in the midst of setting up its EPR solution for cigarette filters in collaboration major tobacco producers, given the Single-Use Plastics Directives associated requirements for this waste stream. Established in April 2005 under the WEEE Directive, Electrão organises the treatment and recycling from authorised collection points, on behalf of its producer members.

Key insights from Electrão's journey so far

- **Diversification of producer's base**: a notable success for Electrão has been its ability to attract a wider array of producers by offering an integrated compliance packages covering various waste streams including packaging, batteries, and electronics. Electrão noticed a notable uptake in companies joining the PRO thanks to the convenience of having a "one stop shop" related to multiple compliance requirements, with the decision to start offering packaging EPR compliance service causing multiple producers to also sign up to Electrão's compliance services for WEEE and batteries.
- **Operational and economic synergies and efficiencies**: managing multiple waste streams has also resulted in a series of operational efficiencies with regards to facilitating more robust collaboration with municipalities, retailers, and recyclers, and finding new opportunities across the waste streams they cover. A critical pillar for preparing their EPR solution for tobacco product waste has been the task of calculating the costs of clean-up activities associated to the littering of cigarette filters. Amongst several activities conducted to determine such costs, Electrão assessed the waste compositions within street bins as well as waste from street cleaning, to identify the share of weight of cigarette filters within this waste, and then discern the respective associated costs of waste management of these filters.

During this exercise, Electrão found that approximately 50% of content within undifferentiated public waste bins was household primary packaging of high quality such as PET and glass bottles. As a result, Electrão decided to run a pilot sorting trial in partnership with the Lisbon municipality and a waste management operator for sorting and rerouting this specific waste stream to avoid commingling this high-quality packaging with other household waste.

- **Communication and awareness campaigns for tobacco waste**: Electrão has founded the single use plastic PRO named UNICO, in conjunction with tobacco producers in Portugal (PMI, JTI, BTA, Imperial and Landwick), and, whilst still awaiting the operation permit, it has already started to implement communication and awareness campaigns. These campaigns are presently mandated by law and once the permit has been awarded UNICO will have to spend approximately 7% of the PRO turnover on a yearly basis in communication and awareness initiatives. With the support of the communication team at Electrão and with the participation of all the partners tobacco producers, a joint communication and awareness campaign was launched with digital and street activation in selected busy city spots, conveying the message of the need to correctly discard cigarette butts and which included the distribution of ashtrays. Another previous campaign beach also targeted beach spots.
- **Local complexities**: challenges in Portugal persist regarding conflicting jurisdictional responsibilities between producers and municipalities resulting in bureaucratic obstacles and inefficiencies in waste collection, particularly concerning overlapping duties in managing various waste streams.

Vision for the future of EPR and ongoing challenges

- **Commingling of waste streams and need for more holistic vision**: despite the importance of selective collection and the superior waste treatment it offers, communal separate collection remains the primary source of waste directed towards sorting, shredding and incineration plants resulting in recycling opportunities (such as for CRMs) being lost in the process. As such, Electrão underlines that EPR financial resources should not be solely allocated to the improvement of selective collection and recycling of different waste streams, but also directed towards improving processing of commingled/ mixed waste streams which will remain a significant waste source and which often contain the individual waste streams that are in theory supposed to be collected separately. Failing to do so neglects its substantial recycling potential and the possibility to process material hazards and divert these from landfills.
- **Role of PROs in the recycled materials**: for certain waste streams where applicable, PROs could set standards and oversee recycling processes to maintain integrity. Further, Electrão proposes a model in which PROs retain ownership of waste and recycled materials, **with the treatment operations performed by external contracted operators**, serving to **secure the demand of recycled materials** from the manufacturers. Recyclers may be receptive to this idea as Electrão explains that they currently face the challenge of volatile raw material prices, making it difficult to market recycled materials.
- **Consumer engagement**: engagement of consumers is essential for promoting responsible waste disposal practices, including initiatives against littering of tobacco product waste. Incentives tailored to specific products are crucial to engage consumers effectively, as evidenced by the success of **deposit return systems** for certain packaging in increasing collection rates. However, implementing similar systems for other streams such as electronics, batteries and textiles is **challenging due to the extended lifespan of these products**.
- **Awareness-raising in pollution hotspots:** Electrão suggests that PROs could **play a role in preventing waste from entering the ocean in littering hotspots**, incentivando such as harbours and marinas by emphasising awareness in these areas to help prevent waste from polluting the ocean. PROs could have a substantial impact in this regard due to their financial and operational flexibility compared to municipalities.
- **Legislative reforms**: Electrão suggests that legislative reforms are crucial to driving sustainable practices, focusing on measures like **mandatory incorporation of recycled materials** in production and **encourage waste prevention and reuse initiatives. Streamlining legislative frameworks**, particularly through regulations like the Batteries Regulation, can enhance regulatory clarity and facilitate effective implementation at national and European level.
- **Exploration of innovative solutions for packaging**: in the packaging sector, with the expected EU Packaging and Packaging Waste Regulation[8] requiring all packaging be recyclable by 2030 and introducing stringent reuse and reduction targets, PROs can be poised to play an active role in maximising new opportunities for innovative solutions regarding achieving recyclability, Plastics Pact targets, and consumer engagement.

[8] *https://environment.ec.europa.eu/publications/proposal-packaging-and-packaging-waste_en.*

B. Navigating the evolution of batteries EPR: insights from EUCOBAT and WEEE Ireland

EUCOBAT functions as the European association of national collection schemes managing battery collection programs in the EU. The interview conducted sheds light on the forthcoming developments in EPR concerning batteries, highlighting EUCOBAT's role as a collaboration facilitator allowing coordination among PROs to amplify advocacy efforts and adapt more effectively to regulatory changes.

WEEE Ireland is a not-for-profit organisation, operational since 2005, supporting producers of household and dual use (B2C) EEE and all types of batteries – portable, industrial, and automotive. With over 1,300 members, it represents 96% of the Irish battery industry and 74% of the household electrical and electronic industry.

Key Points and Discussions on the evolution of EPR for batteries

- **Success driven by a strong battery collection framework**: Eucobat attributed success factors of those of its members that have reached high collection rates to the implementation of strong collection frameworks made possible due to robust financial support, effective communication strategies and a well-established collection network. Further, WEEE Ireland highlights the importance of **stakeholder collaboration with its strong collection network and retailer participation**, in waste management, with approximately 60% of waste returned coming from retailers (as of 2022, more than 8.000 retailers were registered with WEEE Ireland). Strong collaboration with local authorities ensures a comprehensive take-back program, minimising leakage in waste streams.

- **Regulatory strength and industry collaboration**: the nature of Ireland's regulatory framework enables quicker implementation of changes, supported by strong collaboration with industry networks such as the national repair and reuse network, which bolsters the ability to scale circularity and repair efforts, leveraging on existing producer networks for reuse operations. Challenges still require more engagement with industry to **scale up reuse and repair options**.

- **Synergies by covering both WEEE and batteries as a scheme**: WEEE Ireland's treatment process for small WEEE allows them to recover substantial portion of batteries (14% of batteries collected by WEEE Ireland in 2022 came from WEEE, with 202 tonnes of this coming from small WEEE), with their small WEEE processing facility in Ireland being instrumental in this endeavour.

- **Challenges in battery recycling**: Eucobat highlights that challenges include material visibility, calculation methodologies, and market dynamics influencing recycling efforts. Ensuring accurate reporting and preventing misclassification of materials are key concerns. The shift from recycling efficiency responsibility with the new Batteries Regulation from producers to recyclers is embraced as a positive one.

- **EV sector presents unique challenges**: while significant funding has been allocated for building recycling facilities alongside EV factories, Eucobat highlights that concerns persist about recycling batteries that could still be reused or repurposed. Moreover, there's a discrepancy in how recycling efficiency is measured, particularly regarding material recovery from batteries recycled outside of Europe with some European recyclers pushing for exclusive recognition of materials recycled within Europe. Overall, there's a need for greater collaboration between PROs and recyclers, with a focus on improving recycling efficiency and material recovery processes.

- The **batteries regulation** is welcomed by both Eucobat and WEEE Ireland for its potential to serve as example for other waste streams (albeit tailored to specificities of each sector) offering a holistic, detailed, harmonised, and crosscutting framework that boosts batteries' circularity with a full life-cycle vision, from the design phase to end-of-life.

Vision for the future of EPR for batteries

- **Batteries collection**: extensive consumer communication programs to encourage battery return are critical for achieving collection targets, as cited by WEEE Ireland. Further, ensuring the availability of a wide and encompassing collection network with secure and safe collection, transport, and storage of waste batteries must accompany awareness-raising to facilitate proper disposal of batteries.

- **Competition challenges**: competition between PROs leading to what WEEE Ireland labels a **"race to the bottom"**, with PROs rushing to offer the lowest price to attract members, to the detriment of investment in higher quality treatment of waste. WEEE Ireland suggests that **not-for-profit models should be the standard for PROs**, to address competition issues and ensure prioritisation of quality treatment and collection initiatives.

- **Future trends in battery reuse**: Eucobat anticipates that a prominent advancement in coming years shall be the increased push for battery reuse, particularly for the increasing markets of EV and light means of transport (LMT) sectors. Emphasising that recycling should not be the only destination of batteries with the objective going forward shifting towards extending battery lifespan through second-life applications. Repurposing in these sectors will be critical, with storage solutions offering extension of battery life.

- **The main challenges in CRM recovery** include ensuring visibility of the total waste batteries chain and adopting appropriate calculation methodologies regarding collection rates as the **calculation process should reflect the availability of batteries in the market**: which is particularly relevant given the likelihood that in the near future batteries containing CRMs may not reach recycling stage if repurposed and reused. Moreover, potential disappearance of valuable materials like lithium before collection due to repurposing practices must also be considered. **A key part of addressing this lies in the prioritisation of quality treatment**, emphasis on quality over quantity targets (alongside investments in higher quality treatment methods) for waste. Even beyond strictly CRM recovery, quality treatment must be a central priority. WEEE Ireland explains that while in the case of Ireland a battery treatment plant is not feasible due to insufficient economic volume, **the PRO focuses on investing in quality and health and safety measures**, ensuring through dedicated strategies for battery management, sorting and preparation for safety prior to shipment and overall handling. WEEE Ireland's model emphasises the importance of **safe transport** to facilitate the subsequent operations, including preparation for reuse, ensuring appliances are palletised and shrink-wrapped.

- **Future of PROs' role**: the decision of whether a PRO should take a more proactive approach beyond merely meeting minimum requirements often hinges on PROs' and its members' preferences. However, given the emphasis on sustainability and resource conservation, Eucobat expresses that there is a growing recognition of the need for a comprehensive approach that addresses the entire product lifecycle.

- Further expanding on this, regarding **whether PROs should retain ownership of recovered materials** or if it this should lie with producers, Eucobat highlights that a notable issue is the **distinctions among materials recovered, particularly with batteries, due to brand differences**. When reintegrating recycled materials into products, there may be a preference from producers for specific recycled materials derived from their own products rather than a mixture of various recycled materials with differing chemistries. This preference from certain producers and manufacturers to obtain their own recycled content from their own black mass, would require efforts and innovation related to the activity of segregation of waste collected.

C. Insights into EPR evolution for WEEE in UK: REPIC's journey and the road ahead

REPIC (Recycling Electrical Producers Industry Consortium) is a not-for-profit PRO founded in 2004, and currently offering EPR compliance solutions for Waste Electrical and Electronic Equipment (WEEE), Portable Batteries and Packaging.

Brief background on the UK's regulatory context. In the UK context, in late December 2023, the UK Government launched a review of the regulatory framework for the EPR system[9] for the UK's **2013 Waste Electrical and Electronic Equipment Regulations**. Policy proposals outlined by the government included goals to increase collections of WEEE from households, increase retailers' collection infrastructure, introduce new producer obligations for online marketplaces and fulfilment houses, and for a system governance – with creation of a WEEE scheme administrator and performance indicators.

Key insights from REPIC's journey so far

- **Competition amongst compliance schemes**: the UK's WEEE system, which has 26 EPR compliance schemes (all of which are for profit except REPIC and Recolight), has a persistent challenge of competition within the compliance market. REPIC highlights that market competition has often led to profit making dominating WEEE management. Historically, it has been possible for PROs to operate without physically collecting WEEE. To counter this phenomenon REPIC, in collaboration with producers, has spearheaded policy advocacy efforts over the years that have aided in some progress in WEEE collection and treatment.
- **Stakeholder collaboration**: the UK system prioritises stakeholder collaboration to improve the system's overall effectiveness, with active involvement from producers, retailers, and treatment operators.
- **Targets and compliance fee system**: REPIC underlines the benefit from the UK's shift away from the rigid 65% collection targets present in the EU. Instead, the UK operate under a target system that allows for alternative compliance methods if targets cannot be met, namely the option to pay a compliance fee, intended to mirror the costs avoided through alternative means of compliance to support beneficial activities. However, REPIC points out that doubts arise regarding the effectiveness and use/destination of compliance fees collected. Targets are also based on what was collected in previous years and are focused on specific categories of WEEE where there is a need to increase the collection.

Vision for the future of EPR and ongoing challenges

- **Lack of allocation system of the collection points in the UK**: the UK's WEEE system operates on a market share basis, determining obligations by product weight Put on the Market (POM). However, this approach may not sufficiently incentivise circular practices considering the absence of a coordinated allocation system of the collection points around the Country, leading to competition among compliance schemes and suboptimal collection methods.
- **Lack of information on CRMs in the UK:** insufficient information on CRMs in the UK poses challenges for developing effective recovery strategies, emphasising the importance of understanding CRM availability. REPIC, together with Erion, is currently involved in the FutuRaM research project which is seeking to identify stocks and flows of CRMs. Uncertainties remain in relation to the UK's own strategy to CRM recovery and how this will relate to developments in the EU's CRM Act.
- **Promoting reuse practices and standards around reuse & refurbishment**: the current WEEE system's limitations in encouraging reuse, including items deposited at municipalities often being non-functional, underscores the need for improved collection mechanisms and obligations to enhance opportunities for reuse. Better regulation is necessary to **ensure safety and quality standards in reuse and refurbishment activities**, preventing substandard practices that undermine WEEE management efforts.
- **Lack of consumer engagement**: despite proposed initiatives in the UK like doorstep collections, concerns persist regarding their cost-effectiveness and consumer adoption rates, highlighting the need to foster a culture of consumer awareness.

[9] *https://www.legislation.gov.uk/uksi/2013/3113/contents/made.*

D. The rising challenges in textile sector: the viewpoints from the Federation of the European Sporting Goods Industry

Through its 2022 "**Strategy for Sustainable and Circular Textiles"**[10], the European Commission plans to introduce measures for textiles on design, labelling, reuse and EPR, requiring Member States by 1 January 2025 to guarantee the separate collection of textiles for reuse, preparation for reuse and recycling. The legislative developments impacting the sector, such as the revision of the Waste Framework Directive and the ESPR, necessitate an exploration of how the future of EPR for textiles should evolve.

For this, this case study explores the viewpoints from the Federation of the European Sporting Goods Industry (FESI), who represents the interests of 1.800 sporting goods manufacturers (85% of the European market) through its National Sporting Goods Industry Federations and its directly affiliated member companies. Located in Brussels, FESI supports sporting goods companies to leverage their expertise into one steady and coherent voice in Brussels in relation to EU policy developments.

Key insights regarding textiles EPR development

- **Regulatory developments and harmonisation**: various regulatory developments in the EU, including traceability, transparency, and eco-modulation fees, are overwhelming for producers. While the ESPR, Waste Framework Directive and Waste Shipments Regulation, all individually make sense, harmonisation is essential for effective implementation. Furthermore, fragmented initiatives in individual Member States (e.g. France and the Netherlands) add to the complexity. Many proposals developed in silos have contradictory objectives, alongside conflicting scopes for instance, certain chemical restrictions introduced through REACH, while attempting to promote health and safety goals, can lead to the use of alternative chemicals that negatively impact mechanical recycling of textiles.
- **Trade-offs in eco-design and challenges in textiles recycling**: challenging design choices exist due to trade-offs between ensuring product durability or functionality, and prioritising recycled content or recyclability (e.g. synthetic fibres tend to be more durable for products). There are also limits to how much recycled content can be integrated without compromising future recyclability, for instance. Further, recyclers urge mono-material designs for better recyclability, but industry trends focus more on performance and functionality. High-tech fabrics containing materials like copper pose challenges for recycling due to complexity. Thus, there is a need for prioritisation of goals to avoid conflicts within product design choices.
- **Unfair competition and lack of traceability with free riders:** given the high percentage of external 'free rider' products entering the EU market which often do not comply with the EU requirements (e.g. chemicals restrictions), the overall quality of recycled materials in the continent may be negatively impacted. This in turn may **pur reluctance from brands to use recycled content** due to potential legacy and hazardous chemicals coming from manufacturers outside of the EU.

[10] *https://environment.ec.europa.eu/strategy/textiles-strategy_en.*

Vision for the future

- **PRO network across the EU driving future requirements**: the setting up of PROs in all MS with clear roles in terms of preparation for recycling, sorting, separating electronic parts from textiles and supporting in tools such as the DPP, will be one of the most fundamental factors for the implementation of EPR in the textiles sector. Once set up robustly, PROs should be responsible for collecting fees from members and reinvesting them into research and innovation to boost recycling capabilities. Future progress stemming from innovation developments should then dictate policy updates, to tailor legislation to progress made, rather than setting everything in stone from the outset.
- **Consumer Engagement**: clear disposal instructions and convenient collection infrastructure for consumers are vital. Digital communication formatting (rather than relying uniquely on physical labelling) such as through the DPP are critical tools for ensuring consumer action.
- **Regulatory harmonisation**: conflicts between regulations such as chemicals/health and safety restrictions and sustainability goals need resolution. Clearly defined goals and scope of textiles EPR legislation is fundamental.
- **Repairability**: efforts to boost repairability of products should centre on information related requirements (i.e. instructions by producers to enable repair activities to be undertaken for their products), at least initially, with spare parts provision being more challenging due to plethora of design variations and parts within textiles products.

E. The nexus between automotive and batteries: the new mobility challenge for Volkswagen

The future of ELV EPR policy development

The European Commission has initiated a journey to establish a circular economy for materials in End-of-Life Vehicles (ELVs) proposing a new regulation, replaces two existing directives Directive 2000/53/EC[11] on end-of-life vehicles and Directive 2005/64/EC[12]), with the aim of ensuring sustainable management of ELVs and of maximizing the reuse or recycling of most ELV parts and materials. The proposed new rules cover all aspects of a vehicle from its design and placement on the market until its final treatment at the end-of-life; including improvement of removability of materials, parts and components, minimum recycled content targets (25%) for plastics, and increase in the quality of materials recovered, including CRMs.

Policymakers aim to shift the design, production, and treatment of ELVs, with a primary focus on optimising the recovery and recycling of critical raw materials crucial for zero-emission vehicle manufacturing. Moreover, with over six million vehicles reaching the end of their life annually in Europe, the initiative is expected to generate 1.8 billion euros in net revenue by 2035 and create approximately 22,000 jobs in the waste management and recycling sector. Further, the transition to a circular economy for ELVs is forecasted to lead to an annual reduction of 12.3 million tonnes of CO_2 emissions by 2035[13].

Insights from Volkswagen's journey on ELV circularity as learnings for ELV EPR

Considering the substantial developments of ELV circularity related policies, the interview with Volkswagen Group Italia (VGI), a leading company in the sector, explores the organisation's progress towards achieving circularity in its electric mobility sector. VGI aims for electric mobility to be the primary driver of its passenger cars, with a target of 80% EV sales in Europe by 2030 and plans to launch by 2030 up to 70 all-electric models. As such, with VGI's ICE (internal combustion engine) process of recycling now substantially well-defined, VGI's current efforts centring on achieving the circularity of its electric mobility sector, with a strong focus on the topic of **batteries**.

- **Battery production and recycling**: VGI is planning to consolidate its battery platforms to optimise economies of scale and reduce costs: giga-factories are in contraction in Germany and Spain to produce their own cells. By 2030, VGI aims for 80% of their cars globally to utilise solely one type of battery cell, enhancing cost efficiency and streamlining recycling processes. VGI acknowledges the importance of recycling and plans to integrate recycling modules into their gigafactories, aiming to recycle a portion of the batteries they put on the market, as well as partnering with other recycling plants across Europe.
- **Supply chain control and recycling plant consideration**: VGI expresses interest in having their own recycling plant, to have control of their supply chain from production to end-of-life recycling. This would enable VGI to manage the chemistry of their batteries, potentially leading to more efficient recycling processes. VGI is also exploring innovative recycling procedures related to lithium recycling, such as with hydro technical processes.
- **VGI hopes to reduce the cost of recycled materials** compared to raw materials sourced from mining sectors, making them a more economical and sustainable choice. Ultimately the overall approach is to aim towards attaining control of recycling operations as well as retaining ownership of the materials.

Vision for the future

- **VGI envisions establishing recycling plants in key European countries** with significant automotive markets like Italy, France, Germany, and the UK. While these local recyclers may not manage 100% of batteries, some will be used to feed VGI own recycling plants, agreements will be established to secure black mass for new batteries. This strategic move aims to minimise logistical complexities associated with transporting battery materials, such as model cells and black mass, across borders. By localising recycling operations, VGI seeks to streamline supply chain processes and reduce costs incurred from inter-country movements.
- **VGI advocates for the formulation of regulations and standards to facilitate the use of recycled materials in battery production**. These rules would not only specify the percentage of recycled materials required but also address pricing dynamics. VGI emphasises the importance of competitive pricing for recycled raw materials to incentivise their use in battery manufacturing. Lowering the cost of recycled materials is seen as crucial for reducing overall battery prices, thus enhancing affordability for consumers.
- **In the context of financial considerations**, VGI highlights the significance of profit margins for automotive companies, especially in evolving market conditions. By focusing on reducing the costs associated to Critical Raw Materials, VGI aims to deliver cost-effective battery solutions to consumers, ultimately driving market adoption of electromobility.
- **PROs' role as solution facilitators**: Given the significant recycling challenges present in this sector, facilitation of innovative solutions is crucial. It is here where PROs can play a key role in supporting battery recycling initiatives by facilitating collaboration between producers, recyclers, and regulators. Further, helping secure access to black mass for producers will also be a potential route, given PROs aptitude facilitating these materials to their members from waste management activities conducted.

[11] *chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX%3A02000L0053-20180704.*
[12] *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=celex%3A32005L0064.*
[13] *https://www.innovationnewsnetwork.com/new-eu-end-of-life-vehicles-policy-creates-a-circular-economy-for-ev-materials/34830/.*

04. Future of EPR: Vision for 2050, and steps for adapting to future challenges and opportunities

Vision for the future

Both as its role as a PRO, and relating more broadly to EPR across the EU, Erion envisions the following key characteristics for the trajectory towards 2050:

- **EU-focused approach** to EPR is crucial to ensure a holistic perspective across the continent, particularly concerning treatment efficiency and material proximity to production sites. There should be a single market for recovery and high-tech treatment of materials to supply industry needs, beyond national borders. **#EEE #batteries #packaging #textiles #ELV**
- **PROs to go beyond compliance to play an active role** in finding and fostering collaboration and innovative solutions via consumer engagement, sustainable production, correct disposal, and, where applicable, material recovery, recycling, and reuse/repair promotion that bolster circular economy. **#allstreams**
- **Fair and reasonable targets** aligned with changing industry dynamics. In particular, targets should be adjusted to reflect true waste available for collection, for instance, given the evolving landscape of battery chemistries and the potential impact on waste collection targets of the phase-out of non-rechargeable batteries. Furthermore, it is critical to balance sustainability goals, that may be competing, such as durability versus recycled content and recyclability, underscoring the need for an approach that accommodates both sustainability as well practical functionality and safety in consumer products. **#EEE #batteries #packaging #textiles #ELV**
- **Create feedback loop for producers** to optimise the lifecycle of different products, including, for sectors in which applicable, product design changes to facilitate recycling or stability of, for instance, batteries chemistries to enhance recyclability. In the packaging sector, with the long awaited EU Packaging and Packaging Waste Regulation requiring all packaging be recyclable by 2030 and introducing stringent reuse and reduction targets, there is the potential for PROs develop tools – such as those existing in France and UK – to support members to analyse data across their supply chains regarding recyclability, carbon impact, Plastics Pact targets, costs and supplier performance. In this manner, PROs can eventually facilitate the exploration of innovative solutions through a holistic approach beyond recycling and material recovery. **#EEE #batteries #packaging #textiles #ELV**
- **PROs should offer comprehensive compliance services across different product sectors**: as learned with the case studies, a strategy of providing compliance services across diverse waste streams broadens PROs' customer base and gives light to synergistic and efficient operational and economic models. **#EEE #batteries #packaging #textiles #ELV #tobacco**

Given the evolving landscape of sustainability and EPR's corresponding importance, PROs, if willing, are poised to play a pivotal role in the transition, moving to a more strategic approach for producers, to become custodians of valuable resources within the environmental sustainability framework:

- **Strategic resource management**: PROs can strategically manage and optimise resources recovered through EPR programs, maximising the recovery of CRMs and high-quality recycled materials. This in the long term might also consider options or models where PROs may retain ownership of recycled materials. This approach may not suit all producers, wherein tailored strategies are necessary for each PRO to accommodate varying producer preferences and industry dynamic. **#EEE #batteries #textiles #ELV**
- **Facilitators of collaboration and innovation within the environmental sustainability,** helping catalyse the development of innovative communication practices to consumers and recycling technologies. **#EEE #batteries #packaging #textiles #ELV #tobacco**
- **Promotion of reuse and repair** – extending PRO's focus beyond recycling to embrace other facets of the circular economy. **#EEE #batteries #packaging #textiles #ELV**
- **Awareness-raising to consumers** about the sensibilisation against littering, the availability of collection points for various waste streams and, for sectors in which applicable, actively promoting reuse and repair alternatives. Raising awareness in pollution hotspots is particularly common, and PROs may be well posed to undertake this task in collaboration with local municipalities. **#EEE #batteries #packaging #textiles #ELV #tobacco**

Ultimately **PR and PROs are positioned to transition beyond traditional waste management roles, adopting a strategic and holistic approach to sustainability**. Broadening their focus to encompass the entire product lifecycle, integral for securing CRMs and aiding the EU in its ambitions toward material security and decarbonisation targets.

Actions to achieve the EPR 2050 vision

Departing from the key points Erion envisions for the future of EPR, and based on the lessons and insights outlined throughout the case studies, the following recommended actions are put forth, classified under organisational takeaways and legislative recommendations.

Organisational takeaways on best practices for EPR:

- **Wide collection networks** with dedicated outreach and collection efforts are essential to ensure comprehensive waste recovery. Ensuring full access to waste generated and accounting for all materials is crucial for achieving comprehensive waste recovery. However, where challenges arise when municipalities face limitations to meet collection targets, jeopardising overall waste recovery goals, PROs should be allowed to also complement those efforts in ensuring full access to waste generated. **#EEE #batteries #packaging #textiles #ELV**
- **Holistic waste management vision** to improve commingled waste collection and ensuring the efficient allocation of resources is needed. This includes **greater promotion of reuse and repair market uptake within legislation** to promote circular economy **beyond mere recycling** alongside promotion of standards on refurbishment and reused products, including the repurposing of batteries (extending the life span) in EV and LMT sectors. **#EEE #batteries #packaging #textiles #ELV**
- **Consumer engagement and incentivisation**: exploring different sensibilisation and incentivisation mechanisms is needed as seen in the effectiveness of deposit return systems for packaging which has shown the necessity of product-specific incentives. Products with longer life cycles (electronics, batteries, textiles), will require more tailored incentives for encouraging proper disposal practices. Consumer awareness particularly for newer EPR streams such as tobacco is fundamental. **#EEE #batteries #packaging #textiles #ELV #tobacco**
- **Collaboration with all stakeholders**, particularly producers and municipalities, fosters engagement and drives sustainability principles. **#EEE #batteries #packaging #textiles #ELV #tobacco**

Policy changes needed for an improved EPR framework

- Identification of **coherent and meaningful targets** per or activities of PROs, going beyond the collection targets based on products placed on the market but rather considering the waste available for collection and the different loops of materials and the waste hierarchy and Circular Economy priorities. **#EEE #batteries #packaging #textiles #ELV**

- **Stimulating the market for recycled materials**: sono necessari **mandatory requirements** on the incorporation of recycled content in new products. Further, there should be a shift in focus for **quality over quantity.** legislative priorities beyond merely meeting collection rate targets to investing in high-quality waste treatment processes. Developing **advanced techniques and frameworks to maintain visibility of materials (including CRMs)** throughout the product lifecycle is fundamental. **#EEE #batteries #packaging #textiles #ELV**

- **Strengthening standards and enforcement**: rigorous enforcement of collection and recycling standards to prevent material scavenging and ensure high-quality recycling. Market dynamics, especially for valuable waste streams, should not justify sub-standard treatment operations. **Streamlined administrative processes for retailers and municipalities**, to facilitate waste collection, ensuring compliance and effectiveness should also be considered as alternative to cumbersome procedures hardly enforced. **#EEE #batteries #packaging #textiles #ELV**

- **Sustainability and eco-design considerations**: Legislation should support innovation in design that prioritises not just the recyclability of components but also the sustainable production, the ease of extraction and reintegration of materials into new products. This approach demands navigating inherent trade-offs. For instance, decisions between enhancing product durability and optimising for recyclability or the integration of recycled content. Other contradictions emerge within chemicals restrictions pertaining to health and safety goals impacting recyclability for instance. As such, harmonised design requirements with a clear prioritisation of certain sustainability goals are essential to prevent counterproductive measures with conflicting objectives and to promote a truly sustainable product lifecycle. **#EEE #batteries #packaging #textiles #ELV #tobacco**

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