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REPORT

Analysis of Extended Producer Responsibility Schemes

Assessing the performance of selected schemes in European and EU countries with a focus on WEEE, waste packaging and waste batteries

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List of Abbreviations

ABE	Approved Battery Exporter
ABTO	Approved Battery Treatment Operator
ARF	Advance Recycling Fee
BAFU	Swiss Federal Office for the Environment
BW	White Goods
CEAP	Circular Economy Action Plan
CF	Fridges and Freezers
DCF	Designated Collection Facilities
EC	European Commission
EEA	European Economic Areas
EEE	Electrical and Electronic Equipment
EPR	Extended Producer Responsibility
EU	European Union
GS	Gemeinsame Stelle dualer Systeme Deutschlands
KPI	Key performance indicator
LMP	Light Bulbs
LVP	Lightweight packaging
MoE	Ministry of the Environment
MSW	Municipal Solid Waste
OTH	Other Devices
POM	Put on Market
PPW	Packaging and Packaging Waste
PRO	Producer Responsibility Organisation
RAC	Recupel Approved Collectors
SUP	Single-Use Plastic Directive
TVM	Televisions and Screens
UBA	German Environmental Protection Agency (Umweltbundesamt)
VAT	Value Added Tax
WEEE	Waste Electrical and Electronic Equipment
WFD	Waste Framework Directive
ZSVR	German Central Registry (Zentrale Stelle Verpackungsregister)

Executive Summary

First introduced in the 1990s in Germany, Sweden and France, the reputation of Extended Producer Responsibility (EPR) as a powerful tool for promoting effective waste management solutions has grown tremendously and was meanwhile adopted by an increasing number of countries. Due to differences in national legislations, however, the landscape and performance of EPR schemes remains extremely heterogeneous and vastly differs amongst European countries and EU Member States, with some EPR schemes consistently performing above average, meeting the increasingly ambitious targets set out at EU level (e.g. in terms of collection rates), and others continuing to underperform. As a result, many stakeholders have expressed their concerns about the increasing complexity of the EPR landscape, highlighting that the large discrepancies between countries can create inefficiencies and adversely affect the functioning of the EU single market.

In an effort to streamline and further harmonise the implementation of EPR across the EU, the latest revision of the Waste Framework Directive (WFD), adopted in 2018, laid out general minimum requirements as part of Article 8a (European Parliament and Council 11/22/2008). Defining, among other things, that Member States: (1) introduce specific objectives and/or targets for waste management; (2) put in place specific obligations for Producer Responsibility Organisations (PROs); (3) implement adequate monitoring and enforcement mechanisms to reduce free-riding and appoint at least one body independent of private interests to oversee the implementation for countries with multiple EPR schemes; and (4) define a minimum scope of EPR cost coverage and encourage eco-design by implementing eco-modulated fees, whilst ensuring that waste management services are delivered in a cost-effective way.

In order to effectively implement these requirements, there is an urgent need to better understand the conditions under which EPR systems can perform well and deliver best results. Based on an in-depth assessment of 6 case studies, supported by results from a literature review, expert interviews and focus group discussions, this study aims to fill this knowledge gap by analysing the performance of different EPR schemes in Europe and the EU.

The analysis demonstrates that the performance of EPR schemes for Waste Electrical and

Electronic Equipment (WEEE), waste packaging and waste batteries is strongly influenced by the countries' socio-economic contexts and national modalities for implementation. Although the difference in scope, distribution of tasks, definitions, methods, data quality, etc. does not allow for a performance comparison of EPR schemes on a one-to-one basis, the analysis resulted in a range of overarching observations on the advantages and drawbacks of different schemes as well as for EPR systems in general. To address identified shortcomings in the light of regulatory requirements for competitive EPR schemes in Europe and the EU, the study further proposes a range of recommendations for effective implementation of existing and upcoming EPR requirements. These recommendations may serve as inputs for the upcoming EPR guidelines and/or regulatory reforms, supporting the improved and harmonised implementation of EPR across the EU and other European countries.

Performance of competitive and monopolistic EPR schemes

Competition between PROs can create real leverage for innovation and efficiency increases as PROs have a strong incentive to improve the services offered to their clients. However, innovations are usually associated with either economic incentives or competitive advantages. Measures that would result in higher contributions for producers are often more difficult to promote as they entail the risk of losing clients to competitors. **Monopolistic systems, on the other hand, do not have to fear competitive disadvantages from investments** that are not linked to an immediate return and are therefore at an advantage in this respect.

To effectively support system-level innovation in a competitive environment, it is recommended to set up a coordination centre, responsible for planning, steering and implementing joint activities of PROs in areas such as consumer awareness raising, basic research (e.g. new recycling technologies) and waste collection on a broader level.

Customer satisfaction among producers tends to be higher in competitive systems, where it is usually not only the performance of the system that is decisive, but the availability of choices for the best price-service ratio. Producers often highlight that they feel "treated as customers" in

competitive systems, whereas this is typically not the case in monopolistic systems.

Competition can keep costs for waste management operations low. Driven by the PROs' strong self-interest in minimising their operating costs in competitive environments, the tendering of waste management activities implemented by multiple PROs has proven to result in prices close to the necessary cost for the services provided. The tendering of waste management services by several competing PROs also benefits the maintenance of a diverse landscape of waste management service providers. This in turn prevents a concentration of market power in a few service providers and thus eliminates the associated risk of market power abuse, while also leading to efficiency gains resulting from the competition between a comparably larger variety of waste management operators and recyclers.

Competition for the access to waste may lead to inefficiencies and higher costs as certain actors may intentionally overfulfill their obligations and speculate on selling the excess quantities at a profit to other PROs that can otherwise not meet their collection quotas. The problem is further exacerbated by a systematic "cherry-picking" of particularly high-yield and easy-to-reach collection points.

To ensure both, a level playing field between competing PROs and the efficiency of waste collection services, collection responsibilities should be coordinated and monitored via a coordinating body. Depending on the waste stream and national specificities, this may either be organised via the allocation of collection areas and/or collection points or through a non-competitive approach to joint waste collection in combination with a pre-agreed cost allocation mechanism.

As, in a monopolistic system, the costs associated with information and awareness campaigns can be more easily passed on to producers, such systems tend to make larger investments in information and awareness campaigns. This usually results in **information and awareness campaigns being larger and more far-reaching in monopolistic systems** than in competitive systems.

In order to successfully implement large-scale awareness-raising campaigns in competitive EPR systems, responsibilities to inform shall be organised and facilitated through a joint coordinating body. Besides avoiding potential competitive disadvantages through individual campaigns, this would also provide the advantage that the level of awareness and recognition of a single body among the population would be much higher than in the case of a multitude of individual efforts by several PROs. In both, competitive and monopolistic systems, it is also recommended to define measurable indicators for the effectiveness of information and awareness-raising campaigns.

Implementation of eco-modulated fees

In competitive systems, the implementation of modulated fees proves to be more challenging than in monopolistic setups, as here the products registered with the PROs do not directly correspond to the waste collected. Hence, there is a possibility that PROs catering to producers selling long-lived, repairable and eco-friendly products face financial deficits, while PROs that mainly serve producers whose products do not meet the modulation criteria could generate a surplus by charging malus prices.

For fee modulation to provide real eco-design incentives for producers and encourage waste prevention and recycling, it is essential to design the implementation mechanisms as simple as possible for both producers and authorities. It is therefore recommended to start with a very limited set of universal product categories and eco-modulation criteria that are applicable to many products. Furthermore, a harmonised and enforceable set of modulation criteria should be developed at EU level, including both, a uniform definition of recyclability, durability, repairability, re-usability, etc. and standardised reporting obligations for companies.

In competitive constellations, it is also important to ensure an appropriate offsetting mechanism that compensates for the lack of correlation between PRO-specific products/producers and collected waste. This can be achieved, for example, through a central fund fed by malus payments and used to finance joint PRO activities.

Cost-efficient waste management services

Although recent studies have already attempted to look at possible approaches to determining the necessary costs, it **remains very difficult to find a harmonised definition of the costs that are necessary to comply with the obligations listed in Article 8a of the Waste Framework Directive**. This is mainly also due to the different national approaches to the implementation of EU directives, missing benchmarks (in particular in monopolistic setups) as well as the multitude of influencing factors that need to be considered.

An effective way to guarantee that the costs of waste management services does not exceed a necessary level is to ensure that prices can be compared with equivalent services. While in a well-regulated and independently governed competitive framework, competition (e.g. between PROs, collectors, recyclers) leads to the respective services being offered at the lowest achievable costs (necessary costs), monopolistic constellations usually lack suitable benchmarks against which costs can be compared and therefore require the development of artificial benchmarks.

Performance of EPR schemes in general

The different registration obligations for portable batteries in small electrical appliances and the appliances themselves pose a major challenge for manufacturers. This promotes freeriding and in turn leads to inaccuracies in the reported performance figures and an uneven distribution of the recycling costs.

To address the increasingly pressing issues of batteries included in small Electrical and Electronic Equipment (EEE), it is recommended to cover batteries that are sold together with small EEE within the respective EPR schemes for WEEE. This would reduce both, the complexity for producers and the amount of unregistered batteries.

Purely quantitative recycling targets undermine output quality of packaging waste.

Despite sufficient technological capacities, the quality of the materials recycled from packaging is often insufficient to enable a closed material cycle. This is facilitated by the fact that - apart from the quantities to be collected and treated - the quantitative recovery rates set by the EU are currently the main performance indicator for

PROs, while the quality of output recyclates is neglected as a steering mechanism.

To improve the quality of recycled packaging waste, it is recommended to complement the quantitative recycling targets with additional qualitative targets. The measure should aim to incentivise PROs and recyclers to increase the quality of recycled products, even if this initially leads to lower recycling rates.

There is a lack of clarity regarding the definition of products subject to system participation. This creates potential loopholes for non-compliance and also causes unnecessary confusion, especially for smaller producers. While for batteries this particularly concerns the distinction between portable and industrial batteries (“hand-held”), EPR schemes for packaging often lack a clear distinction between consumer (sales), transport and commercial packaging.

In order to reduce uncertainties with regard to products subject to system participation, there is a clear need to further refine the definitions. EPR schemes for batteries may also consider the option of introducing an open scope EPR, which would by default cover all batteries as long as there is no explicit exemption.

EPR schemes continue to show a lack of enforcement that offsets the regulatory frameworks. Although the lack of enforcement generally applies to all waste streams considered as part of the study, it is particularly relevant in the case of WEEE collection and recycling, where improper disposal, informal collection and illegal exports still account for a large share of WEEE available on the market.

In order to reduce the share of undocumented WEEE flows, it is recommended to create additional tools that facilitate and simplify the reporting of recycled WEEE for all licensed treatment operators, including operators not contracted to a PRO. To counteract fraudulent activities, falsified declarations or free riders, it is further recommended that a public register is established in which all producers and distributors including online sellers, obliged to participate in the system, must register and to which they must report the quantities and types of products they place on the market.

1 Introduction

1.1 Motivation for this Study

As nations become wealthier, they tend to consume increasing amounts of materials. In absence of any further policy interventions, projections by the OECD suggest that global materials use could almost double by 2060, thereby also generating increasing amounts of waste, which need to be disposed of responsibly (OECD 2018). Global assessments by the World Bank suggest that the world generated about 2.01 billion tonnes of municipal solid waste (MSW) in 2016. Following a business-as-usual trajectory, this amount is expected to grow to 3.40 billion tonnes by 2050 (Kaza 2018). In this context, Extended Producer Responsibility (EPR) has become recognized as an internationally applied policy principle that helps reduce waste generation and promote re-use and recycling operations.

EPR was first introduced in the 1990s by Germany, Sweden and France (OECD 2014). Since then, it has been continuously adopted by more and more countries across Europe. As of 2014, the World Bank recorded a total of 106 legally binding EPR schemes under implementation by EU Member States (then 28), mainly in the area of waste electrical and electronic equipment (WEEE), waste packaging, waste batteries and end-of-life vehicles (Kaza 2018). Since then, the EU has undergone significant institutional and legislative changes but EPR has remained at the centre of its waste management policies.

With the adoption of the ambitious Green Deal in 2019 and the new Circular Economy Action Plan (CEAP) in 2020, the European Commission (EC) has re-confirmed the importance of EPR as an important policy tool to accelerate the transition to a circular, climate-neutral economy. In addition to a range of comprehensive measures addressing the entire lifecycle of goods and services, the EC announced that it will lay out ambitious reduction targets for specific waste streams and further seeks to enhance the implementation of the recently adopted requirements for EPR schemes in the context of the Waste Framework Directive (WFD) (European Parliament and Council 11/22/2008).

Due to the decentralised nature in which waste legislations are transposed and implemented in the European Economic Areas (EEA) and Switzerland, the landscape of EPR schemes is extremely heterogeneous and differs vastly amongst European countries and EU Member States. While some EPR schemes have consistently performed above average and met the increasingly ambitious targets set out at EU level (e.g. in terms of collection rates), many schemes continue to underperform and show mixed results (Monier et al. 2014). Key distinguishing factors that are frequently being raised to influence the performance of EPR schemes include, inter alia, the number of Producer Responsibility Organisations (PROs) operating in a market (competitive or monopolistic schemes), the legal character of PROs (for-profit or non-profit) and the different types of ownership structures (producer-owned, producer-controlled, independent and/or the degree of vertical integration).

Many stakeholders have expressed concerns about the increasing complexity of the EPR landscape and highlighted that the large discrepancies between countries can create inefficiencies and adversely affect the functioning of the EU single market (ibid.). To streamline the diversity of schemes and further harmonise the implementation of EPR across the EU, the latest revision of the WFD adopted in 2018 laid out the general minimum requirements in Article 8a (European Parliament and Council 11/22/2008). Amongst others, this requires Member States to:

- introduce specific objectives and/or targets for waste management (incl. reporting, equal treatment of producers and PROs as well as the definition of roles and responsibilities of all stakeholders);
- put in place specific obligations for PROs (e.g. in regards to geographical, product and material scope, the availability of collection points and self-control mechanisms);
- implement adequate monitoring and enforcement mechanisms to reduce free-riding in competitive EPR systems and appoint at least one body independent of private interests to oversee the implementation; and

- define a minimum scope of EPR cost coverage and encourage eco-design by implementing eco-modulated fees, whilst ensuring that waste management services are delivered in a cost-effective way (i.e. meeting the necessary cost principle).

Since the EC intends to publish written guidelines for the implementation of Article 8a later this year, there is an urgent need to better understand the conditions under which EPR systems can perform well and how they deliver best results. To address this knowledge gap, the European Recycling Platform (ERP) has commissioned adelphi to develop an independent study that analyses the performance of different EPR schemes and provides recommendations for the effective implementation of existing and upcoming requirements. The study has a two-fold objective. Firstly, it aims to analyse the strengths and weaknesses of different EPR schemes by focusing on:

- three priority waste streams relevant to the European/EU market (waste packaging, WEEE and waste batteries);
- monopolistic vs. competitive EPR schemes (i.e. countries with multiple PROs vis-à-vis countries with a single, centralised PRO); and
- for-profit vs. non-profit setups of PROs as the key service providers.

Secondly, the study seeks to develop proposals for addressing the identified shortcomings in the light of regulatory requirements for competitive EPR schemes in Europe and the EU. Here a particular emphasis is put on the minimum requirements described in Article 8a of the WFD, namely:

- the fair allocation and balancing of obligations amongst key stakeholders;
- approaches for effective awareness creation, research and innovation,
- implementation of eco-modulated fees; and
- cost efficient delivery of waste management services.

1.2 Methodology

The study employed a set of qualitative and quantitative methods in order to produce warranted findings. Beginning with secondary data collection, the assessments presented in this report are based on a comprehensive review of more than 50 publications (peer-reviewed articles, grey literature, industry and policy reports, and legislations, amongst others), which evaluate the performance of different EPR schemes and provide further insights into the implementation of EPR at European and EU level. Data from these publications was used to inform the background analysis and derive specific conclusions at the level of individual case studies. For instance, data extracted from the annual reports of PROs in monopolistic schemes (Switzerland, Spain, Belgium) was used to calculate historical or existing reserves and derive estimates for prices per tonne of waste collected and recycled/treated.

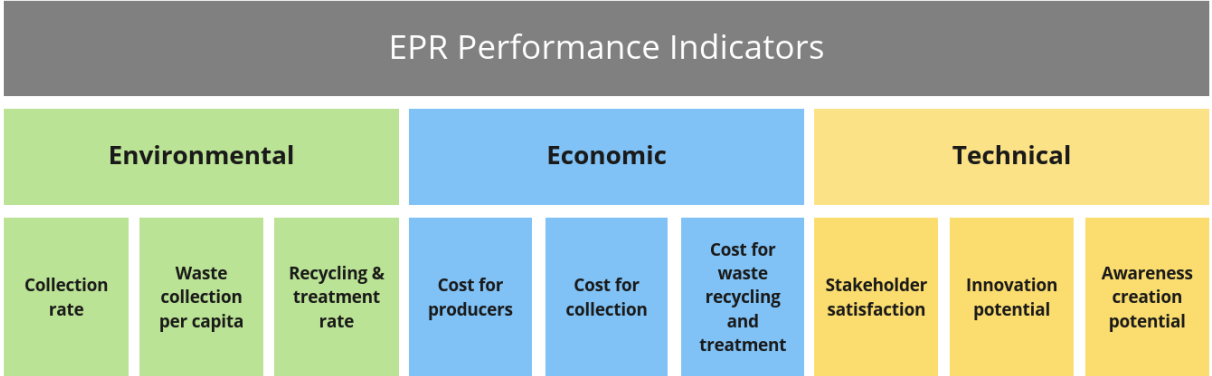
In regards to collection of primary data, the analysis relied on a total of 35 semi-structured interviews and focus group discussions with multiple industry experts. These were conducted between September 2020 and April 2021 and carried out in three steps. In a first step, a set of scoping and policy interviews was conducted that helped analyse the overarching advantages and drawbacks of different EPR schemes, identify upcoming regulatory requirements and gather suggestions for potential case studies. In a second step (after the case studies had been selected), another set of in-depth interviews was conducted in order to evaluate the performance of the chosen schemes and develop recommendations for their improvement. Finally, the results of the analysis were presented and discussed during a half-day consultation workshop, which was conducted online and attended by more than 20 EPR experts, representing various stakeholder groups and interests from industry (producers, associations), research (universities, think tanks) as well as PROs operating in monopolistic and competitive schemes. The interview guides and the workshop agenda are presented in the Annex.

The selection of case studies was based on four key criteria, namely: i) collection, recovery and recycling rates (as reported per Eurostat) to understand whether a scheme’s performance, in the aggregate, could be considered high, medium or low; ii) the uniqueness of the scheme, to consider if a scheme is characterised by distinctive institutional arrangements (e.g. the existence of a coordination body or historical changes from competitive to monopolistic, or vice versa) that positively or negatively affect its performance; iii) data availability, to ensure that sufficient information could be derived from interviews and public sources (e.g. stakeholders’ anticipated willingness to share insights, data and recommendations); and iv) recommendations from stakeholders as discussed during the initial scoping interviews to draw from the experts’ insights into a wide range of different schemes. In addition, a balancing criterion was applied to ensure that the selected case studies adequately reflect the heterogeneity of EPR schemes across Europe and the EU, thus resulting in an equal representation of countries with high/low levels of performance, competitive/monopolistic schemes and for-profit/non-profit setups.

The subsequently conducted performance analysis focused on six selected case studies, which were evaluated through a total of nine environmental, economic and technical key performance indicators (KPIs). In regards to environmental KPIs, the analysis focuses on collection rates, waste collection per capita and recycling/treatment rates. Economic KPIs comprise the costs for producers (per tonne POM), costs for collection as well as costs for recycling/treatment. Moreover, technical KPIs reflect the level of stakeholder satisfaction, the innovation potential of the EPR scheme as a whole and its awareness creation potential. While environmental and economic KPIs were expressed in numerical values, technical KPIs were evaluated qualitatively (ranging from low – medium – high).

In the context of this report, stakeholder satisfaction levels mainly reflect the views of producers (e.g. in terms service delivery of PROs, treating them as customers and offering cost effective services) and public authorities’ perception in regards to the overall performance of the system. Innovation potential mainly describes a scheme’s ability to provide simple compliance solutions to producers, its tendency to encourage eco-design as well as the PRO’s portfolio beyond mere compliance services. A detailed illustration of the KPIs’ scope as well as corresponding data sources applied for evaluation is presented in the Annex.

Figure 1: KPIs for EPR schemes analysed in each of the six case studies



A key challenge in regards to the performance assessment is the limited comparability of the KPIs across the selected case studies. During the interviews, stakeholders repeatedly mentioned that attempts to compare such KPIs of EPR schemes on a one-to-one basis usually fail due to the vastly different design elements across schemes. Factors that decisively limit comparison of the schemes’ performance include, amongst others, differences in the material scope and cost coverage (e.g. waste from business-to-business versus business-to-consumer operations), the allocation of responsibilities (simple financial responsibility to full organisational responsibility), varying definitions applied at national level and disparities in data collection methodologies. Moreover, a wide range of geo-physical (topography), socio-economic (levels of income, awareness) and cultural characteristics (e.g. in regards to hoarding of used equipment) can significantly influence a country’s performance in regards to EPR.

An additional limitation includes the varying levels of data quality and data availability, especially in regards to cost data in competitive EPR schemes. The fee structure of most competitive PROs is confidential and is not shared publicly. Hence, assessments of economic KPIs had to rely on best available proxies, such as market price estimates from industry experts collected during interviews or via exchange of e-mails. Given the various limitations and the restricted scope of the study, the analysis presented in the following chapters does not intend to provide a one-to-one comparison of performance levels among different schemes. Instead, the analysis seeks to highlight the contextual factors that affect under which conditions an EPR scheme can perform well or worse. Based on this premise, the underlying limitations do not undermine the robustness of data or the general validity of the findings but merely highlight experts' inability to draw sweeping and simplified conclusions in regards to the performance of EPR schemes.

1.3 Reading Guidance

The report is divided into five chapters. Following the introduction (chapter 1), chapter 2 provides a comprehensive overview of existing EPR systems and relevant policy frameworks in Europe and the EU, covering both, existing frameworks and initiatives and future developments. Subsequently, chapter 3 presents an in-depth performance assessment of six selected EPR case studies on WEEE (Italy, Belgium), waste packaging (Germany, Spain) and waste portable batteries (Switzerland, UK). The assessment equally covers monopolistic and competitive schemes with for-profit and non-profit PROs and draws interim conclusions on the advantages and disadvantages of different types of schemes. Based on the analysis presented in chapters 2 and 3, chapter 4 provides recommendations for improving the performance of EPR schemes with a particular focus on competitive environments with multiple PROs and upcoming policy requirements, such as the implementation of modulated fees and meeting the necessary cost principle. The study concludes in chapter 5, which summarises the key findings and provides an outlook on the way forward.

2 Towards Circularity: Relevant Policy Frameworks and EPR Schemes and in the EU

2.1 Relevant Policy Frameworks and Legislation in the Context of EPR

The legislative landscape on waste in Europe and the EU focuses on the key aspect of circular economy: to turn waste into resources. In the EU, a set of Directives and regulations, supported by the European Green Deal and the Circular Economy Action Plan (CEAP), seeks to promote sustainable consumption and production and boost the competitiveness of the EU's economy as a whole. Collection and recovery targets for specific waste streams act as drivers to improve waste management practices, limiting landfilling and fostering innovation in the sector (European Commission 2021b). The Waste Framework Directive (WFD) stipulates the waste management hierarchy as a key regulative idea and gives priority to waste prevention over preparation for re-use, recycling, recovery and, finally, disposal as the least preferred option.

In regards to the three priority waste streams addressed by this study (i.e. WEEE, waste packaging and waste batteries), Directives form the EU's key legislative vehicles to regulate their handling and disposal through more specific provisions. Due to the flexible nature of Directives, Member States need to transpose their contents into national legislation, while regulations and decisions are immediately binding across the entire EU. As a result, Directives are often not transposed on a one-to-one basis by a single corresponding national legislation, but are implemented in a piecemeal fashion through a complex interaction of various existing legislative acts at the level of individual Member States. Examples for this approach are presented in the case studies in chapter 3.

Figure 2: Policy and regulatory frameworks on waste and EPR in the EU



The WFD (Directive 2008/98/EC) is the core of the EU's waste legislation. Amended most recently in 2018, it provides a broad legal framework for waste management activities in the EU and defines the basic concepts and principles for the sector, among them the polluter pays principle and the waste hierarchy (Municipal Waste Europe 2021). Most notably, the Directive establishes EPR as a central element of waste management across the entire EU by providing the following general definition of EPR schemes (European Parliament and Council 11/22/2008): "Extended producer responsibility scheme' means a set of measures taken by Member States to ensure that producers of products bear financial responsibility or financial and organisational responsibility for the management of the waste stage of a product's life cycle".

Since its latest revision from 2018, the WFD additionally sets out minimum requirements for the implementation of EPR in Article 8a. This article stipulates Member States' obligations to define roles and responsibilities of all actors involved in the implementation of EPR, the obligation to inform waste holders in regards to take-back and collection options as well as waste prevention measures and mandates the setting of quantitative targets. According to the Article 8a, EPR fees need to be calculated in a transparent manner and in a way that they cover all costs for waste management and re-use activities in a cost-effective way (also referred to as the Necessary Cost Principle). Further, where the obligations under EPR schemes are met by specialised compliance services providers (i.e. PROs), a modulation of financial contributions is required in order to incentivise durability, reparability, re-usability as well as recyclability and reduce the presence of hazardous substances.

Waste from electrical and electronic equipment (WEEE)

Management of WEEE in the EU is regulated by the WEEE Directive (Directive 2012/19/EU). Following the stipulations of the WFD, Article 7 of the WEEE Directive highlights that for the purpose of separate collection, “each Member State shall ensure the implementation of the ‘producer responsibility’ principle and, on that basis, that a minimum collection rate is achieved annually” (European Parliament and Council 7/4/2012). The same article requires Member States to achieve a collection rate of 45% by 2016 and 65% by 2019, calculated as a percentage of the average weight of electrical and electronic equipment (EEE) put on market (POM) in the three preceding years. In addition, Articles 12 and 13 require Member States to ensure that producers bear the full cost for collection, treatment, recovery and environmentally sound disposal of WEEE from private households and other sources.¹

Similarly, responsibility for treatment of any separately collected WEEE falls within the responsibility of producers, allowing them to implement either individual treatment solutions or join collective schemes (i.e. PROs) in line with Article 8 of the WEEE Directive. Types of equipment that fall within the realm of the WEEE Directive are laid out in Article 2. As of 2018, the Directive employs an “open scope” by providing a non-exhaustive list of types of EEE that are clustered into six different categories as per Annex III. In terms of registration, information and reporting (Article 16), Member States are required to establish registers of EEE producers to collect data on the amounts of EEE POM on an annual basis and monitor compliance (ibid.).

Table 1: Collection and recycling targets for WEEE according to Directive 2012/19/EU

Collection target	Recycling target
<ul style="list-style-type: none"> 65% of EEE POM or 85% of WEEE generated in Member State 	<ul style="list-style-type: none"> Temperature exchange equipment: 80% (Recovery: 85%) Screens, monitors, and equipment with screens >100m²: 70% (Recovery: 80%) Lamps: 80% Large equipment (any external dimension more than 50 cm): 80% (Recovery: 85%) Small equipment (no external dimension more than 50 cm): 55% (Recovery: 75%) Small IT and telecommunication equipment (no external dimension more than 50 cm): 55% (Recovery: 75%)

Packaging and packaging waste, including single-use plastics

First introduced in 1994, the EU Packaging and Packaging Waste Directive (Directive 94/62/EC) seeks to harmonise national efforts for the management of packaging and packaging waste (PPW), provide a high level of environmental protection and ensure good functioning of the EU internal market. According

¹ Notably, financing of collection of WEEE arising from private households is restricted to waste that has been collected at dedicated collection points. This effectively mandates municipalities and, in part, retailers to drive collection of household-generated WEEE.

to Article 2, it covers all types of packaging POM in the EU, regardless of its source or purpose (European Parliament and Council 12/20/1994). The mitigation of negative environmental impacts is further stimulated by specific recycling and recovery targets set out in Article 6, which were raised during the latest amendment in 2018 (see Table 3). Moreover, Article 9 and Annex II lay out essential requirements for packaging placed on the EU market. These requirements guide the manufacturing and composition of packaging and promote re-usability and recoverability of all types of packaging.

Article 7.2 of the Directive (EU) 2018/852, which amended the packaging Directive, requires all Member States to “ensure that, by 31 December of 2024, extended producer responsibility schemes are established for all packaging in accordance with Articles 8 and 8a of Directive 2008/98/EC”. In September 2020, a public consultation on the review of the essential requirements for packaging and other measures to prevent packaging waste was launched and later concluded in January 2021. A related proposal for a new or revised PPW Directive is expected by the fourth quarter of 2021 but might be delayed.

Table 2: Collection and recycling targets for packaging waste according to Directive 94/62/EC

Collection target	Recycling target
<ul style="list-style-type: none"> n/a 	<ul style="list-style-type: none"> All packaging: 55% by 2020, 65% by 2025, 70% by 2030 Plastic: 25% by 2020, 50% by 2025, 55% by 2030 Wood: 5% by 2020, 25% by 2025, 30% by 2030 Ferrous metals: 50% (incl. Al) by 2020, 70% by 2025, 80% by 2030 Aluminum: 50% by 2025, 60% by 2030 Glass: 60% by 2020, 70% by 2025, 75% by 2030 Paper and cardboard: 60% by 2020, 75% by 2025, 85% by 2030

Waste batteries and accumulators

Management of waste batteries is subject to the Directive on batteries and accumulators and waste batteries and accumulators (Batteries Directive 2006/66/EC). Inter alia, it prohibits the marketing of batteries containing certain hazardous substances, requires the establishment of schemes for collection and recycling and sets out targets. The responsibility for waste management operations is per se directed to producers or distributors. Instead, Article 8 of the Batteries Directive requires Member States to “ensure that appropriate collection schemes are in place” but leaves open if these should be set up by producers in line with EPR and continue to use existing schemes (European Parliament and Council 7/6/2006). As of 2016, Member States are required to achieve a collection rate of 45% (Article 10).

Table 3: Collection and recycling targets for batteries and accumulators according to Directive 2006/66/EC

Collection target	Recycling target
<ul style="list-style-type: none"> 45% of batteries and accumulators 	<ul style="list-style-type: none"> 65 % of lead-acid batteries and accumulators of average weight of batteries 75 % of nickel-cadmium batteries and accumulators 50 % of other waste batteries and accumulators

Since its introduction in 2006 to repeal the preceding Directive on batteries and accumulators from 1991 (91/157/EEC), the Batteries Directive has been subject to multiple revisions and an in-depth evaluation was concluded in 2019. In December 2020, the Commission proposed a new and comprehensive Batteries Regulation. Given that the proposal was presented as a Regulation, this represents a landmark deviation and would introduce harmonised requirements across all Member States. While it was

welcomed by multiple stakeholders in the system, it remains unclear whether it will ultimately be proposed as a Regulation or Directive.

In summary, the Commission proposes significant changes and new requirements for all batteries (industrial, automotive, electric vehicle and portable) placed on the EU market. These include the need to use responsibly sourced materials, minimum contents of recycled materials, carbon foot printing, performance and durability requirements, labelling provisions as well as more ambitious collection and recycling targets (rising from currently 45% to 65 % in 2025 and 70% in 2030). Furthermore, the proposed Article 47 relates to Article 8a of the Waste Framework Directive as it introduces the obligation for collective EPR schemes to modulate their fees (European Commission 2021a).

2.2 Overview of EPR Schemes in Europe and the EU

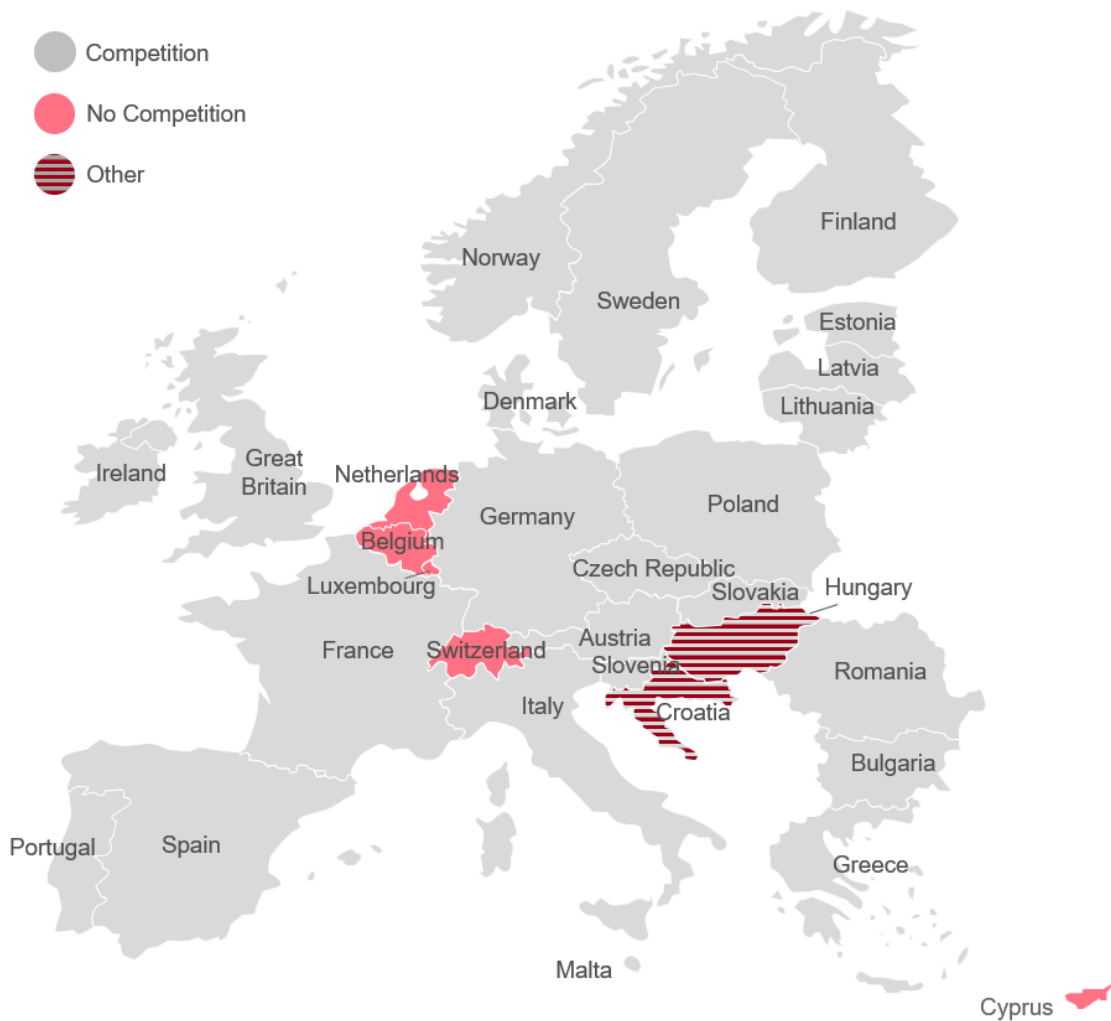
2.2.1 WEEE

In 2018, EU Member States (then 28, including the UK) collectively put approximately 10.3 million tonnes of EEE on the market, representing an increase of around 820,890 tonnes (+8,7%) compared to 2010. The average annual amount of WEEE generated per inhabitant amounted to 20.02 kg in 2018 (eurostat 2021). Large household appliances are the dominant product category in all Member States. In 2017, they accounted for 51.5% of the total EEE put on the market at EAA level. Consumer appliances ranked second with a share of 10.4% (eurostat 2020a).

In 2018, a total volume of 4.8 million tonnes of WEEE were collected in the EU. Given the average amount of 10.2 million tonnes POM in the years 2015 – 2017, this represents a collection rate of 47.8% at the EAA level (eurostat 2021). According to the data available on Eurostat for 2018, 18 EU Member States (Belgium, Bulgaria, Czechia, Estonia, Ireland, Spain, France, Croatia, Latvia, Luxembourg, Hungary, Netherlands, Austria, Slovakia, Finland, Sweden, Liechtenstein, Norway) surpassed a collection rate of 45%, while Denmark (44%), Germany (43%), Greece (44%) Italy (43%), Lithuania (44%) and Poland (44%) came very close. The target of 65% collection rate, valid from 2019 on, was only met by Bulgaria (73%), Ireland (65%) and Croatia (83%) in 2018.

In most Member States, producer responsibility for WEEE is implemented via multiple competing PROs, with only 5 countries opting for a monopolistic scheme: Belgium, Netherlands, Luxembourg, Switzerland and Cyprus. Hungary and Croatia are the only states within the European market without a PRO as they are collecting EPR fees via a state fee/tax (Expra 2021; PRO Europe 2019).

Figure 3: EPR schemes for WEEE in Europe



2.2.2 Waste Packaging

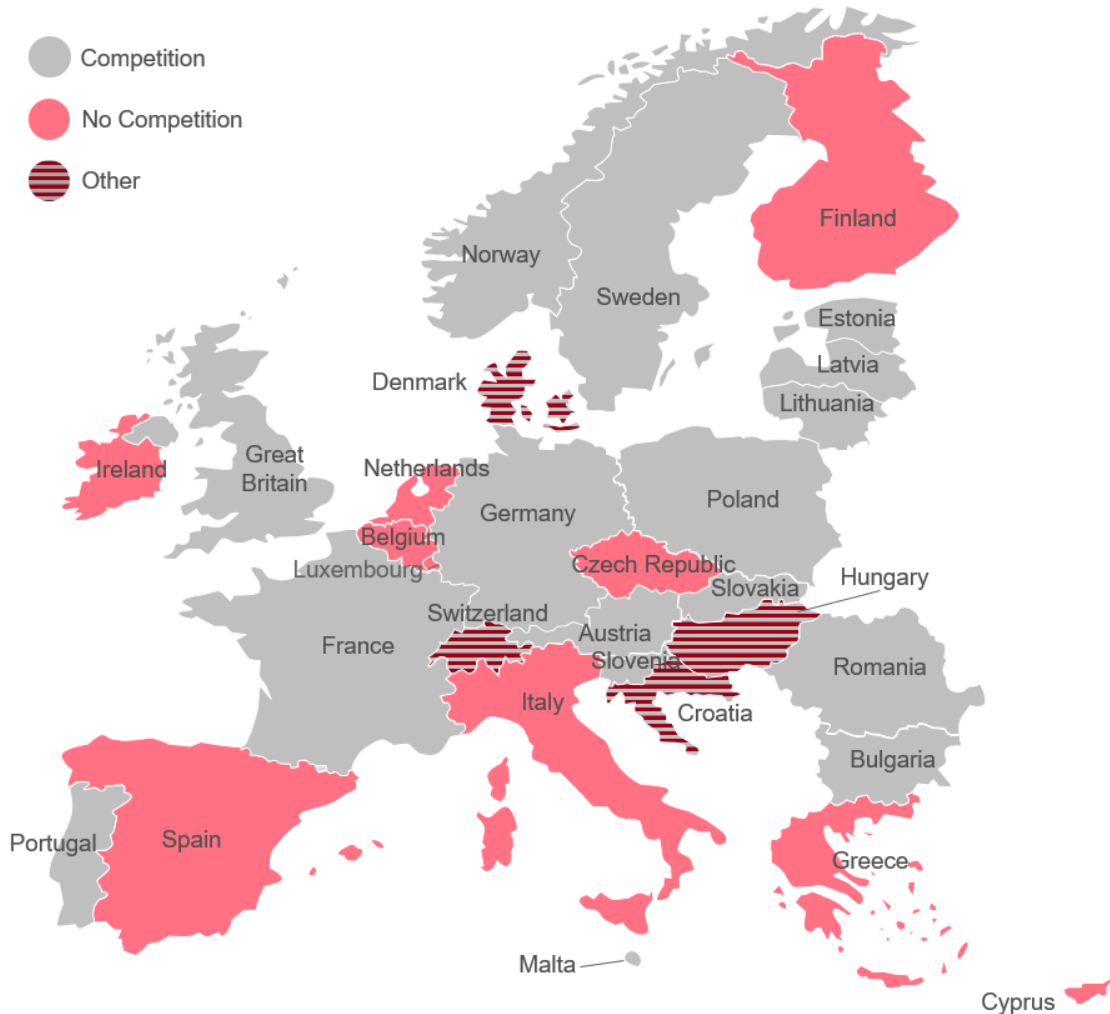
According to Eurostat data, countries in the EEA collectively generated around 77.7 million tonnes of packaging waste in 2018, representing an increase of around 9.8 million tonnes (+14.3%) compared to 2010. The average amount of packaging waste generated per inhabitant amounted to 174 kg in 2018 (eurostat 2020b). At around 31.8 million tonnes, paper and cardboard packaging represent the largest share of packaging waste, followed by plastic packaging, of which 14.8 million tonnes were generated in 2018.

In 2018, a total volume of about 51.5 million tonnes of packaging waste were recycled in the EEA. The recycling rate has thus increased from around 63.9% in 2010 to 66.3%. During the same period, the recovery rate, including incineration in waste-to-energy plants, increased from 77.9% to 80.9%. According to the data available on Eurostat, all EU Member states except Malta were able to achieve the minimum recovery rate (including waste incineration) of 60%, as defined in the Packaging Waste Directive, in 2018. The target of 55% recycled packaging waste was met by all Member States, except Hungary (46.1%) and Malta (35.6 %, 2017 data) (eurostat 2020b).

Producer responsibility for packaging waste is organised relatively evenly across the EEA states through either competitive or monopolistic PRO systems (Figure 4). Denmark, Croatia, Switzerland and Hungary are the only EEA countries without a conventional EPR scheme. While Denmark has opted for the tax-based internalisation of packaging waste management costs rather than setting up an industry-run funding system, Hungary set up the National Waste Management Agency which took over the

coordination of the recycling of packaging waste from 1st January 2012. In Croatia, EPR for waste packaging is organised via fee payments to a central fund (Expra 2021; PRO Europe 2019).

Figure 4: EPR schemes for waste packaging in Europe



2.2.3 Waste Portable Batteries and Accumulators

In 2018, around 191,000 tonnes were POM in the EEA. In the same year, around 88,000 tonnes of waste portable batteries and accumulators were reported as collected, thus resulting in a collection rate of 46% (eurostat 2020c; EPBA 2020). While the amount of portable batteries and accumulators sold varies strongly across the EEA in absolute terms (81 tonnes to more than 52,000 tonnes in 2018), overall battery sales have remained relatively stable over the past years, marginally increasing from 176,000 tonnes in 2010 to 191,000 tonnes in 2018 (eurostat 2020c; EPBA 2020). By contrast, the collection of waste batteries and accumulators has increased consistently since 2010 by an annual average of 6%.

In 2018, 17 states in the EEA for which 2018 data was available reported a collection rate of waste batteries of 45% or more, thus achieving the collection target as defined in the Batteries Directive. The most recent available data indicates a collection rate above 25% for all states in the EEA (eurostat 2020c).

Producer responsibility for portable batteries and accumulators is in most countries managed via multiple competing PROs. Monopolistic systems exist in only 6 countries, most of which are among the smaller countries in terms of area. In Croatia, EPR for waste portable batteries is organised via fee payments to a central fund.

Figure 5: EPR schemes for waste portable batteries and accumulators in Europe



3 Closing the Loop or Running in Circles? Performance Assessment of Selected EPR Schemes

The following sections provide a detailed assessment of different case studies of EPR schemes in regards to their technical, environmental and economic performance. For further details about the underlying methodology and the performance assessment framework, please refer to the Annex.

3.1 Italy (WEEE)



Table 4: Italy - EPR Performance Indicators

	Indicator	Value (2019)
Environmental	Collection rate	38.7%
	Waste collection per capita	5.68 kg
	Recycling rate	84% ²
Economic	Cost for producers per tonne POM	184 €
	Cost for collection per tonne	112 €
	Cost for waste recycling and treatment per tonne	0 ³ €
Technical	Stakeholder satisfaction levels	Medium - high
	Innovation potential	Medium
	Awareness creation potential	High

3.1.1 Overview

National transposition of Directive 2012/19/EU on WEEE

The European WEEE Directive was first transposed into Italian law by the Legislative Decree n.151 in July 2005. This was followed by a series of additional implementing decrees, such as the Legislative Decree n.49 transposed WEEE Directive 2012/19/EU into national law in March 2014 (Baldé et al. 2020; Italian Ministry of Environment 2014). The Italian authority in charge of the transposition of the WEEE Directive and the implementation of EPR for WEEE at the national level is the Ministry of Environment (MoE). Under the current legislation, producers of EEE are required to finance the collection, treatment, recovery and environmentally sound disposal of all domestic WEEE that was put on the market. There

² Value for 2018

³ Non-weighted average of the approximate recycling costs for 5 reference appliances, including any proceeds from the sale of the recycled raw materials.

is no specific “Open Scope” exclusion (CDC RAEE 2018). Producers have to fulfil this obligation by joining a PRO and enrol in the National Register of the Chambers of Commerce⁴ before operating in Italy.

Actors and responsibilities

According to the Italian legislative decree 49/2014, producers and importers of domestic EEE are required to assign the responsibility for managing domestic WEEE to one of multiple PROs operating in Italy. There are currently 13 PROs managing the transport, treatment and recovery of WEEE. The obligation of the PROs is proportionate to the market share of their respective producers and is differentiated by 5 groups of WEEE (CDC RAEE 2018): R1: cooling and freezing appliances, R2: large household appliances, R3: screen monitors, R4: consumer equipment, and R5: lighting equipment.

PROs are required to adopt the legal form of a consortium and have a not-for-profit objective. Retailers, transporters, collection companies and treatment companies may, in accordance with producers, be shareholders (Favot et al. 2016). Recently two of the largest PROs, Ecodom and Remedia, have merged their operations within a new legal entity called Erion with an approximate marketshare of 60%. Erion is thus by far the largest PRO for WEEE in Italy.

With the aim of optimising the management of WEEE throughout the national territory, the Italian EPR system for WEEE operates a clearing house, the WEEE Coordination Centre (CdC RAEE). The coordination centre is managed and governed by the PROs and is in charge of allocating responsibilities for the collection and treatment of WEEE among PROs in the competitive market. This is achieved by assigning collection points to each PRO, which guarantees that the obligations for collection and management are proportional to the market share represented by each individual PRO (Baldé et al. 2020).

3.1.2 Environmental Performance

Collection infrastructure

The collection of WEEE in Italy takes place via a range of different collection points and facilities for different types of end-users. The vast majority of WEEE is collected via Designated Collection Facilities (DCF) set up and managed by either the local authorities/municipalities or authorised WEEE management companies. Citizens can dispose of WEEE at a DCF free of charge. Some DCFs also offer collection services and accept WEEE from distributors. There is a total of 4,367 DCFs in Italy. Other collection points include: distributors’ collection sites where waste from a one-for-one and one-for-zero take-back schemes is accepted; large users (e.g. airports, companies, hospitals etc.) which produce considerable amounts of WEEE especially in the market for lighting equipment; individual collection sites of PROs; and sales outlets or technical assistance centres where WEEE collection from households is provided free of charge following the sale of new household appliances. In 2019, there were a total of 5,196 collection points in Italy, one for each 11,617 inhabitants (CDC RAEE 2019a). Compared to 2018, the number of collection points increased by 6.4%.

Despite the large number of WEEE collection points at national level, the accessibility of collection points varies greatly from region to region. While northern Italy, for instance, has significantly increased the number of DCFs in recent years, other regions in central and southern Italy still have difficulties in providing a sufficiently accessible collection network, which is likely to have adverse effects on the collection rate in these regions (Baldé et al. 2020; CDC RAEE 2018).

Organisation of the collection system

Operators of collection points are responsible for sorting collected WEEE according to the five groups mentioned above. Once sufficient amounts have been collected and are ready for pick-up, they can contact the coordination centre, which subsequently organises collection and transport to designated treatment plants via the responsible PRO or, alternatively, a transport operator that has been sub-contracted by the PRO. Notably, as Italy follows an “all actors approach”, collection points and their

⁴ <https://www.registroaee.it/en>

operators are not required to sign a contract with the WEEE Coordination Centre and hand over their collected WEEE to the PROs/coordination centre. Instead, they may choose to directly deliver the collected WEEE to a registered treatment plant.

Best Practice: Fair allocation of collection points via a coordination centre

The WEEE Coordination Centre as an independent body annually allocates a certain number of all registered collection points to each PRO. The allocation is based on the quantity of EEE POM by their members as well as additional parameters, such as accessibility or the distance between the assigned collection points. This mechanism avoids competition for access to waste, and ensures a fair allocation of waste streams according to the individual obligations of PROs.

Reporting and validation process for statistical data on WEEE collection and treatment

Although some collection points measure the weight of the WEEE collected, most of them do not, meaning that there is typically no reporting of the amount of WEEE collected from the collection points. Instead, whenever a transport company contracted by a PRO delivers WEEE to a registered treatment plant, the amounts delivered are registered and reported to the respective PRO, which in turn will report the amounts collected and transported to the WEEE Coordination Centre. The same procedure applies when collection and transport is organised through the PRO's in-house fleet. Reported amounts are thereby counted as recycled (i.e. delivered to authorised treatment centres).

Challenge: Lack of declaration from non-accredited operators

In addition to the recycling rates reported by PROs, the coordination centre also receives annual reports from the treatment plants on the quantities and fractions of WEEE that have been accepted and treated. The declaration of the amount of WEEE treated is also required from treatment facilities that are not contracted by the PROs and are not directly accredited by the coordination centre. According to the treatment plant report of the CdC RAEE, about 2% of the total WEEE collected is treated by non-accredited treatment facilities (CDC RAEE 2019b). However, investigations of the Ecodom Consortium and the Italian Consumers Association Altroconsumo suggest that the actual share of WEEE treated by other actors amounts to 30 - 40% (Baldé et al. 2020; Croci et al. 2018). This indicates that declaration from non-accredited operators often does not take place, pointing towards a significant lack of enforcement regarding the reporting of non-accredited treatment facilities.

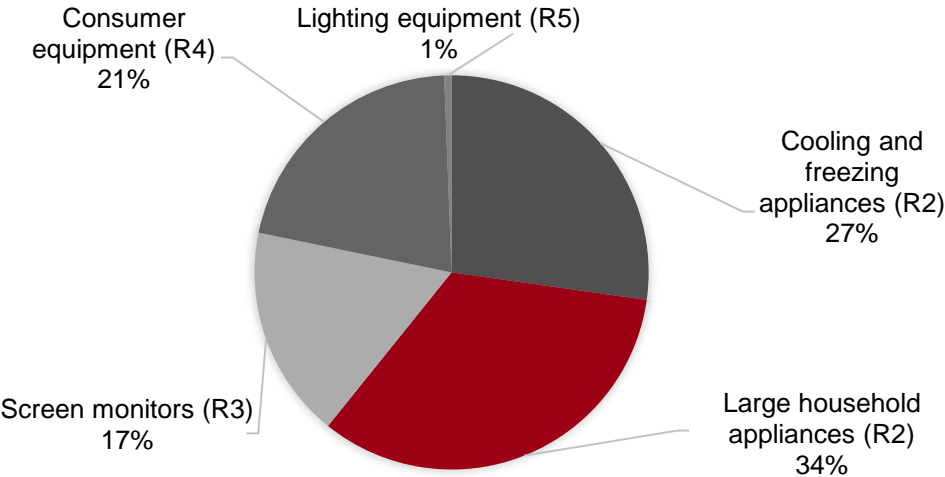
Another issue that significantly skews the reported numbers of WEEE collection and treatment is the processing of WEEE as metal scrap. Scrap metal dealers do not need to follow dismantling and treatment processes according to equivalent standards applied for WEEE. By circumventing the required processing standards, such actors could potentially externalise negative environmental and social impacts, thus significantly reducing the processing costs. This allows them to pay for collected WEEE, therefore providing wrong incentives for collection points to sell their collected WEEE (or at least parts of it) to scrap dealers instead of providing it to operators registered with the WEEE Coordination Centre.

Since compliance audits at DCFs are carried out infrequently, WEEE might also be purposefully declared as metal scrap during sorting. As a result, it is estimated that about 30% of all WEEE collected in Italy is treated as metal scrap instead of WEEE. WEEE treated as scrap metal is not reported to the coordination centre.

Collection rate and achievement of the EU collection target

In 2019, all PROs in Italy combined collected 343,069 tonnes of WEEE, representing about 38.7% of the WEEE POM in the three previous years. The EU's target collection rate of 65% was therefore not achieved. The largest share of WEEE collected is R2 (large household appliances, 33.55%), followed by R1 (cooling and freezing appliances, 27.23%) and R4 (consumer equipment, 21.16%). Appliances with screens (R3) made up 17.45% of the collected volume while lighting equipment (R5) was the category that was collected least (0.6%) (CDC RAEE 2019a).

Figure 6: Share of WEEE categories collected in Italy



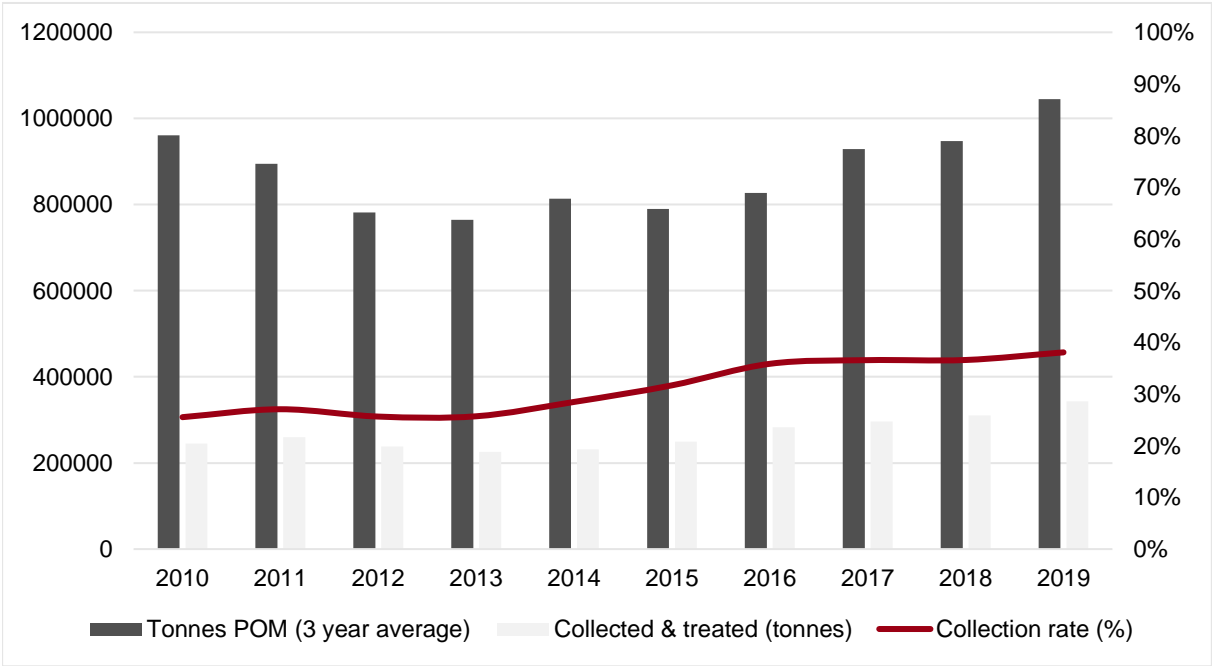
Source: (CDC RAEE 2019a)

Development of the collection rates (in %) between 2010 and 2019

Since its initial introduction in 2008, the Italian EPR system has contributed a more than five-fold increase in collection rates from initially 1.1 kg per capita in 2008 to 5.7 kg per capita in 2019 (CDC RAEE 2019a; Baldé et al. 2020). Due to the geographical variance from northern to southern parts of Italy, collection results vary significantly, with some regions managing to collect 7-10.5 kg per capita of WEEE and others, mainly located in the southern part of the country, collecting less than 3 kg per capita. (Baldé et al. 2020; CDC RAEE 2019a).

Overall collection volumes have increased by 52% since 2013, however, the corresponding improvement of the collection rate was slowed down by the growing amount of EEE POM between 2017 and 2018.

Figure 7: Development of the WEEE collection rate in Italy (2010 - 2019)*



*Data was provided by CdC RAEE.

One of the major drivers for the relatively low collection rate of WEEE is the high share of WEEE that is processed as scrap metal by the informal sector and the fact that these market players often do not report the amounts of WEEE treated to the coordination centre. Nevertheless, the low value of raw materials in the recent years has, to a certain extent, disincentivised informal treatment of WEEE, which in turn resulted in higher volumes of WEEE collected via the formal channels (Baldé et al. 2020). Other factors that negatively influence the collection rate of WEEE in Italy are the incorrect disposal of WEEE (e.g. in the household waste) and WEEE exported for re-use. However, data on such WEEE flows is currently not available. Factors that have positively influenced the collection rate in Italy are the increased availability of collection points as well as information and awareness campaigns initiated by the coordination centre (3.1.4).

Treatment capacities

As of December 2018, 53 waste treatment companies with a total of 59 treatment plants were registered with the coordination centre. Of these plants, 14 were authorised for treatment of cooling and freezing equipment (R1), 47 for large household appliances (R2), 19 for the TVs and monitors (R3), 37 for small household appliances (R4) and 11 for lighting equipment (R5) (CDC RAEE 2018). In addition to the registered treatment facilities, there are currently 903 other facilities in Italy that also deal with the treatment of WEEE (CDC RAEE 2019b). The available recycling capacities are deemed to be sufficient to treat the WEEE collected in Italy by interviewed market experts (Personal Communication 2021).

Treatment requirements

In order to ensure adequate and consistent levels of treatment and qualification of the companies involved, Law Decree 49/2014 requires the WEEE Coordination Centre to produce “Agreements between trade associations of recyclers in order to ensure adequate and consistent levels of treatment and qualification of the companies involved” (CDC RAEE 2019b). Together with the associations representing the recycling companies (ASSORAE, ASSOFERMET and ASSORECUPERI), CdC RAEE produced an agreement on the treatment of WEEE, which outlines the minimum requirements of WEEE treatment as well as the respective operating methods for the treatment plants required to become “authorised” and can therefore accept and treat household WEEE managed by the PROs. The document does not specify any quotas or targets for the recycling quality or quantity of WEEE groups and instead focuses on the implementation and use of available best practices for recycling. The current agreement was signed by the involved parties in 2016 (CDC RAEE 2014). A revision of the agreement is currently under preparation. Under the agreement, all accredited treatment facilities are further obliged to allow both scheduled and unscheduled audits by the coordination centre or a commissioned third-party auditor to verify compliance with or maintenance of the requirements for accreditation (CDC RAEE 2014).

Achievement of recycling/preparation for re-use targets per waste category in 2019

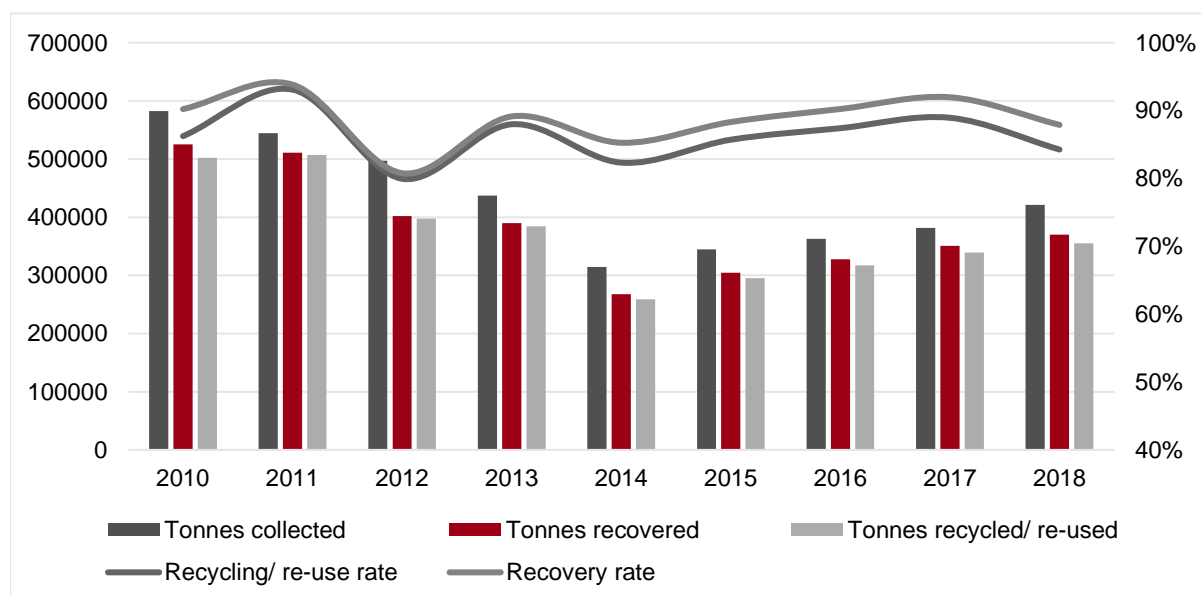
Annex 5 of the Legislative Decree 49/2014 describes the minimum recycling and treatment objectives applicable per category as from August 2018 (Figure 8). The targets are set with regard to the following WEEE categories: (1) Temperature Exchange Equipment; (2) Screens & Monitors that have a surface greater than 100 cm²; (3) Lamps; (4) Large EEE including among other things large household appliances, telecommunication equipment, luminaire, etc.; (5) small EEE, (6) small IT and telecommunications equipment (Italian Ministry of Environment 2014). Figures on the results of the achieved recycling efficiency are not reported to the coordination centre. According to the latest available data on Eurostat, Italy achieved an overall recovery rate of 88% and a recycling and re-use rate of 84% in 2018 (eurostat 2021). However, it has to be noted that the Eurostat data on WEEE collection differ from the data published by the coordination centre as they include WEEE from other sources than those managed by the PROs.

Figure 8: WEEE recovery and recycling and re-use targets in Italy

WEEE Category ⁵	Recovery target	Recycling and re-use target
1 & 4	85%	80%
2	80%	70%
5 & 6	75%	55%
3	N/A	80%

A common problem affecting WEEE recycling performance in Italy is scavenging of valuable WEEE components prior to transportation to the treatment plan. This means that collected equipment is often missing essential components (e.g. compressors, motors, etc.), thus reducing the quality and increasing the costs of recycling. In the case of Italy, it is estimated that over 30% of collected WEEE is affected by this. This rate is closely linked to the price of raw materials (Croci et al. 2018).

Figure 9: Development of recovery and recycling and re-use rate in Italy⁶



Source: (eurostat 2021)

3.1.3 Economic Performance

Cost for producers

Although the fee structure is not defined by the national regulatory framework, the majority of PROs in Italy charge EEE producers per tonne POM, the only exception being lighting equipment, which is charged on a piece basis. Based on the estimations provided by market experts, the average fees charged to producers and importers of EEE amounts to 184 € per tonne POM. According to large EEE producers, the PRO participation fees in Italy are very similar among the PROs because all of them use the same treatment plants, thus resulting in similar gate fees (Personal Communication 2021).

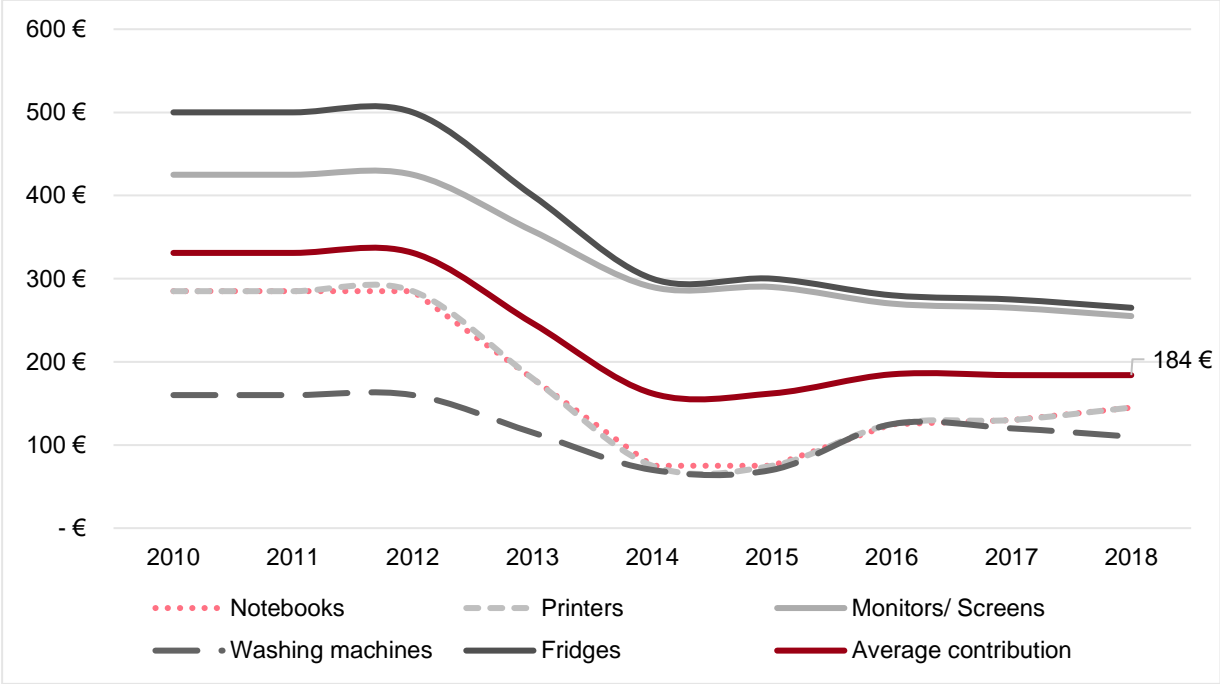
As shown in Figure 10 participation fees were significantly higher (19% - 47%, depending on product category) in the initial years of the system, often exceeding the real costs for PROs, thus partly resulting

⁵ (1) Temperature Exchange Equipment; (2) Screens & Monitors that have a surface greater than 100 cm²; (3) Lamps; (4) Large EEE equipment including among other things large household appliances, telecommunication equipment, luminaire, etc.; (5) small EEE equipment, (6) small IT and telecommunications equipment

⁶ Data for 2016 is not available and was therefore calculated based on data from 2015 and 2017

in the build-up of large financial reserves. Although PROs are technically not allowed to use their reserves to acquire new customers, some gaps in the enforcement still allow the use for activities not-related to the core-business including, for instance, the hosting of events for potential new clients.

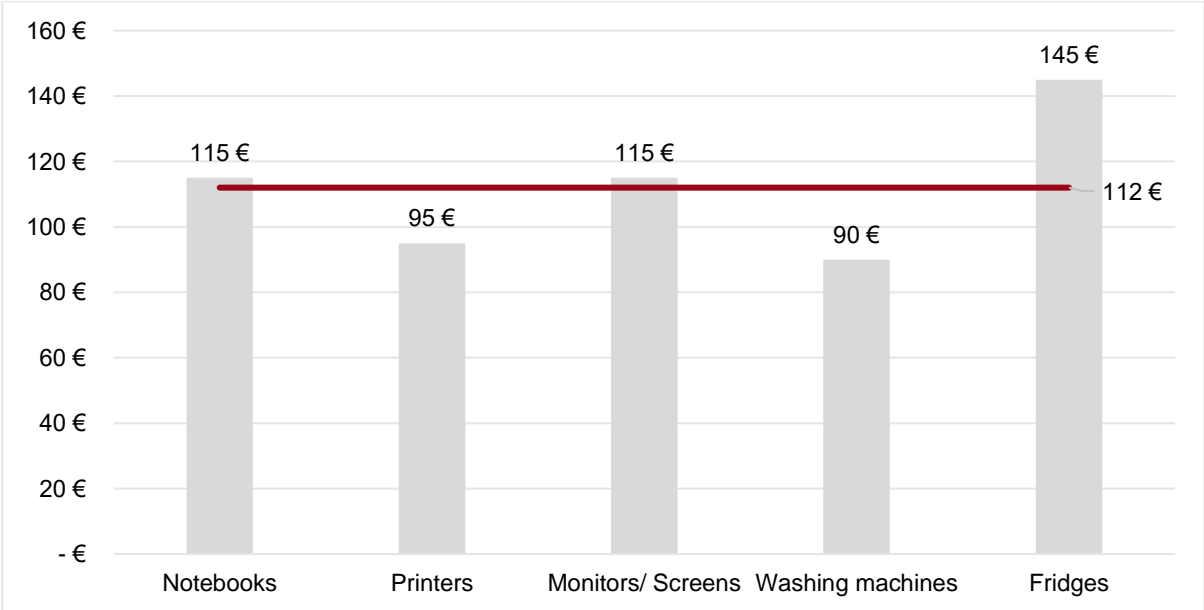
Figure 10: Average contribution per tonne POM for 5 common reference appliances in Italy⁷



Cost for collection & logistics

While the separate collection systems for WEEE from private households are the responsibility of the municipalities, the producers are responsible for financing pick-up and transport of waste from the collection points to recycling facilities (Crocì et al. 2018). Based on approximate market prices for the transport of five reference appliances, we estimate average logistic costs of 112 € per tonne (Figure 11).

Figure 11: Average cost for transport of WEEE from initial point of collection to treatment plant⁸



⁷ The cost where calculated based on an elaboration of the annual standard costs per collection group defined by the CdC RAEE. The standard costs are calculated as a weighted average price applied by the compliance schemes in the Italian market.

⁸ Data represents the approximate market prices as assumed by experts

Best Practice: Efficiency rewards for WEEE collection points

A notable feature of the cost structure of the Italian EPR system for WEEE are the “Efficiency Rewards” for WEEE collection points. Efficiency rewards are financial bonuses paid by PROs to collection points following collection, provided that the amount of WEEE collected reaches or exceeds certain volume thresholds (Table 5). Appliances that were cannibalised (e.g. refrigerators without compressors) are not counted towards the thresholds. This practice not only improves the collection efficiency, but also counteracts WEEE cannibalism and improves the overall quality of the collected WEEE (CDC RAEE 2018; Baldé et al. 2020; Croci et al. 2018).

Table 5: Good operating thresholds and efficiency rewards for WEEE collection points in Italy

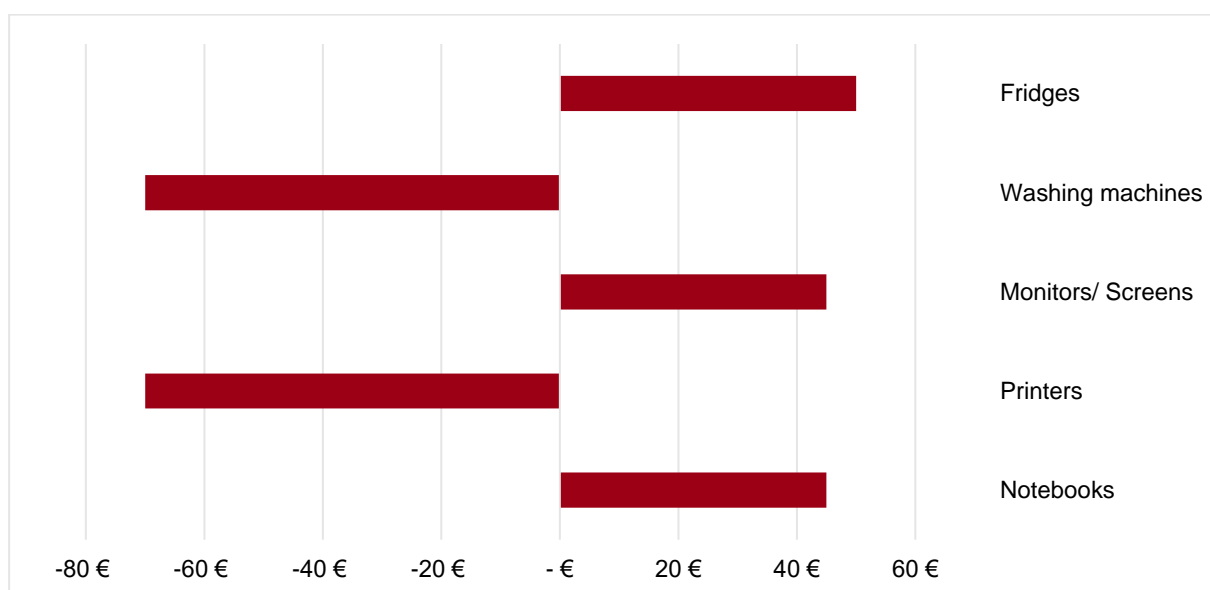
WEEE categories	Good operating threshold (kg)	Efficiency reward (€/tonne)
R1	1,200	55 €
R2	2,000	115 €
R3	1,300	55 €
R4	800	115 €
R5	50 – 100	300 €

In 2019 the collective systems paid a total of 20.264.666 € in efficiency rewards to the collection points (CDC RAEE 2019a). Given the volume of 343.069 tonnes of WEEE collected in the same year, the average magnitude of the efficiency bonus amounts to 59 €/tonne.

Cost for waste recycling and treatment

Naturally, recycling cost for WEEE in Italy are heavily influenced by the prices for raw materials. As raw material values are decreasing, total costs for recycling and recovery are going up because sales revenues from the recovered materials are decreasing as well and vice versa. Figure 12 shows the average costs/revenues for the recycling of the 5 reference appliances in Italy. According to the interviewed experts, the prices for recycling have recently and noticeably increased due to the merger of the two formerly largest PROs and the resulting shifts in market power (Personal Communication 2021).

Figure 12: Costs/revenues for the recycling of WEEE in Italy



Administrative costs

According to cost approximations provided by experts, PROs in Italy spend around 10-12% of their total costs on administration and overheads (Personal Communication 2021).

3.1.4 Technical Performance

Innovation potential

Within the Italian EPR scheme for WEEE, innovation mainly takes place at the level of services offered by PROs that go beyond mere compliance. These services include, among others, consulting services for waste management processes at the production level, as well as customer support services. Each compliance scheme is furthermore actively engaged in developing new innovative solutions that make the recycling of WEEE more efficient or improve the management of recycled materials. The competition between PROs is assumed to be an important stimulus for these activities. However, given the competitive nature of the EPR system, only those innovations are supported by PROs that ultimately help to increase customer experience, efficiency and/or reduce costs of their own operations.

To improve the collection of WEEE from the various collection points, the coordination centre has developed the “MyRdR app”, which allows the operators of collection points to quickly enter collection requests directly from the collection site, even in the absence of a dedicated personal computer. The app further provides the users with a timely and up-to-date control of the status of their requests.

Awareness creation potential

Producers of EEE in Italy are responsible for financing communication, information and education activities, which must be in line with the objectives set out in Article 6 of Legislative Decree 49/2014 and are required to promote public awareness of WEEE and its collection. Although there is no mandatory contribution to be paid, Italian EEE producers have in the recent years agreed to jointly finance national activities that promote the collection of WEEE within the country. The producers' share for these activities is collected through the participation fees of the PROs, which pass it on to the coordination centre according to the respective market share of their members. In 2019, the producers provided a total of 1,000,000 € for information and communication activities.

Using this money, the coordination centre finances nationwide media campaigns on television, radio and social media every year, focusing on a broad target group of people between the age of 14 and 64. Relevant information on the topic of WEEE collection and recycling as well as current information campaigns and initiatives are also published on a dedicated RAEE website (raccoltarae.it).

In 2020, the communication efforts resulted in 196 television commercials and 1,045 airings on six different radio stations (CDC RAEE 2021). A Google Ads campaign for the social media pages of raccoltarae.it further resulted in 83,943,361 impressions and over 555,000 views on YouTube, adding to a total of 807,000 views during one year. Both the ongoing Facebook campaign, which in 2020 was complemented by two new educational initiatives (Colora con RAEE Man and Caccia ai RAEE) and the Instagram channel further increase the number of their outreach to a total of 6,544 followers on Facebook and 6,320 followers on Instagram.

Complementary to the nationwide campaigns, a certain share of the total communication budget is allocated to local communication activities specifically aimed at improving WEEE collection in a given area. To access the funding, all collection operators registered with the coordinating body can submit proposals for information campaigns. An independent steering committee then selects the most promising applications to be awarded funding. In 2019, the producers provided 400,000 € for local communication campaigns (CDC RAEE 2020).

According to the coordination centre and interviewed experts, the large-scale communication and awareness campaigns in Italy have notably improved the overall collection rate and especially the collection of small EEE and information technology. However, large appliances have also shown a significant increase in collection rates following the implementation of the various campaigns mentioned above (Personal Communication 2021).

Best Practice: Coordination of information campaigns

The coordination and implementation of information and awareness-raising campaigns by the coordinating centre defuses possible disadvantages and tensions for PROs to individually invest in large scale campaigns that may not directly improve their own collection results or even benefit their competitors. It has proven to be an effective mechanism to overcome typical win-lose situations for awareness creation in competitive systems.

Stakeholder satisfaction and involvement

EEE producers appear to be generally satisfied with the services offered by the PROs. On the one hand, this may be attributed to the possibility to change PROs in case their offered services are not satisfactory and on the other hand due to the range of additional services that PROs offer beyond pure compliance (see above). All producers have a voice in the consortium of PROs and can further influence decisions of the government and the coordination centre via the various trade association. While producers have used this option to exert a strong active influence on the system in the early years, their participation in the further development of the system has notably decreased in recent years. Especially smaller producers may often also lack the capacities to be actively involved in this process.

3.1.5 Key take-aways

The EPR scheme has significantly increased the quantities of WEEE collected in Italy

The figures reported by the PROs and the coordination centre show a collection rate that increased more than five-fold from initially 1.1 kg per capita in 2008 to 5.7 kg per capita in 2019 (CDC RAEE 2019a; Baldé et al. 2020). A key driver of this improvement is the important role that the EPR system has played in financing disposal infrastructure in Italy, which has led, among other things, to a significant increase in available WEEE collection points. However, it remains to be seen whether the positive trend in collection rates will continue in the coming years.

The coordination centre is a best practice example for competitive EPR schemes on WEEE in the EU

The establishment of the CdC RAEE has been instrumental in ensuring a consistent service for collection and treatment of WEEE throughout the country as well as creating a level playing field for all PROs involved in collection and treatment. As access to collection points is allocated by the coordination centre, PROs in Italy do not have to compete for the access to waste, which in turn is keeping the corresponding cost at a minimum level, while also ensuring that all PROs are able to achieve their collection obligations. The coordination and implementation of information and awareness-raising campaigns by the coordinating centre further defuses possible disadvantages and tensions for PROs to individually invest in large scale campaigns that may not directly improve their own collection results or even benefit their competitors. It has proven to be an effective mechanism for overcoming typical win-lose situations for awareness creation in competitive systems.

There is a significant lack of enforcement with regard to the tracking and reporting of WEEE

One of the main obstacles for improving the collection and recovery of WEEE in Italy is the strong competition between formal operators, other actors and informal actors, which leads to a high share of WEEE being not declared, wrongfully declared or even treated as scrap metal. The issue is further exacerbated by a significant lack of enforcement regarding the declaration of the amount of WEEE treated by unaccredited facilities. Although the current decline in raw material prices is to some extent counteracting the informal treatment of WEEE, this trend cannot be expected to continue indefinitely. It is therefore imperative to increase the transparency of the overall WEEE flows and to ensure that existing regulations are respected. Besides stricter enforcement, additional financial incentives for collection points may be a potential option to be explored. Other options may include a mandatory handover of the collected WEEE to operators registered with the coordination centre. However, this would need to be backed up by effective enforcement mechanisms nonetheless.



3.2 Belgium (WEEE)

Table 6: Belgium - EPR Performance Indicators

	Indicator	Value (2019)
Environmental	Collection rate	42% ⁹
	Waste collection per capita	10.69 kg
	Recycling rate	79.3%
Economic	Cost for producers per tonne POM	52 € ¹⁰
	Cost for collection per tonne collected	n/a
	Cost for waste recycling and treatment per tonne	n/a
Technical	Stakeholder satisfaction levels	Medium
	Innovation potential	Medium - high
	Awareness creation potential	High

3.2.1 Overview

National transposition of Directive 2012/19/EU on WEEE

A collection and processing system for WEEE has been in place in Belgium since July 2001. The provisions of the EU Directives on WEEE and on the Restriction of Hazardous Substances in Electrical and Electronic Equipment were transposed into Belgian law by royal decree in October 2004. The legislative and executive authority for waste management in Belgium has been transferred three competent regional authorities in Flanders, Wallonia and Brussels. The three regional authorities are jointly responsible for achieving the collection target at state level and have transposed the EU guideline into local regulations (FPS Public Health 2016):

- Flemish Region: the decree of December 20th, 2011 regarding the sustainable management of material cycles and waste of the Flemish Government
- Walloon Region: the decrees of March 10th, 2005 and September 23rd, 2010 of the Walloon Government
- Brussels Capital Region: the decree of the Brussels Capital Government of June 3rd, 2004

Under the Belgian legislation, producers (including importers, manufacturers as well as intermediaries and retailers, which distribute or sell their products) that put products on the Belgian market are legally in charge of the collection, treatment, recovery and environmentally sound disposal of that EEE at the

⁹ When including the amount of WEEE reported via BeWEEE Belgium achieves a collection rate of 51%

¹⁰ Calculated based on the per unit-fees and average weight of 5 reference appliances (Notebooks, Printers, Monitors/ Screens, Washing machines, Fridges)

end-of-life. There is no specific “Open Scope” exclusion. A product is deemed to be on the Belgian market as soon as a value added tax (VAT) becomes payable in Belgium (Mallien 2006).

Actors and responsibilities

To comply with their take-back obligations, Belgian manufacturers and importers have founded a single centralised, not-for-profit PRO responsible for managing the collection, sorting, processing and recycling of WEEE, including financing, reporting and awareness raising: Recupel. The system came into force in July 2001.

Recupel operates on the basis of a so-called Environmental Convention (recently the term’s covenant is used as it represents a bit different flexible form of agreement), a contract between the regional authority (each region of Belgium signs a different one) and the EEE industry representatives (e.g. associations). Based on this contractual arrangement, the regional authorities are closely involved in Recupel’s activities by, among other things, sitting on the board as directors, being involved in the awarding of contracts for collection and processing, receiving details of Recupel’s communication campaigns in advance, and playing an important role in all major decisions such as the approval of the annual budget, the year-end accounts and the amount of contributions to be charged.

Instead of joining Recupel, Belgian EEE importers or manufacturers are also allowed to set up their own waste management plan.

3.2.2 Environmental Performance

Collection infrastructure

Recupel organises the collection of WEEE through a range of different collection channels. The majority of WEEE is however collected via recycling or container parks at municipal level where individuals can dispose of their WEEE free of charge. Despite their name, recycling parks only serve as points for collecting and sorting WEEE and do not carry out any further activities related to recycling. Recycling parks are either run by intermunicipal companies or the municipalities themselves (Recupel 2021e). They have a direct agreement with Recupel stating that all WEEE gathered at recycling parks is fully handled by Recupel. This implies that all WEEE that is collected at the recycling park eventually ends up at one of Recupel’s contracted processors (not considering the possibility of theft or WEEE scavenging at recycling parks). In 2019, Belgium had a total of 543 recycling parks (Recupel 2018, 2020).

Retailers, which are obliged by EU law to take back old, comparable appliances whenever a new appliance is bought on a 1-to-1 basis, can also register as a collection point by submitting a request to Recupel. To qualify as a collection point, a retailer must be able to collect at least 8 large appliances or provide for a full box pallet pick-up at least 4 times a year or every 3 months. Complementing the collection points at retail level, small electrical goods (largest dimension L/W/H <25 cm) and light bulbs can be returned via RecyclePoints, usually located in supermarkets or small hardware stores on a 1-to-0 basis. Retailers can register as an official RecyclePoint via the Recupel Website. In 2019 there were 4,862 collection points in the distribution sector and about 3,231 RecyclePoints available throughout Belgium.

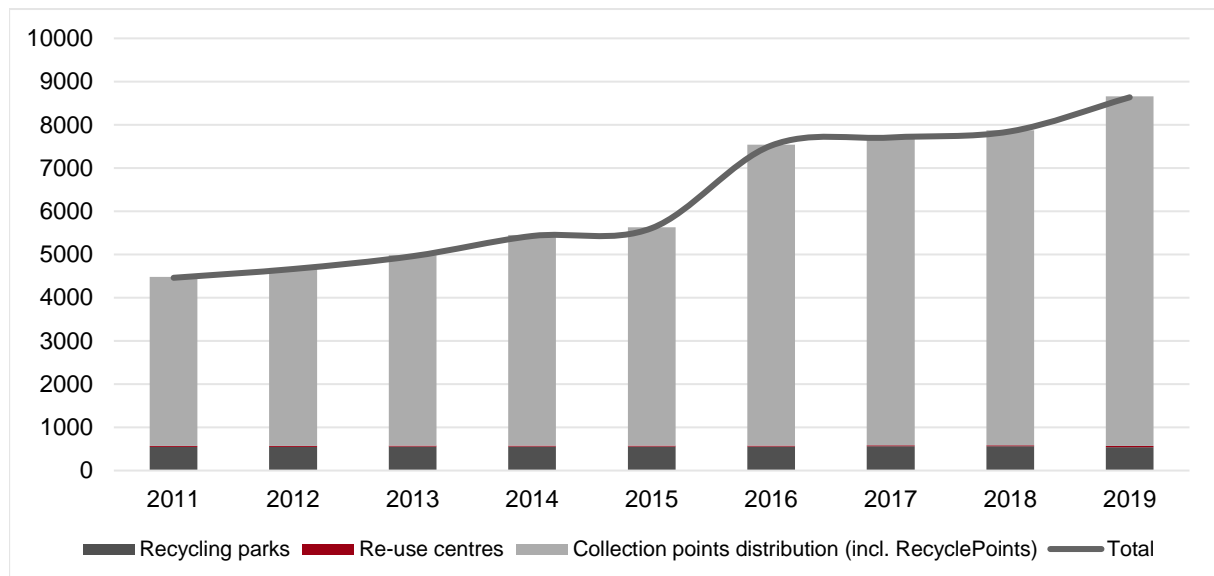
In case used EEE is still in working order, consumers can also bring their unwanted equipment to one of the 25 re-use centres that work directly with Recupel. The re-use centres carry out necessary repairs and prepare the collected appliances for re-use. These appliances are then taken to one of the many second-hand shops to be remarketed.

Best Practice: Dense WEEE collection network with strong involvement of the retail sector

In 2019 there were a total of 8,663 recycling parks, retail collection points, RecyclePoints and re-use centres in Belgium, 1 for each 1,322 citizens (Figure 13). The dense collection can be assumed to be a major driver for the comparatively high collection results of WEEE in Belgium. The strong involvement and participation of the retail sector as collection points as well as the numerous RecyclePoints for small appliances further amplifies this effect.

Recupel's collection network is further supported by Recupel Approved Collectors (RAC) that are individually engaged in the collection of WEEE. To become an RAC, a company needs to sign the Recupel charter for the collection of WEEE. The charter network is mostly used by companies for the collection of professional WEEE appliances. In 2019 there were 91 charter collectors registered with Recupel (Recupel 2020).

Figure 13: Development of the collection network in Belgium



Source: (Recupel 2020)

Organisation of the collection system

In case WEEE needs to be picked up from a recycling park or collection point at the retail level, the corresponding intermunicipal companies/municipalities/retailers can turn to Recupel with a transport request. Recupel then arranges a pick-up via one of its contracted transporters. The transporters collect the full containers/box pallets and provide the recycling parks with new empty ones free of charge. The WEEE is then transported to one of Recupel's approved WEEE processors (Recupel 2021c). In case of RecyclePoints for small WEEE or light bulbs, operators can call a dedicated number to arrange for collection within a 3-days' time frame (Recupel 2021d). However, not all actors involved in the collection of WEEE are obliged to hand over WEEE to Recupel (Recupel 2018; Baldé et al. 2020).

The contracts for the transport of WEEE in Belgium are regularly put to tender by Recupel for a fixed contract period of 3 years. However, some waste treatment operators have voiced their concerns about the procurement process not being sufficiently transparent, making it, among other things, difficult for them to understand on what basis the winning bid was selected. This in turn results in a perceived lack of fairness on the part of some companies. For the collection and treatment of professional (non-household) WEEE, Recupel provides a list of accredited recyclers on its website, via which offers can be requested. In this case, Recupel only acts as a facilitator but does not directly engage in the management process.

Reporting and validation process for statistical data on WEEE collection, recovery and recycling

All actors that have a direct contract with Recupel are required to report the amount of WEEE collected, treated and prepared for re-use to Recupel. The reporting system and the collected reporting data are regularly (at least once a year) audited by an external party. Recupel in turn prepares a detailed annual report on the collected and treated amounts for submission to the competent authorities. The same applies to the quantity of EEE POM of producers who have a membership with the PRO. All members are regularly audited by Recupel in order to assure completeness and accuracy of the data provided. Producers that have set up individual plans for the collection and treatment of WEEE also provide their numbers (EEE POM, WEEE collected, WEEE treated) to Recupel.

Challenge: High share of undocumented WEEE flows

Despite the well-developed formal WEEE collection network, the share of WEEE that is collected, treated and/or re-used in Belgium but not reported to and by Recupel (documented non-registered WEEE flows) is estimated to be relatively high (20% in 2017). A high proportion of this non-registered WEEE can be attributed to the treatment of WEEE as metal scrap. This is mainly due to the fact that the processing of metal scrap does not require dismantling and treatment processes according to the high standards for WEEE, which in turn significantly reduces the associated costs and thus makes the treatment profitable. As a result, some collection points have an incentive to sell their collected WEEE to metal scrap dealers instead of handing it over to transporters contracted by Recupel. A study on WEEE flows in Belgium estimates that about 9% of all WEEE POM ends up as metal scrap. Another large share of documented non-registered WEEE is composed of legal EEE exports to other countries (e.g. for second-hand use) and therefore cannot be collected and treated in Belgium. It is estimated that EEE exports account for about 6.5% of EEE POM¹¹. The smallest share of unregistered flows can be attributed to WEEE wrongfully disposed of in the municipal waste, amount to about 1.5% of EEE POM (Recupel 2018).

Best Practice: Additional reporting tool for previously undocumented WEEE streams

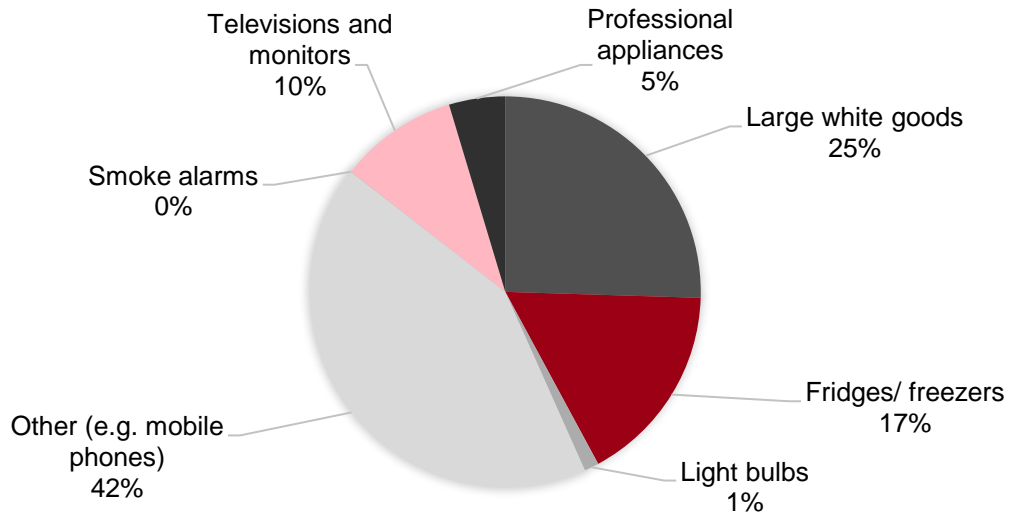
To improve the reporting results and reduce the amount of unregistered WEEE flows, Recupel has, together with other non-profit organisations, developed the BeWEEE tool in 2018. BeWEEE is a reporting tool via which actors that have a contract with Recupel but only report a certain part of the WEEE they treat to Recupel, as well as actors that do not have a contract with Recupel, can comply with their reporting obligations more easily and report the amounts of WEEE POM, collected, treated and re-used. Although BeWEEE was used to report 28,554 tonnes in 2019, only 25% of the companies that do not report to Recupel actually used the tool, pointing towards significant room for improvement in the reporting unregistered WEEE flows (Baldé et al. 2020; Recupel 2020).

¹¹ Not including the illegal export of WEEE, which is neither documented nor registered due to its illegal nature.

Achievement of the EU collection target

In 2019, Recupel collected 122,548 tonnes of WEEE, representing about 42% of the average amount of WEEE POM in the 3 previous years (Recupel 2020; BeWEEE 2020)¹². Although the collection rate is relatively high compared to other European countries, the EU's target collection rate of 65% was not achieved. The share of WEEE categories collected is shown in Figure 14.

Figure 14: WEEE collection as per category in Belgium

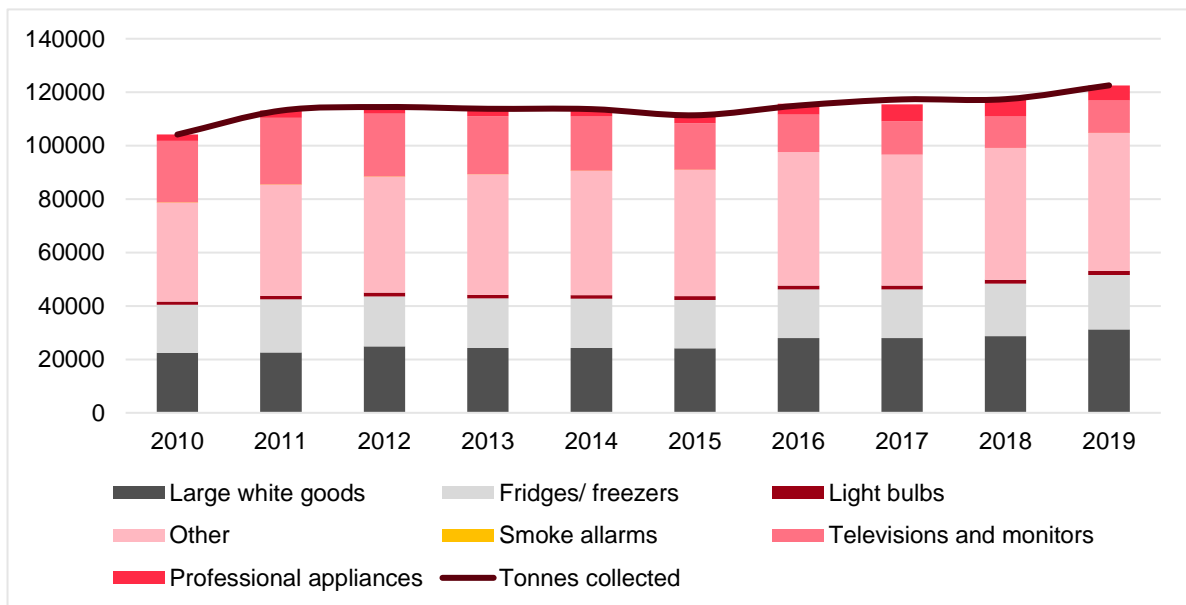


Source: (Recupel 2020)

Development of the collection rates (in %) between 2010 and 2019

While the total volume of collected WEEE in Belgium has been relatively high since 2011, the country is recently facing difficulties in further increasing its collection results (Figure 15). It is assumed that especially the undocumented WEEE flows are a major driver behind this development. Additionally, free riders have become an increasingly pressing issue for Belgium over the recent years. This development is expected to continue in the near future as the share of EEE sold via e-commerce increases (Baldé et al. 2020).

Figure 15: Development of WEEE collection in tonnes/year in Belgium

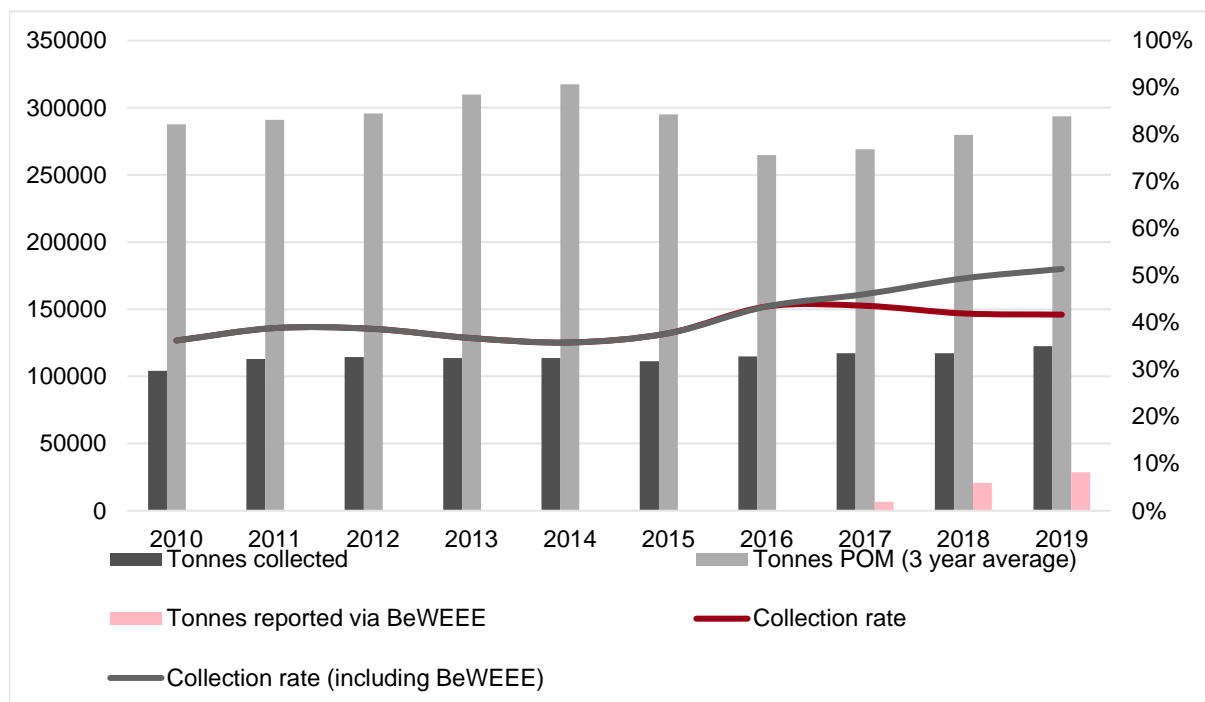


Source: (Recupel 2016, 2020)

¹² When adding the 28,554 tonnes of WEEE reported via BeWEEE in 2019 the collection rate increases to 51% of the EEE POM in the 3 preceding years

Despite the almost unchanged volumes of WEEE collected by Recupel, the reporting of previously non-registered WEEE flows via BeWEEE has, since 2017, significantly increased the reported volumes of collected WEEE. While in 2017, 6,662 tonnes were reported directly in the tool, the volume of WEEE reported via BeWEEE grew to 28,554 tonnes in 2019 (BeWEEE 2020). As a result, the total collection rate in Belgium improved significantly since 2017 (Figure 16). With regard to the collected WEEE categories, there has been a particular increase in the collection of small EEE such as mobile phones, computers and electric toothbrushes in the “other” category, which improved by 5% from 2018 to 2019. The number of collected large white goods also increased by 9%.

Figure 16: Development of WEEE collection rates in Belgium



Source: (eurostat 2021; BeWEEE 2020)

Treatment Capacities

In 2017, there were a total of 14 recycling facilities (processors) approved by Recupel (also referred to as Recupel Approved Recyclers). These facilities can, to the extent possible, either process the WEEE within their facilities or choose to bring the WEEE to another (more specialised) approved processor. In addition, there are companies that have a contractual agreement with Recupel for the processing of the WEEE that Recupel collects. As of December 2017, there were 10 Recupel contracted processors in total (Recupel 2018). Taken together, the existing recycling capacities in the country are more than sufficient to treat the WEEE generated in Belgium. This is also reflected in a relatively low share of WEEE treated outside of Belgium (4% of the total WEEE collected in 2019) (eurostat 2021). However, there are differences in the availability of recycling facilities between the regions (e.g. Wallonia compared to Brussels).

Similar to the transport of WEEE, contracts for the recycling of WEEE in Belgium are regularly put to tender by Recupel for a fixed contract period of 6-9 years. Although long-term contracts support recycling operators in making long-term investments, some operators have also expressed concerns about the long contracting periods. They argue that it is very difficult to renegotiate the contractual terms and conditions with Recupel, which could be problematic for some operators in a fast-moving segment with volatile market prices of the output fractions typical for WEEE processing.

Apart from Recupel Approved Recyclers and contracted processors, there are companies collecting and processing WEEE that do not maintain a direct contractual relation with Recupel. These companies can either transport WEEE to a Recupel Approved Recycler, an unlicensed processor (in Belgium or abroad) or recycle the WEEE within their own facilities (Recupel 2018).

Processing requirements

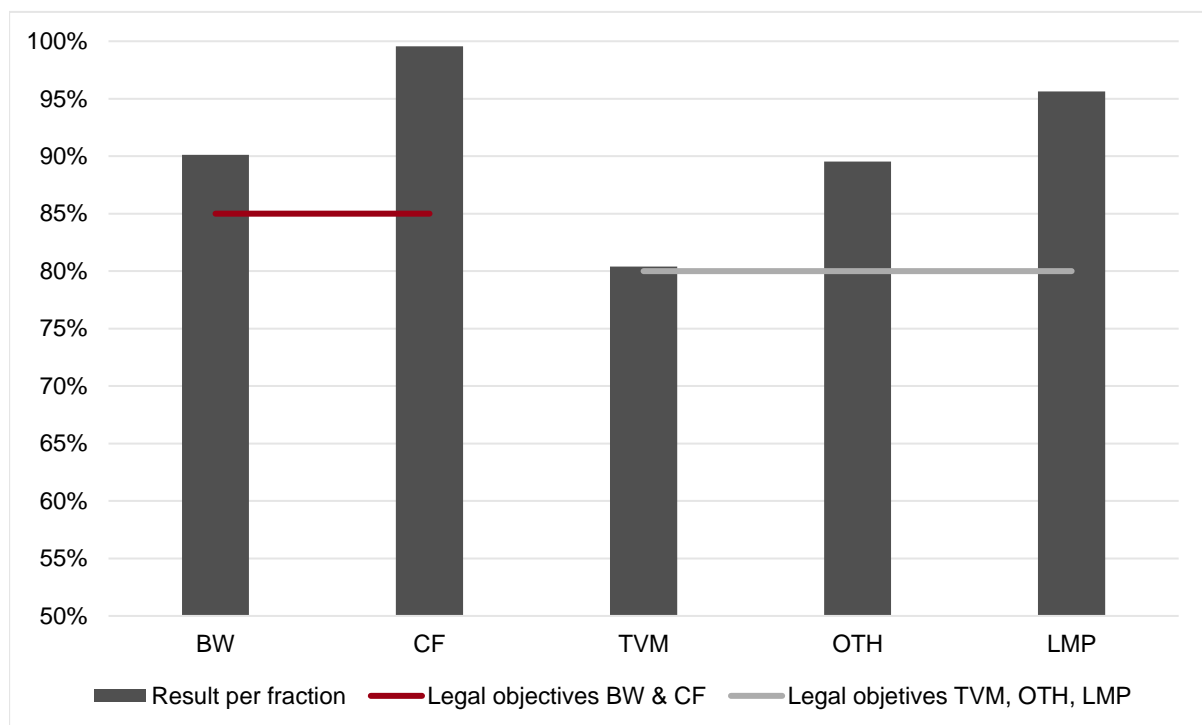
In accordance with EU requirements, the processing of WEEE at a Recupel Approved Recycler is carried out in two steps. First, the most contaminated parts need to be removed during manual disassembly. For small appliances and computers, this includes batteries, cables and small light bulbs as well as the cartridges from printers. All electronic components must be put aside. Television and computer screens must be processed separately because they contain heavy metals (lead in the glass, fluorescent metal powder in the screens). The wooden or plastic construction must be dismantled, electronics and screens must be removed. Since old refrigerators and freezers often contain freon gas (or CFRP) in the insulating foam and/or as part of the cooling liquid, these appliances must be degassed and oils must be removed from the compressor. The coolant gas must then be separated from the oil. To recover the freon gas in the insulating foam, the foam is vacuum-shredded and converted into powder. The released gas must be collected.

All harmful substances that are removed from the WEEE (e.g. asbestos, mercury, condensers, batteries, etc.) either need to be recovered (e.g. mercury, oils, ink cartridges, etc.), destroyed (e.g. via incineration) or processed in an environmentally friendly way at authorised companies. The remaining parts must be mechanically shredded, with materials such as ferrous and non-ferrous metals, glass and various plastics separated and recovered as far as possible (Recupel 2021c). Recupel regularly conducts site visits and audits to verify that the conditions at their contracted recycling sites are in line with these requirements.

Achievement of recycling/preparation for re-use targets per waste category in 2019

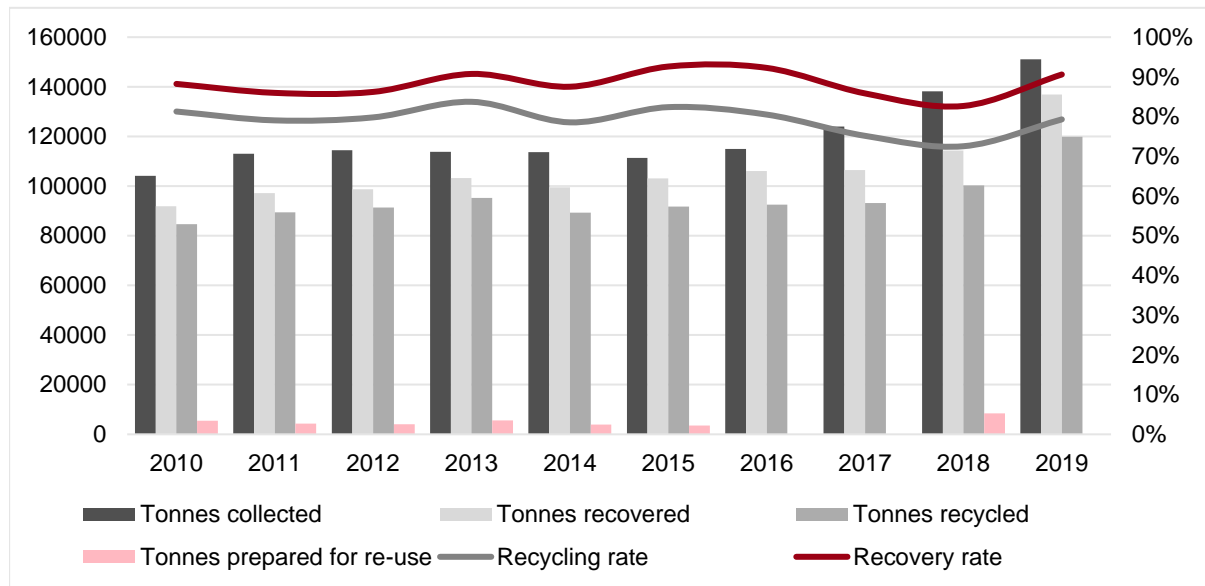
According to Recupel, about 79.3% of the WEEE that cannot be repaired is recycled in line with the above-mentioned standards, while 10.7% is incinerated (Recupel 2020). For the recycling of WEEE, Belgium has further set specific recycling quotas that exceed the legal objectives set by the EU. According to these quotas, 95% of all ferrous and non-ferrous metals as well as 80% of all plastics (with a useful application of 100%) have to be recycled. With respect to the different WEEE fractions, the following targets apply: 85% for fridges and freezers (CF), 85% for big white goods (BW), 80% for televisions and screens (TVM), 80% for light bulbs (LMP) and 80% for other devices (OTH). As displayed in Figure 17, the recycling results as reported by Recupel in 2019 meet or exceed these objectives.

Figure 17: Recycling results and legal objectives per appliance category in Belgium



Source: (Recupel 2020)

Figure 18: Development of the recycling and recovery rates in Belgium



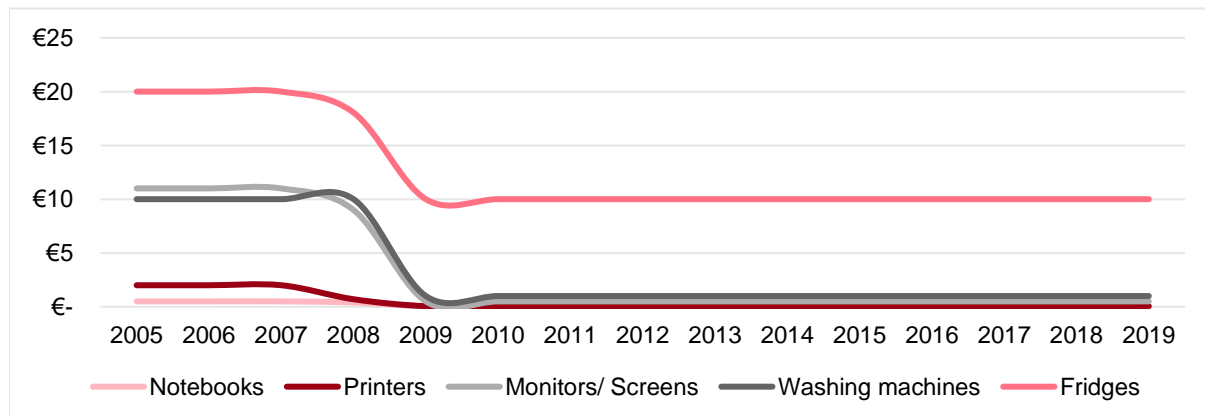
Source: (eurostat 2021)

3.2.3 Economic Performance

Cost for producers

All producers of electrical appliances and light bulbs that have a membership with Recupel are required to pay a financial contribution for each product POM. The amount of the contribution is, in consultation with the supervising authorities, determined by the competent Recupel sector non-profits. It is calculated on the basis of, among other things, the average weight, the components in the device, the collection percentage, the processing technique and the service life of the product (Recupel 2020). While producers of household appliances are charged with an “all-in” contribution that covers the costs for the collection, sorting, treatment and recycling of WEEE in Belgium, producers of professional EEE only have to pay an administrative contribution. This contribution covers the costs incurred by Recupel for administration and reporting but not those for collection and treatment (Recupel 2019). The applicable contributions are regularly published on Recupel’s website (Recupel 2021a). For the five selected reference products presented in Figure 19, the “all-in” contributions have remained unchanged since 2010 at 0.05 € per notebook, 0.05 € per printer, 0.5 € per monitor/screen, 1 € per washing machine and 10 € per refrigerator POM. Based on the average weight¹³ of these appliances, Figure 21 displays the average contributions per tonne POM.

Figure 19: “All-in” contribution per device charged by Recupel for 5 reference appliances



Source: (Recupel 2021a)

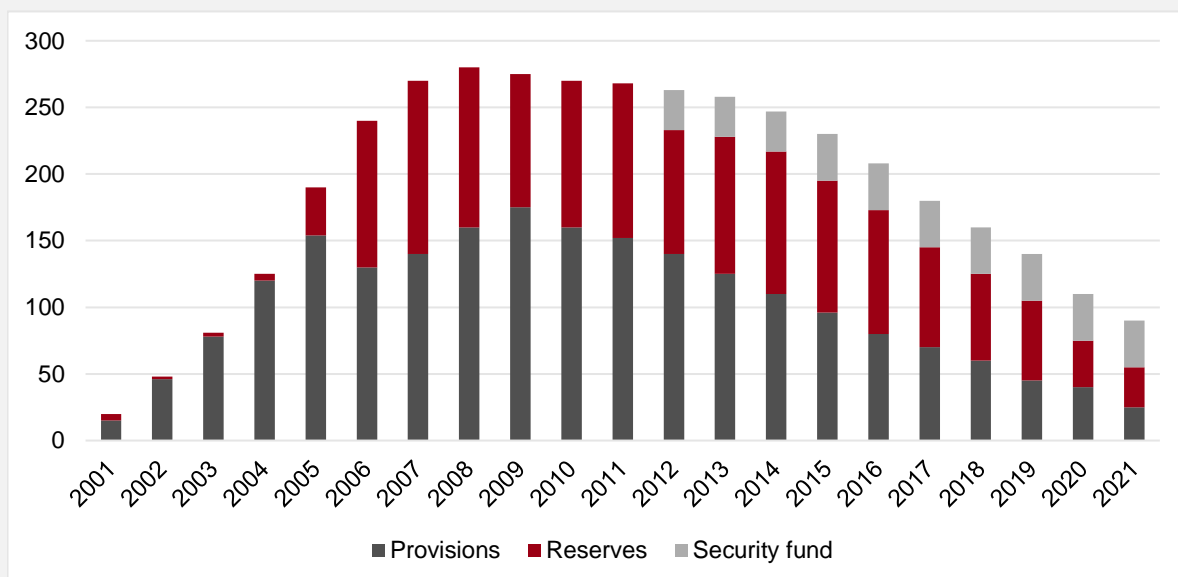
¹³ The average weight was calculated based on the weight of comparable appliances most frequently sold on amazon.de. The following weight averages were applied in the calculation: Notebooks (1,4kg); Printers (3kg); Monitors/ Screens (15kg); Washing Machines (64kg); Fridges (63kg)

Challenge: High initial contributions led to the build-up of large financial reserves

Compared to the contributions collected by PROs in other European countries, the "all-in" contributions collected by Recupel are rather low. However, it should be noted that the contributions charged by Recupel at the beginning of the scheme were significantly higher (Figure 19). In fact, the contributions were so high that the income exceeded the costs incurred and thus led to the accumulation of about 280 million € in financial reserves by 2008. Recupel has since reduced its reserves by drastically lowering producer contributions and partially paying for the costs of collection, transport and recycling of WEEE (Figure 20). In 2019, Recupel was still in the process of reducing its reserves and it can thus be assumed that the above-mentioned contributions do not fully cover the actual costs incurred for collection and disposal. While it can be argued that Recupel is using the reserves resulting from the high initial contributions to cover its current obligations, thus offsetting the historically higher costs for producers, it must also be taken into account that not all of the producers benefiting from the current low prices were already on the market before the contributions were reduced. Therefore, it is mainly new producers who benefit from the contributions from producers who have been on the market for a longer period of time.

By 2025, Recupel aims to use up all reserves and arrive at a "pay-as-you-go" system to cover the costs of the collection, transport and recycling (Personal Communication 2021). Once this target is achieved, it is expected that contributions will increase.

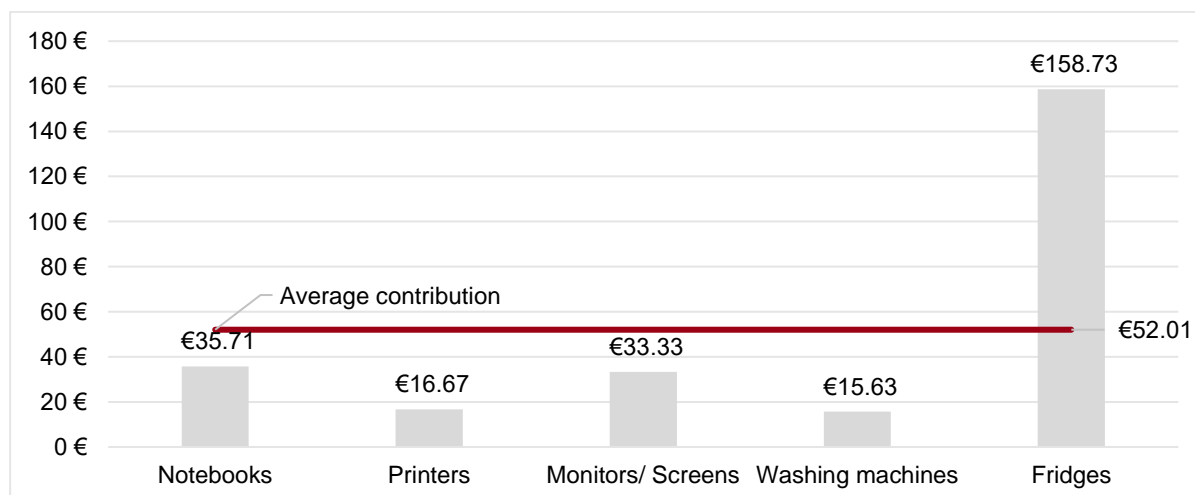
Figure 20: Development of Recupels financial reserves (in million €) between 2001 and 2021¹⁴



Source: (Recupel 2017)

¹⁴ The data for the years 2017 – 2021 represents a forecast of the development of the reserves as calculated by Recupel in 2017

Figure 21: Average Recupel contribution (tonne/POM) based on 5 reference appliances



Cost for collection and logistics

In the context of collection services, Recupel fully compensates local authorities (municipalities, intermunicipal waste companies) for all costs related to the collection of domestic WEEE at the level of recycling/container parks. This includes, for instance, compensation for information services provided by park guards to consumers in the container park (Recupel 2021c). Moreover, Recupel provides financial reimbursements for operators of collection points (usually retailers or distributors) to compensate the temporary storage of WEEE. In order to receive reimbursements, the operators need to be registered as a collection point with Recupel, have a sufficient number of appliances collected and have signed a distribution contract (Recupel 2021b).

The financial reimbursement paid by Recupel to transport operators for pick-up, sorting and transportation to the recycling facilities depends on the respective contractual agreements between both parties. According to the experts interviewed, the high availability of recyclers in Belgium enables Recupel to organise the transport of WEEE from recycling points in a cost-efficient way (Personal Communication 2021). As of today, quantitative data on the total cost for collection and logistics occurred as a result of Recupel's activities are not publicly available.

Cost for waste recycling and treatment

Financial reimbursement paid by Recupel to recycling facilities depends on the respective contractual agreements. However, stakeholders from the Belgian recycling sector have expressed concerns that the remunerations paid for the correct recycling of WEEE may not always be sufficient, thus further incentivising the incorrect treatment of WEEE (e.g. as metal scrap). Specific figures on the total cost for the recycling and recovery that occurred as a result of Recupel's activities are currently not publicly available. The well-developed recycling capacities in Belgium (see above) and the comparably small size of the country are likely to have a positive influence on the prices because there is no need for long-range transport of WEEE, thus reducing costs for logistics.

Administrative costs

According to the financial results published in the 2019 annual report, Recupel spent 7.4% (3,078,657 €) of its entire operating charges (41,219,938 €) for remunerations and direct social securities. This represents a slight increase from 7.2% in 2018 (Recupel 2020).

3.2.4 Technical Performance

Innovation potential

Recupel actively invests in new innovative approaches to support the collection and recycling of WEEE in Belgium. Thereby, the PRO shows a strong focus on innovation that supports the different stakeholders within the country. To address the large amounts of WEEE hoarded in businesses, schools

and healthcare, Recupel launched the digital marketplace "Smartloop" in 2019. Smartloop significantly reduces the administrative and logistical burden associated with organising collection and recycling, as organisations can use the marketplace to post their appliances, agree on a price and arrange for a collection date (Smartloop 2021).

With the goal to develop a self-learning sorting software, Recupel also engaged in a cooperation with the University of Antwerp in 2018. The system automatically recognises different types of electronic appliances (e.g. mobile phones, small household appliances, radios, computers and DVD players), the corresponding brand and the year of manufacturing. Eventually, this software could be applied in recycling facilities to identify appliances that contain valuable materials and sort these even more accurately (Recupel 2020). The BeWEEE tool (see 3.2.2) is another innovative tool, that has been developed by Recupel in cooperation with other partners. Despite its apparent success in increasing the registered volume of collected WEEE in Belgium, some stakeholders have voiced their discontent about the user-friendliness and added-value of the tool.

Awareness creation potential

Recupel is also responsible for information and awareness campaigns. To comply with this obligation, Recupel frequently engages in nation-wide, large scale campaigns that aim to improve the overall collection and recycling results of WEEE in Belgium. The most recent campaign in this context was termed "Missing-Fridges" and aimed at tackling the issue of a large number of end-of-life fridges and freezers in Belgium never ending up at a certified recycler. As part of the campaign, Recupel launched a quality label for traders with which consumers can safely leave their old fridges as well as an online competition for which any consumer with an end-of-life fridge could register, have a tracker installed in their fridge and follow its entire journey from collection to processing. As a result of this campaign, Recupel and its partners increased the number of collected fridges by 9% and signed up 249 kitchen builders and electro dealers for the quality label (Recupel 2020).

Another campaign to increase awareness for the collection of light bulbs and fittings was launched by Recupel in 2018. As part of the campaign, Belgian citizens were invited to nominate hidden treasures of their country, which after having been selected by a jury, were illuminated by Recupel. To encourage young people to provide their WEEE for recycling or re-use, Recupel furthermore runs pop-up cafés in different Belgian cities since 2016 (in 2019: Ghent, Brussels and Louvain-la-Neuve). In exchange of old EEE, the café offers visitors a free local beer, a juice or a soup. The café also provides visitors with information about the importance of re-using and recycling EEE (Recupel 2020).

Together with GoodPlanet, Recupel has also developed an interactive game, targeted at younger people, which shows players where EEE is made, what materials it contains, and why it is essential to bring broken appliances to collection points. The game further introduces its players to the concepts of Circular Economy and Urban Mining (Recupel 2020).

Stakeholder satisfaction levels

Although there are currently no market studies on the level of stakeholder satisfaction regarding the Belgian EPR system for WEEE, it can be assumed that the low contribution and good collection results currently lead to a high level of satisfaction among producers. However, some waste management operators and their corresponding associations seem to be dissatisfied with Recupel's operations in recent years. In this context, a lack of transparency in the tendering process, very strict contract conditions, low remunerations and insufficient involvement in the planning processes were mentioned.

3.2.5 Key take-aways

The dense collection network and well organised information campaigns in Belgium significantly contribute to high collection rates for WEEE

The dense collection network for WEEE in Belgium offers one collection point for every 1,322 citizens. It can be assumed to be a major driver for the comparatively high collection results of WEEE in Belgium. The strong involvement and participation of the retail sector as collection points as well as the numerous RecyclePoints for small appliances further amplifies this effect. Moreover, the well-organised, large-

scale awareness-raising campaigns that Recupel has conducted in recent years have proven to be very successful in informing Belgian citizens about where and how to dispose of WEEE in an adequate manner. This has likely contributed to a higher proportion of WEEE being disposed of through the official collection network.

Reporting tools like BeWEEE can significantly reduce the share of non-registered WEEE flows but its value-added needs to be communicated clearly

Similar to other European countries, the share of unregistered WEEE collected and recycled in Belgium is still relatively high. With over 28,554 additional tonnes of WEEE reported in 2019, the BeWEEE tool is evidently successful in tracing these flows. However, the comparatively low share of waste management operators not registered with Recupel that are using the tool shows that there is still room for improvement, which in turn likely requires additional capacities for enforcement at the level of WEEE collectors and recyclers. Moreover, the value-added of the tool needs to be clearly communicated. Alternative approaches may include attempts to convince more waste collectors and processors to join Recupel's formal network, for instance by offering more attractive contract conditions.

Despite the dense collection network, the share of WEEE treated as metal scrap is still high

With approximately 9.06% of EEE POM, a significant share of EEE is treated as metal scrap instead of WEEE. Similar to other countries, this trend is heavily influenced by the value of raw materials and the higher value of metal scrap when compared to WEEE. Possible measures to address this problem could be the introduction of additional financial incentives for scrap dealers, rewarding the sorted collection and transfer of WEEE and thus compensating for the difference in value compared to the treatment of scrap metal. This principle has been introduced in Switzerland, reducing the share of WEEE in scrap metal to almost zero (Baldé et al. 2020). A mandatory handover of WEEE to authorised collectors and processors or the introduction of additional reporting obligations for WEEE collected and processed by scrap metal dealers may also contribute to lowering the amount treated as metal scrap. However, none of these options are likely to be effective without additional enforcement efforts .

Recupel has saved up considerable financial reserves which contributes to lower fees in the short run

The large financial reserves that have been build up in the initial years of the system are still being used to finance a part of Recupel's operations. The financial reserves which have been financed by the producers at that time thus allow Recupel to reduce contributions charged to their current members. A comparison with producer costs in other European countries is therefore currently not possible on a 1-to-1 basis. While the contributions are likely to rise after financial reserves have been melted down entirely, it remains to be seen how they will develop in the future.

3.3 Germany (Packaging)



Table 7: Germany - EPR Performance Indicators

	Indicator	Value (2018)
Environmental ¹⁵	Collection rate	84%
	Packaging waste collection per capita	72 kg
	Recycling and treatment rate	84%
Economic	Average cost for producers per tonne	287.5 €
	Average cost for collection per tonne	158.5 €
	Average cost for sorting and treatment per tonne	62.6 €
Technical	Stakeholder satisfaction levels	Medium
	Innovation potential	Medium
	Awareness creation potential	Low-Medium

3.3.1 Overview

National Transposition of Directive 94/62/EC

The EPR scheme for packaging waste in Germany was established in 1991 in the form of the German packaging ordinance (Verpackungsverordnung). Since then, it was amended multiple times to lay out increasingly ambitious targets, transpose the requirements of the EU Packaging and Packaging Waste Directive (94/62/EC) into national law and increase the performance of the system as a whole. Starting out as monopolistic scheme with only a centralised, non-profit PRO, the German EPR scheme eventually evolved into a decentralised scheme with several competing for-profit PROs. Most recently, in 2019, the packaging ordinance was replaced by the Packaging Act (Verpackungsgesetz) which introduced several far-reaching changes to the EPR scheme (Bünemann et al. 2020).

With the shift from a monopolistic to a competitive system from 2003 onwards, several for-profit PROs became active on the German market (Landbell 2020). The change was driven by several investigations from the European Commission and the German anti-trust agency. Even though the move towards a competitive system initially created challenges in its own right, it ultimately decreased the cost for collection and recycling and significantly lowered the corresponding fees for producers (Bünemann et al. 2020). The latest landmark development of the German EPR scheme is reflected by the creation of the Central Agency Packaging Register (Zentrale Stelle Verpackungsregister; ZSVR) in 2019, which operates a uniform data reporting platform LUCID as a tool that seeks to monitor compliance and

¹⁵ Collection, recycling and treatment rates are based on packaging volumes collected by PROs in relation to the licensed amounts

increase transparency. In addition, the Packaging Act includes stricter targets for recycling of collected packaging (Bünemann et al. 2020).

Actors and responsibilities

Under the German Packaging Act, all producers (or other initial distributors of packaging who are subject to participation in the EPR scheme) are obliged to assign a PRO for the collection, sorting and disposal of all packaging which they put on the market. The German approach is unique in the European context as separate collection has been mandatory for all types of packaging and not just for specific packaging types for many years.

Packaging covered by the EPR scheme includes all types of retail packaging or outer-packaging that typically accumulates as waste at the level of private households or comparable sources (private end-consumers). Also included are packaging types designed for the handover (service packaging) and shipment of goods (shipping packaging) to the end-consumer. The Packaging Act also covers secondary packaging offered to end-consumer and packaging which facilitates the handling and transport of goods (transport packaging) but is typically not intended to be passed down to the end-consumer. Notably, most beverage containers are excluded as they are covered by a deposit-refund scheme¹⁶ (Hesselmann service GmbH 2021).

To comply with their obligations, all producers (or initial distributors) of the above-mentioned packaging types are required to contract with one of the German PROs (Figure 22). Contributions paid to PROs are based on the market share of the producers and cover all costs related to collection, sorting and recycling of packaging waste and well as administrative expenditures. The PROs in turn engage in contracts with municipalities and waste management operators on behalf of the producers (Bünemann et al. 2020). Upon collection, the PROs hold ownership of the waste streams and as such have the full organisational responsibility for the collection, sorting and recycling of the packaging waste along the entire end-of-life value chain (Deloitte 2017).

In exceptional cases, the German law also allows for the establishment of industry solutions that do not require the producer's membership in a PRO. In order to obtain approval for an industry solution, the producer must demonstrate that an authorised and free-of-charge disposal infrastructure is available and furthermore assume all reporting obligations that are usually covered by the PRO. Industry solutions can only be applied to packaging that is supplied directly to establishments that are comparable to the end consumer, such as the catering industry, hotels or hospitals (§3 of the Packaging Act). An example of a common industry solution are containers for motor oil sold at petrol stations.

Best Practice: Public Registry

With the Packaging Act coming into force all manufacturers and initial distributors of packaging are since January 2019 obliged to register with a public register, the Zentrale Stelle Verpackungsregister (ZSVR). In addition to its role as a public register, the ZSVR is also responsible for registering the quantities of packaging placed on the market by each producer, monitoring data reporting and declarations of completeness, as well as quality control of the data submitted. The ZSVR is collectively financed by all PROs in proportion to their respective market share and is monitored by the German Environmental Protection Agency (Umweltbundesamt; UBA) (Stiftung zentrale Stelle Verpackungsregister 2020a). The complete list of all registered manufacturers and initial distributors is accessible to everyone in the public section of the packaging register LUCID.

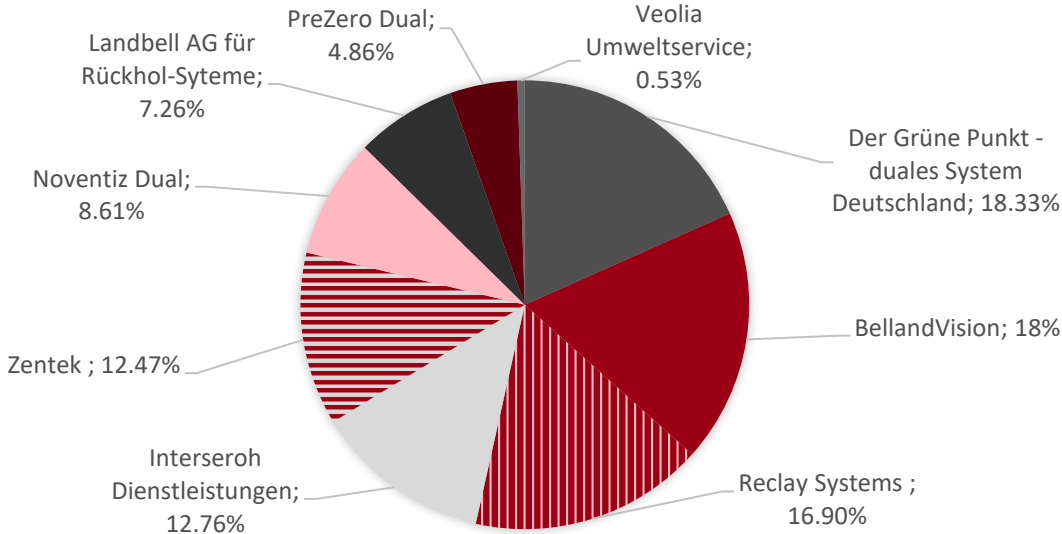
With more than 200,000 companies registered and a corresponding participation rate of about 76% in 2020 the ZSVR has already made a significant contribution to increasing the participation rate of producers in the German EPR scheme.

In order to better coordinate their activities, the PROs in Germany have also founded a joint body: the Gemeinsame Stelle der dualen Systeme Deutschlands GmbH (GS). In addition to facilitating the

¹⁶ The deposit refund system for PET- bottles and cans was established in the early 2000s and is by now integrated into the Packaging Act (Bünemann et al. 2020). The collection infrastructure for glass, plastics and paper/cardboard is organized jointly by the PROs in close cooperation with the municipalities.

communication between PROs, the GS primarily assumes a clearing function by coordinating the competition-neutral tendering of waste collection services in the disposal areas. All PROs are obliged to join the GS by law.

Figure 22: PRO market share in 2020 (based on the amount of packaging POM by their customers)



Source: (Statista 2020)

3.3.2 Environmental Performance

Collection infrastructure

Depending on the packaging type, the collection of packaging waste in Germany is organised via different types of collection containers and employs a mix of various methods: glass in glass containers (bring-system), paper and cardboard packaging in a "blue bin" or paper containers and lightweight packaging (LVP) typically in a "yellow bin" or via "yellow bags" (household collection system). The type of collection system, the size and types of containers as well as the collection intervals are defined within reconciliation agreements between municipalities and PROs (based on §22 Packaging Act). Collection containers are paid for by the PROs and are provided via the municipalities or collection service provider.

Authorised operators are required to collect all of the above-mentioned packaging waste fractions in designated bags or bins from the PROs joint collection and deliver it to allocation centres where individual PROs take over the material in a volume according to their market share for further segregation and processing. Public waste management authorities may also ask the PROs to make use of the local public collection service providers and collection infrastructure, typically available for separate collection of paper, cardboard and carton, for an appropriate fee.

Organisation of the collection system

The collection of packaging waste in Germany is organised jointly between all PROs. For this purpose, the PROs assign lead negotiators, responsible for running the tendering of collection services in certain collection areas (about 500 municipal areas). The responsibility is regularly allocated by the GS via a lottery procedure and in proportion to the PROs market shares. Each year, about one third of the areas are allocated for a period of three years.

Best Practice: Competition-neutral collection

The PRO that has been assigned as a lead negotiator for a particular collection area has the sole responsibility for tendering the necessary collection services, negotiating the price on behalf of all PROs. As the lead negotiator is also required to cover at least 50% of the collection cost in the tendered area there is a strong interest to negotiate the best price. While municipalities are allowed to participate in tenders, they do have to compete with the other private waste management companies (eunomia 2020).

The joint collection of PROs, the related tendering process and the fair allocation of collection volumes and costs for waste-collection, creates a level playing field among PROs for the access to packaging waste in Germany. This ensures an efficient collection while keeping the costs of waste collection to a necessary minimum.

Reporting and validation process for statistical data on collection, sorting & recycling

Primary data on the amount of packaging waste collected, sorted and recycled is made available to PROs in the form of "recycling/recovery certificates", which are issued on a monthly basis by the respective waste management service providers. The quantities of treated packaging waste declared in the certificates are furthermore documented by so-called weighing slips. Weighing slips are issued by the respective waste management operators at all stages of the waste management process. Subsequent to a validation by an independent auditor they are recorded and reported via the wme.fact software tool, which is jointly operated by the PROs.

Based on the certificates provided by their contracted waste management operators, the PROs create "mass flow reports" which contain data on the total amount of packaging waste they collected, sorted, recycled and recovered¹⁷, broken down by individual packaging materials. The report serves as proof of fulfilment of the recycling quotas of the respective PRO. The validation of the data is carried out by the ZVSR by checking the plausibility of the reported quantities from collection to recycling on the basis of the data provided via the respective weighing slips.

In addition to the verification of data provided by the weighing slips, all waste sorting and treatment plants are also required to undergo regular audits. The audit scheme is determined by the ZSVR and defines the frequency and intensity of the audits. The experts interviewed repeatedly mentioned that the entire reporting and validation process is very elaborate and comprehensive. Leakages from the EPR system towards informal disposal pathways are therefore not to be expected at any stage of the end-of-life phase (Personal Communication 2021).

All PROs are further obliged to report data on the (planned) quantities of packaging POM by their manufacturers and distributors to the ZVSR on a quarterly basis. Parallel to this report, all manufacturers and distributors as distributors also report their data in the same form to the ZVSR. In this way, the reported quantities can be compared and differences can be directly tracked and clarified during the year. In case of sufficient indications for non-compliance the ZSVR cooperates closely with enforcement authorities, providing them access to LUCID, automated reports and additional documents.

Development of the recovery rates (in %) between 2010 and 2018

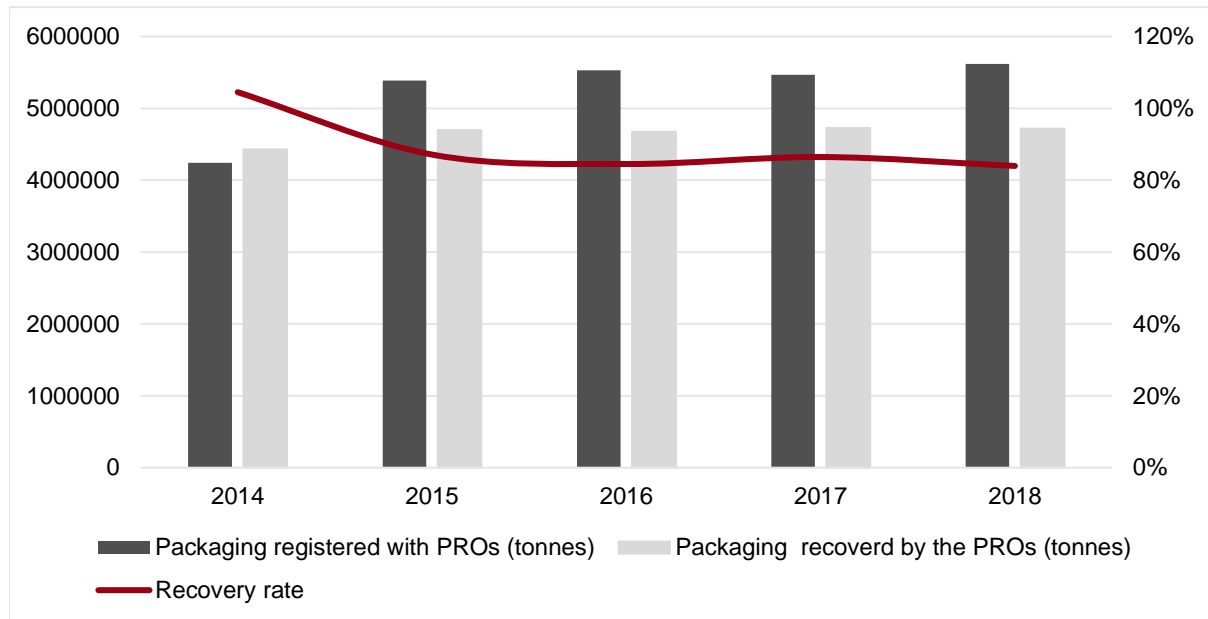
In 2018 the PROs in Germany collected about 4,717,900 tonnes of packaging waste. Given a total of 5,617,800 tonnes of packaging registered with the PROs this results in a combined recovery rate of 84% across all material fractions in 2018¹⁸. It should be noted that the packaging quantities registered with the PROs do not correspond to the actual volumes of chargeable household packaging POM the market, which are estimated at 8,107,900 tonnes in 2018 according to calculations by the German Association for Packaging Market Research (Dehoust et al. 2021). The difference between registered volumes and market volumes indicates that not all producers/distributors fulfil their obligations to contribute to the

¹⁷ The PROs' responsibility for waste management and reporting ends at the recycling plant gate. Measurements of quantities that count towards the fulfilment of recycling quotas as per §1 of the Packaging Act are therefore calculated using the output of the sorting plants.

¹⁸ At the time this report was written, the data for 2019 was not yet available.

disposal and recycling of packaging. Experts estimate that the non-participation rate is around 25% (Schüler 2020; Personal Communication 2021).

Figure 23: Development of collection/ recycling rates of household packaging waste in Germany



Source: (Schüler 2017, 2020)

While the recovery has remained mostly stable between 2015 and 2018 there is a noticeable drop in the recycling rate from 2014 to 2015 (104.5% to 87%). The main reasons for the decline are the abolition of individual take-back solutions and the loss of importance of industry solutions. This in turn led to a strong increase in the contractual volumes of the systems, so that despite increasing recycling volumes, the recycling rates of the dual systems declined (Schüler 2017, 2020)

Table 8: Recovery volumes of packaging in Germany in 2018, based on system participation volumes

Material type	Recovery via PROs*	System participation volume**	Recovery rate (based on system participation)	Market volume (end-consumer packaging)	Recovery rate (based on market volume)
	kt	kt	%	kt	%
Glass	1,794.6	2,168.8	82.7%	2,548.3	70.4%
Paper/ card	1,254.2	1,755.1	71.5%	3,002.0	41.8%
Plastic	1,172.3	1,054.1	111.2%	1,584.9	74.0%
Aluminium	42.7	51.7	82.6%	55.1	77.6%
Tinplate	240.9	252.5	95.4%	386.5	62.3%
Compounds	213.1	335.6	63.5%	531.1	40.1%
Total	4,717.9	5,617.8	84.0%	8,107.9	58.2%

* data base: ZSVR; ** Market volume minus contracted volume of industry solutions and deposit-refund non-refillable beverage containers

Inappropriate sorting practises at the household level and public littering currently pose as the main barriers for increasing the rates of separate collection. Reasons for inappropriate sorting include inertia of citizens, especially in low income and single households, as well as adverse incentives within the municipal statutes for waste management. Municipalities typically charge household fees for collection and disposal of mixed waste by volume or weight. This effectively incentivises citizens to dispose of

mixed waste together with packaging waste containers via yellow bins or bags, which are paid for by the PROs. However, despite being confronted with the effect of such adverse incentives, the interest of local authorities to improve enforcement or engage in awareness raising measures remains limited, despite municipal communication activities are being co-financed by PROs via so called “Nebentgelte” according to §22(9) Packaging Act.

Treatment capacities

According to the experts interviewed, sorting and recycling capacities in Germany are sufficient to treat the packaging waste that is currently produced within the country, whereby the increased statutory recycling quotas from 2019 onwards have noticeably stimulated investments in new sorting facilities and innovative recycling technologies (Personal Communication 2021).

Despite its good recycling capacities, Germany continues to export some of its domestic packaging waste for treatment. Due to the increased recycling rates, this share has increased significantly, especially in the export of plastic packaging waste. While in 2018 around 10% of the collected plastic packaging waste was exported for treatment outside Germany, this figure rose to around 34% in 2019 (Table 9) (Stiftung zentrale Stelle Verpackungsregister and UBA 2020; Stiftung zentrale Stelle Verpackungsregister 2020b).

Table 9: Exported plastic packaging waste (% of total packaging waste) in 2018 and 2019

All systems	2018	2019
Recovery within Germany	89.91%	66.19%
Recovery outside of Germany	10.19%	33.81%
within the EU	10.14%	32.87%
non-EU	0.48%	0.93%
Switzerland	0.05%	0.22%

Treatment requirements and quality

Apart from the minimum requirements for the treatment and recycling of packaging waste applicable to all EU Member States, there are no further requirements in Germany.

Regarding the quality of treatment several market experts’ express concerns about the output quality of packaging waste recycling, especially with regard to plastic packaging. The main factor cited for inadequate recycling quality was the poor quality of sorted packaging waste arriving at the recycling facilities, which often makes it difficult to produce high-quality recyclates. However, the reason for the low quality of sorted packaging waste was not necessarily found to be an insufficient level technology on the part of the sorting plants, but rather a combination of high recycling rates (without quality specifications) and incorrect disposal practices on the part of the end-users. In order to meet prospectively stricter recycling quotas in the future market experts therefore suggest to further improve the collection process or apply new sorting technologies (see for instance HolyGrail 2.0 project) (Personal Communication 2021).

One particular challenge for packaging waste recycling across the EU is currently posed by packaging materials made from paper composites (e.g. laminated lunch boxes, often used as to-go containers). This type of packaging has become very popular in recent years due to growing public awareness of plastic waste. However, the corresponding recycling capacities are still very limited. Moreover, when the material arrives at the plant, it is often contaminated with residues from the packaged good and cannot be further processed.

Achievement of recycling/preparation for re-use targets per waste category in 2019

In 2019, Germany recycled more than 5.3 million tonnes of waste packaging. This represents an increase of 13% compared to the previous year. The increase was most noticeable in the mechanical recycling of plastics, where the volume of recycled material was increased by over 50% (The volumes of recycled glass increased by 5.9%, volumes of recycled paper and cardboard by 31.7% and overall volumes of recycled plastic by 6.7% compared to 2018) (Stiftung zentrale Stelle Verpackungsregister and UBA 2020). As displayed in Table 10 PROs in Germany managed to exceed the ambitious recycling targets set in the Packaging Act in both 2018 and 2019. However, it has to be noted that the recycling rates are not calculated on the basis of the total household packaging quantities POM, but on the quantities registered with the PROs. Since non-registered packaging waste is still collected, the rates are strongly dependent on the degree of system participation or free-riding. Recycling rates above 100%, as in the case of plastic waste, are therefore most likely the result of insufficient system participation and other recyclable non-packaging plastics in the collection.

Table 10: Recycling rates and targets in Germany in 2018 and 2019

Material type		2018			2019		
		Recycling rate	Recycling target	Δ	Recycling rate	Recycling target	Δ
Paper/ card		71.5%	70%	+1.5%	81.9%	85%	-3,1%
Glass		82.8%	75%	+7.8%	81.3%	80%	+1.3%
Plastics	total	111.2%	60%	+51.2%	107.90%	90%	+17.9%
	mechanical	42.1%	36%	+6.1%	58.50%	58.50%	+0%
Aluminium		82.6%	60%	+22.6%	93.90%	80%	+13.9%
Tinplate		95.4%	70%	+25.4%	n/a	n/a	n/a
Ferrous metals		n/a	n/a	n/a	95.20%	80%	+15.2%
Beverage cardboard packaging		n/a.	n/a	n/a.	79.90%	75%	+4.7%
Composites		63.5%	60%	+3.5%	58.80%	55%	+3.80%

3.3.3 Economic performance

Historic cost developments

The shift from an initially monopolistic setup to a competitive EPR system significantly impacted market prices charged by PROs and waste management operators. Higher prices during the initial phase of the German system were influenced by a relatively high take-off price/ton POM and very lucrative contracts for the waste management service providers resulting in high profit margins. Costs charged by waste management operators fell by a total of 54% from 1,777 million € in 2003 to 824 million € in 2011. Differentiating cost reductions across by segments – collection, sorting and recovery, and auxiliary charges – show the effect of the competitive conditions and the new tendering processes: cost reduction was most noticeable for sorting and recovery activities (-76%) while only minor effects are recorded for auxiliary fees (-8%) (Bundeskartellamt 2012).¹⁹

¹⁹ Auxiliary charges are payments made by PROs to the local authorities for costs incurred for waste consultancy services and for the construction, provision, maintenance and cleanliness of areas where large collection containers are placed. The fees are mostly connected to the collection of glass packaging.

Table 11: Operational costs of the dual systems 2003 and 2011

Activity	2003*	2011	Change
	in Mio €		in %
Collection	918	517	-44%
Sorting and recovery	715	173	-76%
Auxiliary charges	144	133	-8%
Total	1777	824	-54%

* Only data for total costs available. Estimation of cost allocation the individual activity is based on the sector study of the German Federal Cartel Office.

By 2010, PROs were able to record comparatively high profits as industry solutions and alternative collection points led to a massive cost reduction in waste management operations. This situation was abused by some PROs by not- or falsely reporting their packaging waste. Consequences included stricter regulation of the collection, the establishment of an effective double accounting system as well as the development of a catalogue of packaging subject to system participation.

Best Practice: Unambiguous catalogue of packaging subject to system participation

An important tool for a level playing field among PROs and producers is the system participation catalogue, which provides unambiguous and transparent orientation to producers or distributors of packaging for the classification of their products into packaging that is subject to the system and packaging that is not. The unambiguous classification of packaging prevents all actors obliged to participate from both not registering certain types of their packaging with a PRO and from arriving at different classification results due to other expert opinions.

Cost for producers

Contributions charged by PROs comprise of their administrative costs, individual costs for waste management operations (collection, sorting and recycling/recovery), the common fees paid to the municipalities for the rental and cleaning of container locations and for their waste consultation services (municipal communication to citizen). Additional costs include the cost connected to running the ZSVR, the joint interface platform GS and the legally required joint communication and awareness raising campaigns (all allocated to individual PROs based on market share).

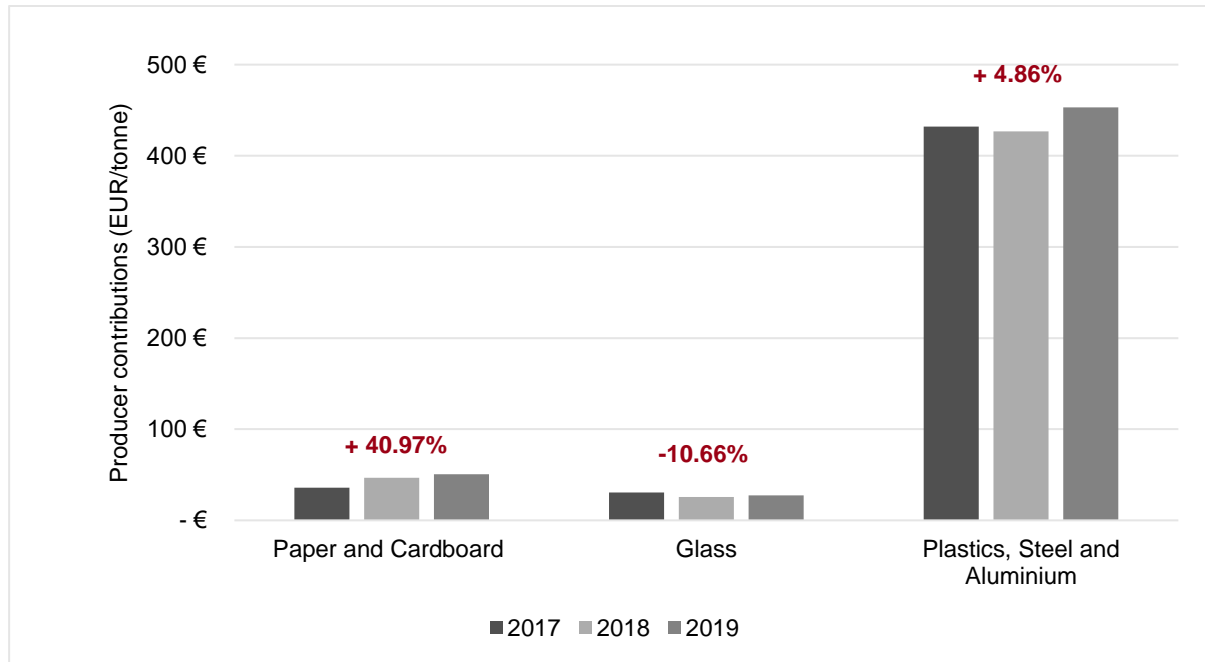
Glass packaging costs are the lowest and have decreased since 2017 by as much as 10% (2017: 30.59 €/tonne; 2018: 25.62€/tonne; 2019: 27.33 €/tonne). Key drivers for this trend may include the high recyclability of the material and the highly efficient collection system. Paper and cardboard are also on the lower end of the price range but witnessed a sharp increase in costs of almost 41% between 2017 and 2019 (2017: 35.98 €/tonne; 2018: 46.78€/tonne; 2019: 50.72 €/tonne). Low system participation rates for this material types and increasing amounts of PPC waste drive this development. Costs for plastics, steel and aluminium can be assumed to be approximately at a similar level as they are collected through the same infrastructure. Costs for these material types exceed costs for PPK and glass by far and recorded a slight increase of around 5% between 2017 and 2019 (2017: 432.15 €/tonne; 2018: 426.67 €/tonne; 2019: 453.14 €/tonne). The annual cost increase is assumed to be mainly attributed to the cost of the ZSVR as well as cost for the awareness raising campaign and rising costs for collection, sorting and recycling activities incl. those triggered due to higher legal recycling targets.

Due to the strong influence of competition, it can be assumed that costs for producers of similar size and market share are more or less equal between PROs; yet, smaller producers with lower reported amounts of products POM can be expected to pay higher prices in general mainly due to the impact of the included administrative cost. Moreover, PROs tend to offer additional services to increase their attractiveness besides core compliance services. These might include provision of services on an international or pan-European basis, coverage of and expertise in handling multiple waste streams (e.g.

packaging, WEEE and batteries) or consulting services around environmental and product compliance like seminars and trainings on recycling. With increasing complexity of the legislation, this segment has gained further traction in recent years.

There is currently no centrally harmonised approach to fee modulation for packaging waste in Germany, due to missing centrally set harmonized criteria (apart from a standard how to evaluate the recyclability). Instead, provisions in the Packaging Act (§21) require PROs to individually provide financial incentives for packaging that can be sorted, recovered and recycled easily and/or make use of recycled materials or renewable materials. Due to a lack of publicly available data, the impact of this approach cannot be evaluated.

Figure 24: Development of producer contributions per tonne of packaging waste²⁰



Cost for collection, sorting and recycling

Costs for household collection are shared between the PROs while costs for sorting and recycling are fully managed by each PRO individually (Deloitte 2017). Collection and transportation of paper and cardboard and glass packaging waste amounts to around 57 €/tonne. No sorting costs arise for these two types of material and recycling activities generate profits of 7.76 €/tonne for paper and cardboard and close to 26 €/tonne for glass. Collection and sorting costs for plastics, steel and aluminium are comparably high (226,38€/tonne and 216.48 €/tonne). Recycling of these materials costs about 3 €/tonne. Details can be found in the table below.

Table 12: Approximation of annual expenditures for waste management services in Germany²¹

Material type	Logistics (EUR/tonne)*	Sorting (EUR/tonne)	Recycling (EUR/tonne)
Paper/ Card	56.91 €	n/a	- 7.76 €
Glass	56.60 €	n/a	- 25.46 €
Plastics	26.38 €	216.48 €	3.29 €
Steel	226.38 €	216.48 €	3.29 €
Aluminium	226.38 €	216.48 €	3.29 €

* Collection & transportation from initial point of collection to recycling plant gate

²⁰ Data represents the approximate market price developments as assumed by market experts

²¹ Data represents the approximate market prices as assumed by market experts

3.3.4 Technical performance

Innovation potential

Amongst others, the Packaging Act of 2019 encourages the use of recyclable and renewable packaging materials in line with §21. In addition, a set of minimum criteria for the evaluation of the recyclability of packaging material on the basis of existing sorting and recycling infrastructure was that allows for high-quality mechanical recycling was defined by the ZSVR (Bünemann et al. 2020). The minimum criteria provide harmonized guidance on how to evaluate a packaging design. This involves an evaluation whether a suitable recycling infrastructure for a product is available, the sortability and separability of the packaging is examined and recycling incompatibilities are considered. In this way, the recyclability of packaging can be quickly and clearly determined (Stiftung zentrale Stelle Verpackungsregister and UBA 2020). According to interviewed experts, this approach has proven to be effective (Personal Communication 2021).

Several PROs offer additional digital tools that allow producers to evaluate their packaging in regards to recyclability applying above mentioned standard. As a consequence, certificates (or other equivalent evidence) can only be issued by independent experts based on the PROs' own methods. In addition, there is a large variety of different models, such as price reductions per material type for proven recyclability. Other models that incentivise innovation include producer-specific differentiated participation fees, guidelines for packaging optimization (also in the form of workshops) or no separate incentive at all for recyclability, but reference to existing different system participation fees according to material type (Stiftung zentrale Stelle Verpackungsregister and UBA 2020).

The interviewed experts did not unanimously agree that the competitive character of the system enhances the innovation potential. For instance, some experts found the approach to inclusion of eco-design criteria in fees insufficient and perceived that higher fees may be necessary to drive innovations. Other experts perceived financial incentives as a powerful driver for eco-innovations in competitive systems because it enables companies to invest more in research and development. In addition, the competitive environment in which PROs operate was perceived to be beneficial in promoting customer-service innovations (Personal Communication 2021).

To further encourage innovation, legislators could further incentivise technological progress by stipulating specific requirements in regards to eco-design and lower carbon footprints. Other appropriate instruments may include quotas for high-quality recycling or separate collection. In addition, stronger enforcement of already existing requirements was seen as a promising approach.

Awareness creation potential

With the initial introduction of the EPR scheme in 1991, Germany's population became increasingly aware about the importance to segregate waste at the source and reduce public littering. Although hard data about the rate of segregation at the household level is limited, interviewed experts repeatedly highlighted that mismanagement of waste was rare and substantially improved in the early days of the German EPR scheme. However, with the advent of competition among PROs and other stakeholders, awareness raising measures became increasingly neglected until coming almost entirely to halt. Consequently, the rate of mismanagement grew and limits the performance of the system as a whole. This development can be directly attributed to a lack of incentives for PROs to raise awareness amongst the general public in the absence of a mechanism to share the corresponding costs and benefits.

Best Practice: Clear legal requirements for communication and awareness campaigns

Following the implementation of the Packaging Act in 2019 German PROs are legally required to jointly organize and finance local and cross regional communication activities that inform end-consumers about the purpose of separate collection as well as the results of their recovery and recycling operations.

In order to fulfil their obligation, the PROs started a joint information initiative for end-consumers. The initiative operates under the catchphrase “Mülltrennung wirkt” (waste separation is effective), maintains a webpage (www.mülltrennungwirkt.de), an Instagram account (5,275 subscribers; status 31.03.2021) and a Facebook page (1,166 followers; status 31.03.2021). The campaign records an initial budget of about 7 Mio EUR. Although the campaign generates high media attention it has so far unfolded relatively small impacts, partially owing to years of neglect of public awareness issues and partially because recently public awareness predominantly occupied by COVID-19 (Personal Communication 2021).

Experts further called for stronger efforts from municipalities. Increasing involvement of large retail chains can be seen as a promising development; however, it has so far delivered mixed. Collaborative campaigns from various stakeholder groups could generate higher outreach and impact. Hence, acceptance and support from political bodies are essential to create sustainable impact at scale (Personal Communication 2021).

Stakeholder satisfaction and involvement

Producers are reportedly satisfied with the overall performance of the system. Their ability to switch between PROs if services are no longer satisfactory greatly contributes to this. Some producers have voiced criticism with regard to the relatively high prices of the German EPR system for packaging waste compared to other countries, which are however strongly linked to the coverage of all types of consumer packaging (including glass) and the comparatively high collection and recycling targets. Furthermore, it is reported that the increasing complexity of the legislation and the legal requirements of the EPR system pose an increasing challenge, especially for smaller producers.

3.3.5 Key Take-Aways

Due to competition between PROs and waste management operators, system costs have decreased significantly

Through multiple reforms, Germany’s waste management sector has gradually become characterised by a high degree of competition at all levels of waste management. By opening the market to other compliance service providers and by mandating PROs to conduct competitive tendering procedures for employing waste management operators, the costs for collection and recycling in the German EPR system dropped significantly. In turn, this has also translated into lower participation fees for the producers (Bünemann et al. 2020).

Central bodies such as the ZSVR and the GS represent powerful institutions for regulating competition, monitoring producers and addressing the issue of freeriding

In its function as a central register, the ZSVR has demonstrably helped to create a level playing field for competition, monitor PROs and manufacturers and address the issue of free-riding. Especially the public nature of the register, the independent verification of the data submitted by PROs and manufacturers, the development of an unambiguous catalogue of packaging subject to system participation and the precise calculation of the market shares of PROs can be consider as key aspects for its success. The joint interface body of the PROs in Germany (GS), is a useful addition to the ZSVR. Its coordination and communication activities facilitate interaction between the PROs and ensure the competition neutral access to packaging waste.

In order to enable closed material loops, the output quality of plastics recycling has to be further improved

The interviewed experts agreed that current recycling practises in Germany deliver mixed results especially when considering the waste management system's comparatively long history. This is largely due to the combination of high recycling rates and the lack of more extensive quality requirements for recyclates, which in turn incentivise sorting facilities to provide large quantities of low-quality material instead of smaller quantities of high-quality input material in order to meet regulatory requirements.

Joint information and awareness raising campaigns in competitive systems require clear regulatory requirements

The implementation of large-scale awareness campaigns in competitive systems usually entails the risk of free-riding, which may translate to competitive disadvantages for individual PROs. By establishing legal obligations to raise awareness, the Packaging Act has effectively addressed this challenge urging PROs to jointly tackle the issue. However, in order to overcome the years of neglect with regard to awareness raising in Germany, the current efforts likely need to be further strengthened in the future. In this context, for example, joint awareness-raising campaigns by municipalities, retailers and PROs would probably have a more lasting effect. In addition, large retail groups and public authorities could push for a broad and honest discussion about the advantages and disadvantages of different packaging materials.



3.4 Spain (Packaging)

Table 13: Spain - EPR Performance Indicators

	Indicator	Value (2019)
	Collection rate	80.2%
	Waste collection per capita	36.5 kg
	Recycling rate	80.2% ²²
Economic	Average cost for producers per tonne	244 € ²³
	Average cost for collection per tonne	138 € ²⁴
	Average cost for sorting and treatment per tonne	149 € ²⁵
Technical	Stakeholder satisfaction levels	Low
	Innovation potential	Medium
	Awareness creation potential	High

3.4.1 Overview

National transposition of Directive 94/62/EC on Packaging

Spain has implemented the European Packaging Directive via the following regulations:

- Royal Law No. 11 of 24 April 1997 on Packaging and Packaging Waste, as amended on 29 July 2011, and Implementing Decree No. 782 of 30 April 1998.
- Order 10215 of 27 April 1998 on Deposit and Return Systems and
- Royal Decree No. 1416 of 14 December 2001 on packaging for plant protection products Law 22/2011 of 28 July 2011 on waste and contaminated soil, as amended by Law 11 of 19 December 2012 on urgent environmental matters

The central regulation for the implementation of the EU Packaging Directive in Spain is Law No. 11/1997 of 24 April 1997, which is substantiated by Royal Decree 782/1998, the Regulation on Packaging and Packaging Waste. Decree 782/1998 establishes the obligations for producers to arrange for the recycling of the packaging waste associated with the goods they put on the market. To comply with this

²² The recycling rate for packaging waste published by Ecoembes is calculated on the basis of packaging waste fractions processed at the sorting plants and shipped to the recycling facilities. It is therefore identical to the collection rate.

²³ Average green dot fees were calculated based on the total income from green dot fees collected in 2019 and the amount of packaging registered with Ecoembes in the same year

²⁴ Calculated based on the total expenses for collection, sorting, recycling and awareness raising in 2019 and the average cost share for the collection of packaging waste as declared by Ecoembes (36%)

²⁵ Calculated based on the total expenses for collection, sorting, recycling and awareness raising in 2019, the average cost share for the sorting and recycling of packaging waste as declared by Ecoembes (53%) as well as the income from the sales of sorted packaging waste (54€ per tonne)

obligation producers (or initial distributors) of household packaging²⁶ (regardless of threshold values) may either establish their own Deposit and Return System, or join a PRO (Integrated Management System (SIG)). Producers of commercial and industrial packaging are exempt from this obligation as they may transfer the responsibility for the waste to the final waste-holder.

Actors and Responsibilities

To fulfil their obligation, Spanish producers, retailers and packaging manufacturers founded "Ecoembalajes Espana, S.A." (Ecoembes) in 1996. Ecoembes is a monopolistic non-profit PRO that organises and finances the collection, sorting and recycling of packaging waste in Spain. In 1997 Ecoembes was complemented by a second PRO called "Ecovidrio" which organises the collection and recycling of glass waste. Both organisations are financed by the producers.

According to Spanish legislation, local authorities have direct responsibility for the management of packaging waste in their territory and are thus responsible for the development and management of municipal solid waste services in their territories. (Expósito & Velasco, 2018 as cited by (Rubio et al. 2019). To establish the infrastructure and develop the separate collection of packaging waste the local authorities enter into collaboration agreements with both Ecoembes and Ecovidrio that include all necessary procedures to ensure management and control of the entire recycling process, from the moment the citizen disposes of the packaging waste until it becomes a new raw material (Ecoembes 2021c). There are currently more than 8,100 local authorities spread throughout Spain that have signed cooperation agreements with Ecoembes, covering 100% of the Spanish territory.

Members of Ecoembes are obliged to provide declaration on their products, packaging and annual sales to Ecoembes by the 28th of February of each year at the latest. The declaration can be prepared and submitted via a software tool. Producers that put at least 350 tonnes of packaging on the market are additionally required by law to establish a waste-prevention plan at least every three years. This concerns prevention in terms of quantity (the amount of material used) and quality (for example, toxicity of materials). Companies can opt for an individual prevention or a Sector Plan developed by Ecoembes. All waste prevention plans have to be approved by the regional authorities, to which the results must also be reported.

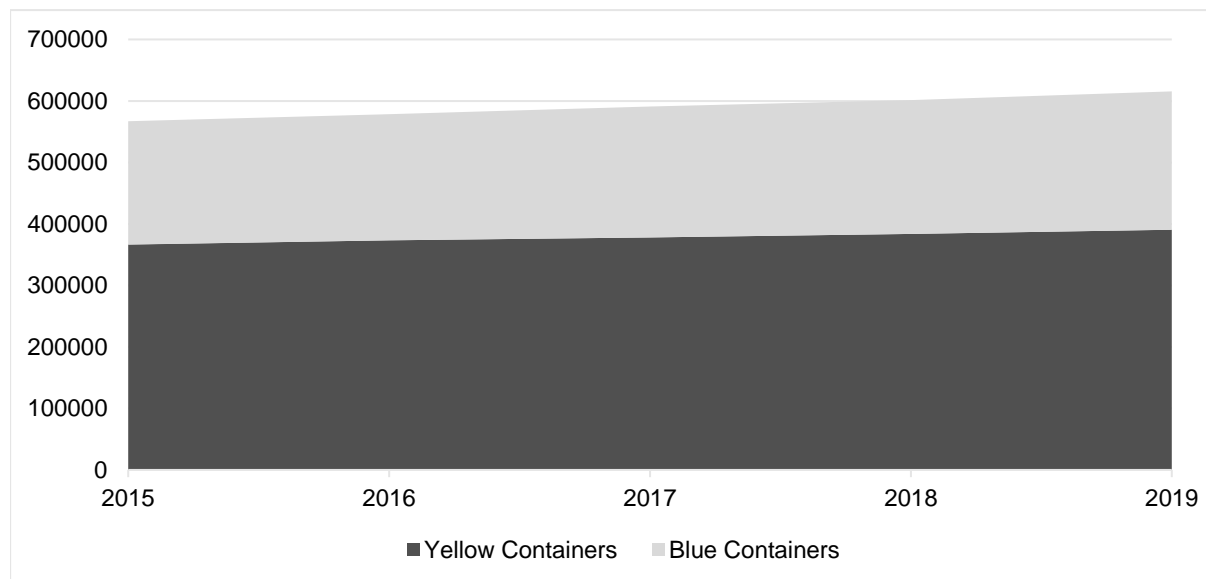
²⁶ Packaging types that are likely to end up with the final consumer

3.4.2 Environmental Performance

Collection Infrastructure

The collection of household packaging waste in Spain is carried out via yellow (plastic and metal) and blue containers (paper and cardboard) to which citizens can deposit their household packaging waste (bring system). The containers are either located on the streets or in places with a large influx of people (offices, shopping and sports centres, public transport, hospitals, etc.). In 2019 there were 390,611 yellow and 224,945 blue containers available on the streets²⁷, resulting in one container for every 119 and 207 inhabitants respectively. All collection containers are set up and managed by the respective local authorities as part of their cooperation agreements with Ecoembes.

Figure 25: Number of collection containers for packaging waste in Spain



Source: (Ecoembes 2021c)

Organisation of the collection system

After the final consumers deposit their packaging waste in the corresponding containers (blue & yellow) the local authorities arrange for its collection and transport. While the content of the blue containers (paper and cardboard) is directly transported to the recyclers, packaging waste from the yellow containers is first transported to dedicated sorting plants, which have to be established by the local authorities as part of the agreement signed with Ecoembes²⁸. The pick-up and transport of the packaging waste from both containers is arranged for by the local authorities via contracts with suitable transport companies. At the sorting plants the packaging waste is then sorted into at least three fractions: metals (steel and aluminium), plastics (PET, HDPE, Film and Plastic Mix) and used beverage cartons (brik packaging). After the sorting process, the local authorities “sell” the sorted waste fractions to Ecoembes, which in turn is responsible for designating the companies responsible for the recovery/recycling of the various materials sorted in the plants. To this end, the recycling of the sorted packaging waste is regularly put out to tender by Ecoembes. Tenders for light packaging made of plastic, steel and food/beverage cartons are issued by region (usually including multiple sorting facilities), while tenders for light packaging made of aluminium and paper/cardboard are issued for one sorting facility each. Only those recyclers that have been certified by Ecoembes qualify to take part in the tenders. In case a bid is won the corresponding recycler is responsible for transforming the sorted waste fractions into new raw material for their reincorporation into new production processes (Ecoembes 2020a; Rubio et al. 2019).

²⁷ There are an additional 440.000 blue and yellow containers available in high traffic areas

²⁸ In addition to the separate collection via blue & yellow containers, Ecoembes also manages a certain share of waste stemming from mixed municipal solid waste collection, which is sorted in bio-mechanical treatment plants. Tenders for sorted packaging fractions from these sources are usually issued for one sorting facility each.

Reporting and validation process for statistical data on collection, sorting & recycling

The data regarding the packaging waste quantities collected, sorted and recycled is provided to Ecoembes on a monthly basis by the local authorities. The numbers are reported through a web application and encompass the amount of waste collected from the yellow and blue containers as well as the amount of sorted packaging waste fractions delivered to the recyclers. (Ecoembes 2021c). Recycling facilities, on the other hand, are not required to report figures on their recycling activities. Accordingly, the effective recycling results achieved by the recycling plants are not publicly available. The quantities of recycled packaging waste reported by Ecoembes thus correspond to the quantities of packaging waste delivered to and sorted by the sorting facilities. On this basis, as well as on the amount of packaging POM reported by the members, Ecoembes subsequently calculates the recovery rate.

In order to verify the data submitted on the quantities collected and recycled, Ecoembes regularly has them checked by third parties. This includes both a review of the work of the local authorities and audits at the level of the sorting plants, where the waste composition and the quality of the waste managed by these plants are analysed to ensure that the recycling data submitted corresponds to what is deposited in the containers and subsequently sorted. Ecoembes-approved recycling facilities are likewise subject to annual audits that ratify the correct recycling of packaging and the subsequent marketing of the new raw material (Ecoembes 2021c). All audits are carried out by authorized third parties. (Ecoembes 2021c).

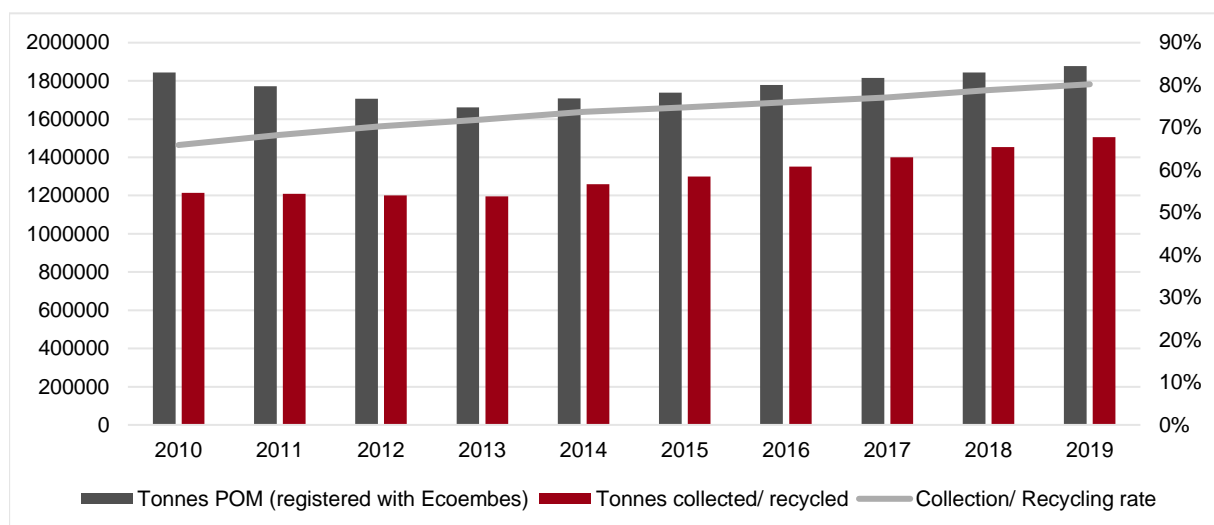
Challenge: Data on collection, sorting & recycling lack verification via a third party

Although the verification of the reported data as described by Ecoembes seems well structured, there is no other institution or organization involved in the verification and compilation of statistical data on the collection, sorting and recovery of household packaging waste in Spain. The resulting exclusive data sovereignty of the PRO has led to strong concerns from some stakeholders about the veracity and validity of the reported data (Personal Communication 2021).

Development of the recovery rates (in %) between 2010 and 2019

In 2019, Ecoembes collected and delivered 1,505,661 tonnes for recycling and treatment. As per the annual report, this accounts for 80.2% of the household packaging that was registered with Ecoembes by the manufacturers. Accordingly, it can be estimated that manufacturers placed nearly 1,877,383 tonnes of household packaging on the market in 2019. This represents an increase of 2% compared to the previous year and 10% compared to 2014 (Ecoembes 2021a). Despite the growing volumes of POM packaging from its members, Ecoembes has achieved a steady improvement in the collection rate over the last 10 years (14.3%).

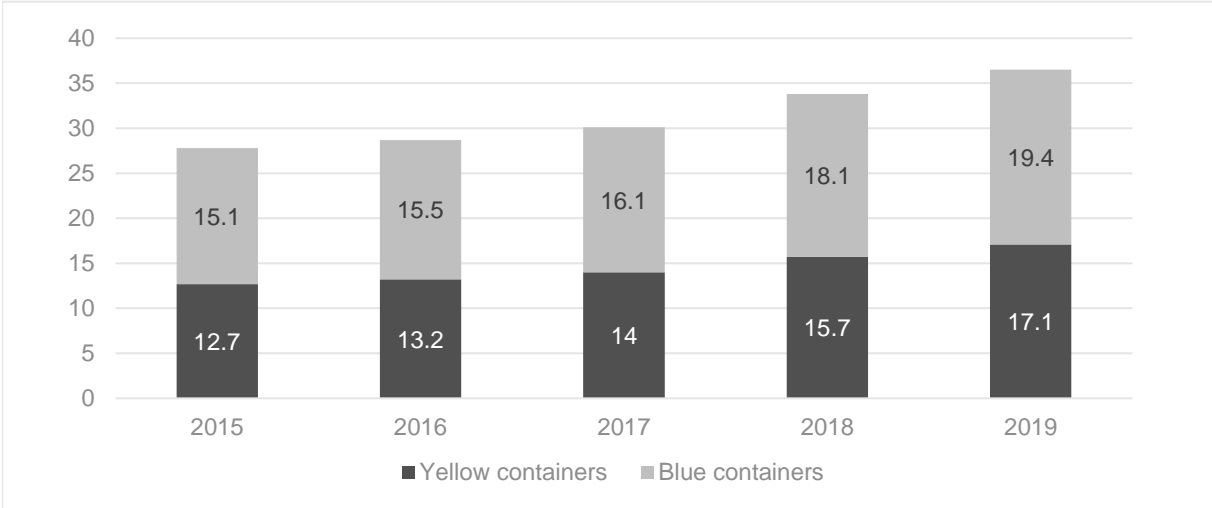
Figure 26: Development of collection/ recycling rates of household packaging waste in Spain



Source: (Ecoembes 2021a)

The observed increase in the overall collection rate of packaging waste is likely correlated to the increased availability of collection containers (Figure 25) as well as the ongoing awareness and information campaigns. This has in the last years resulted in increased volumes of packaging waste separated and disposed of at the household level. In 2019 Spanish citizens on average disposed of 19,4kg packaging waste in blue and 17.1 kg in yellow containers each. This represents an increase of 28.5% for blue bins and 36.8% for yellow bins since 2015, and an average waste collection of 36.5kg per capita. ²⁹ (Figure 27). However, it has to be noted that collection rates highly variate throughout the country with a high per capita collection in the Balears (36.7 kg/27.1 kg) and a low collection in Ceuta (11.9 kg/ 4 kg). These differences may partly be explained by the respective geographical characteristics and population density.

Figure 27: Packaging waste disposed in yellow and blue containers in Spain (kg/ capita)



Source: (Ecoembes 2021a)

Treatment Capacities

As of 2019 the Ecoembes recycling network included 422 certified recyclers. To get certified packaging recyclers are required to undergo a certification process in order to proof that they can provide the required technical, environmental, economic and administrative guarantees to carry out the correct treatment of the materials. The certification process is public and is carried out by an independent third party entity that guarantees that the process is transparent (Ecoembes 2021c). The available recycling capacities in Spain are assumed to be sufficient to treat the packaging waste currently collected by Ecoembes (Personal Communication 2021).

Treatment requirements and quality

Regarding the necessary requirements for the treatment and recycling of packaging waste Ecoembes published technical specifications that aim to ensure the quality of the recycled materials (Ecoembes 2021d). With regard to the recycling of Plastic Materials (PET, HDPE, Film and Mixed Plastics) the minimum requirements for the final products required after treatment are: PET: clean flakes; HDPE: pellets; Film: shredded material; Mixed plastics: a final product whose raw material origin are the flakes produced from the processing of all the materials contained in the respective fraction.

Challenge: Insufficient output quality in the recycling of PET and beverage cartons

Despite the clearly defined recycling specifications and the high recycling rates reported by Ecoembes (Figure 28) some producers have expressed concerns about the quality of packaging recycling in Spain, particularly with regard to the recycling of PET and beverage cartons. According to their estimates, only 25% of all PET delivered for recycling is actually recycled at a quality sufficient to produce new PET, while the rest is either downcycled into flakes (e.g. for use in multilayer plastics), sent for thermal treatment or disposed at a landfill site. A major driver for the low recycling quality is

²⁹ Not including glass

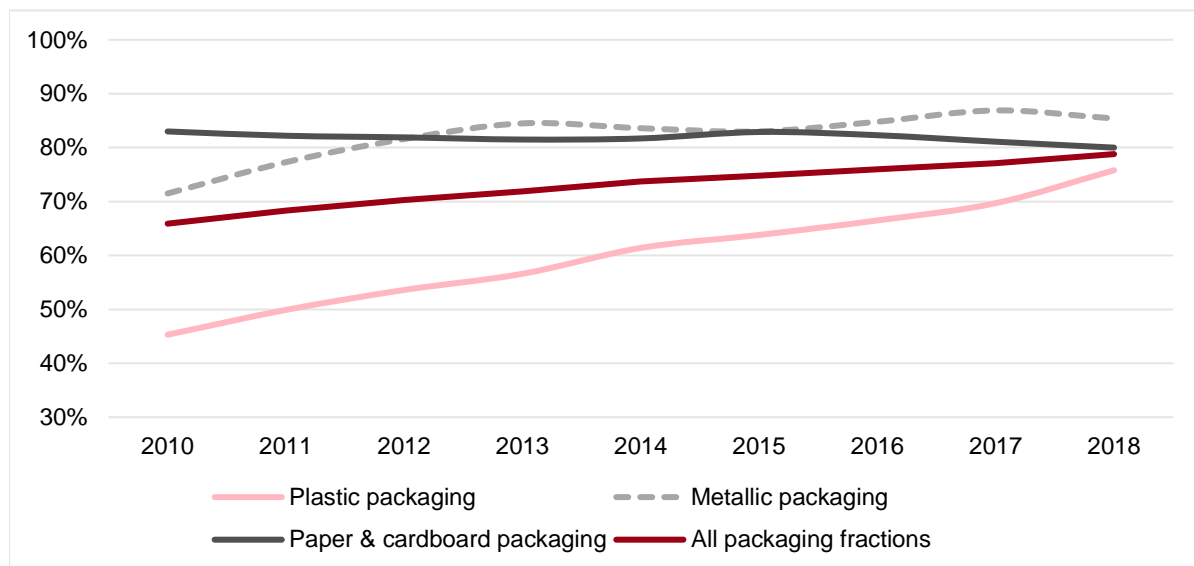
assumed to be sorting process, which according to the conducted interviews often still takes place on a manual level (Personal Communication 2021). Due to the lack of transparency on the effective recycling results it is difficult to verify in how far this also applies to other packaging waste fractions.

Achievement of recycling/preparation for re-use targets per waste category in 2019

With a reported recycling rate of 80.2% Ecoembes surpasses the current recycling target of 55% as defined in the packaging Directive by far. Although the recycling rates for different packaging waste fractions are not available for 2019, the historic recycling rates for plastic, metallic and paper/cardboard packaging suggest that the respective recycling targets of 25%, 50% and 60% have been achieved in 2019 as well (Figure 28). With regard to the strong increase in recycling rates for plastic packaging, some interviewees have voiced their concerns that this may partly be attributable to commercial and transport packaging, which is not actually registered with Ecoembes by the producers, but is nevertheless used to calculate the recycling rate (Personal Communication 2021).

As the reported recycling rates are only calculated on the basis of sorted packaging fractions delivered for recycling, it is not possible to determine the quantities of packaging waste recycled, delivered for thermal treatment or deposited in a landfill. The reporting of recycling rates by packaging type rather than by material (e.g. PET, film, etc.) further prevents the determination of the actual recycling rates of the different materials. This also makes it difficult to identify potential cross-financing mechanisms between different packaging fractions, which in turn leads to resentment on the part of some producers (Personal Communication 2021).

Figure 28: Development of recycling rates for packaging waste fractions in Spain



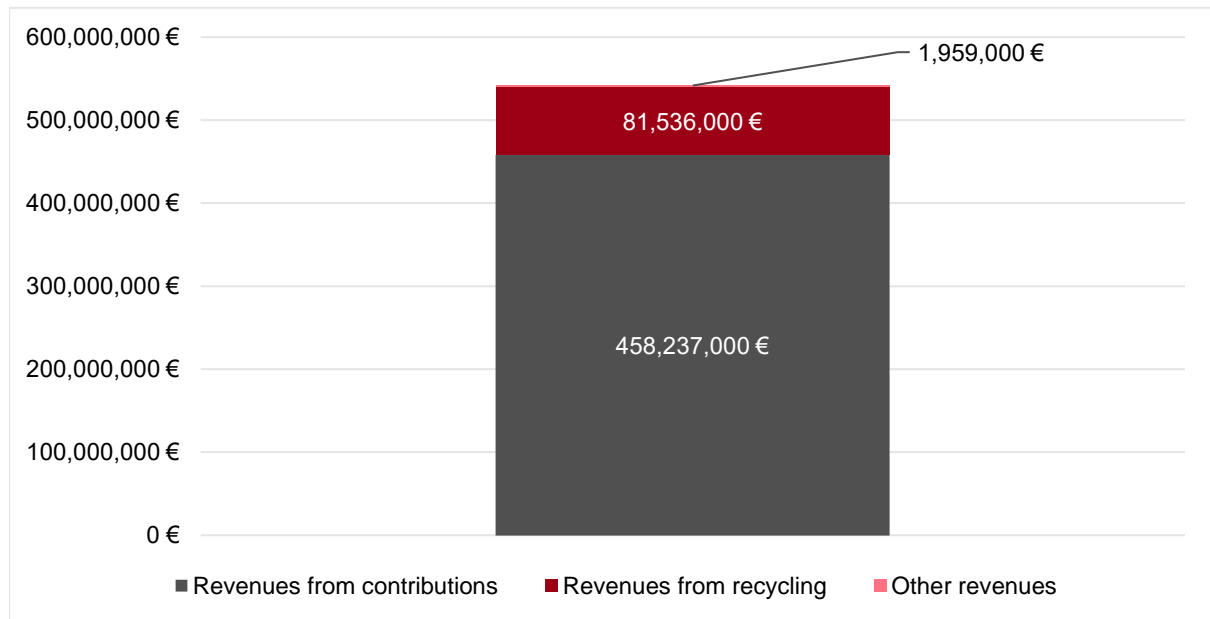
Source: (Ecoembes 2021a)

3.4.3 Economic Performance

Cost for producers

In accordance with Article 10.1 of the Packaging Law, all members of Ecoembes are obliged to finance the system according to the amount of packaging they place on the market. These contributions are known as "Green Dot fees". Charges are levied in such a way that each packaging component of which the packaging consists (cap, handle, bottle, label, box) is charged separately depending on its material type. In the case of composite packaging or packaging components (caps, closures, etc.), i.e. those consisting of two or more materials which are separated at the point of origin and are difficult for the final consumer to separate, the charge is levied for the components with the predominant mass content. The contributions account for approximately 85% of Ecoembes' revenue in 2019. The remaining 15% are collected from the sales of recycled materials (Ecoembes 2020b).

Figure 29: Ecoembes revenues 2019

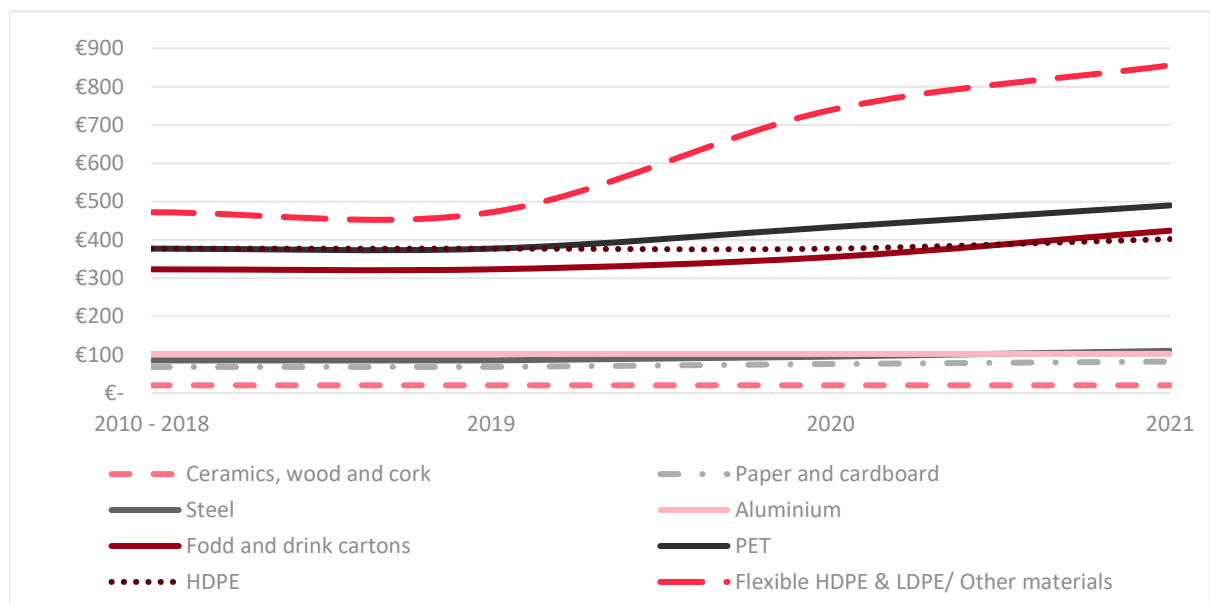


Source: (Ecoembes 2020b)

According to the annual financial report, Ecoembes collected a total of 458.237.000 € in contributions in 2019. Considering the 1,877,382 tonnes of packaging reported by its members for the same year, this represents an average contribution of 244 €/tonne of POM (Ecoembes 2020b). While the majority of the fees collected are used to cover the expenses arising from the agreements signed with local and regional authorities and recyclers for the collection, sorting and treatment of waste, a certain proportion is used for awareness-raising activities as well as research, innovation, and administration (Ecoembes 2021b).

Between 2010 and 2019 the contributions have remained flat at 377 €/tonne for PET and HDPE (rigid plastic), 472 €/tonne for HDPE and LDPE (flexible plastic), 323 €/tonne for food and drink cartons, 76 €/tonne for paper and cardboard, €85/tonne for steel, 102 €/tonne for aluminium; and 21 €/tonne for ceramics, wood and cork. Market experts suggest that these stable price levels during the last decade was significantly supported by existing financial resources built up in the early years of the system (Personal Communication 2021).

Figure 30: Development of contributions per tonne of packaging waste



Source: (Ecoembes 2021b)

In 2019 the Ecoembes Board of Directors approved the increase in the Green Point rates by 25% on average in both 2020 and 2021 with contributions for packaging made from flexible plastics almost doubling over the two-year period (Figure 30). While according to Ecoembes the increase in contributions is mainly related to higher volumes of packaging waste collected and sorted by local authorities, it can be assumed that existing financial reserves have been largely depleted and thus higher costs can no longer be offset. This trend is visible in the recent financial reports published by Ecoembes, which show that between January 2016 and December 2019, reserves were reduced from €271.517.000 to €85.481.000, with €101.080.000 of the existing reserves used to cross-finance operational costs incurred in 2019 alone (€53.548.000 in 2018) (Ecoembes 2020b).

Challenge: Strong bargaining position of local authorities

Additional factors that influence the fee levels are believed to be the strong bargaining position of local authorities, which - within the framework of their cooperation agreements with Ecoembes – may be able to charge comparatively high fees for their collection and sorting services (Personal Communication 2021; Ecoembes 2020a).

Cost for collection

Separate collection of packaging waste in Spain is carried out by local authorities under their cooperation agreements with Ecoembes. Although Ecoembes does not publish the total compensation paid to local authorities for their collection services, it is stated that approximately 36.5% of the total expenses paid for the collection, sorting, recycling and awareness raising activities (577.674.000 € in 2019) are dedicated for the reimbursement of the separate collection of household packaging waste. This translates to approx. 138 €/tonne of waste collected in 2019³⁰ (Ecoembes 2021b).

Cost for sorting and recycling

Similar to the organization of the collection of packaging waste, the sorting of the collected waste is also organized under the cooperation agreements between Ecoembes and the local authorities. After sorting the waste is delivered to the relevant authorized recycling plant contracted by Recupel. Both the local authorities and the recyclers are reimbursed for their services while Ecoembes collects the revenues from the sale of all recycled materials.

According to Ecoembes, approximately 53% of the total expenses for the household packaging waste collection, sorting, recycling and awareness activities are dedicated to reimbursing the sorting and recycling facilities (Ecoembes 2021b). Given the total expenses 577.674,000 € and the 1,505,661 tonnes of waste collected, this equates to 203 €/tonne of waste sorted/recycled in 2019³¹. When subtracting the revenues from the sale of recycled material (81,536,000 €) the cost is reduced to approximately 149 €/tonne.

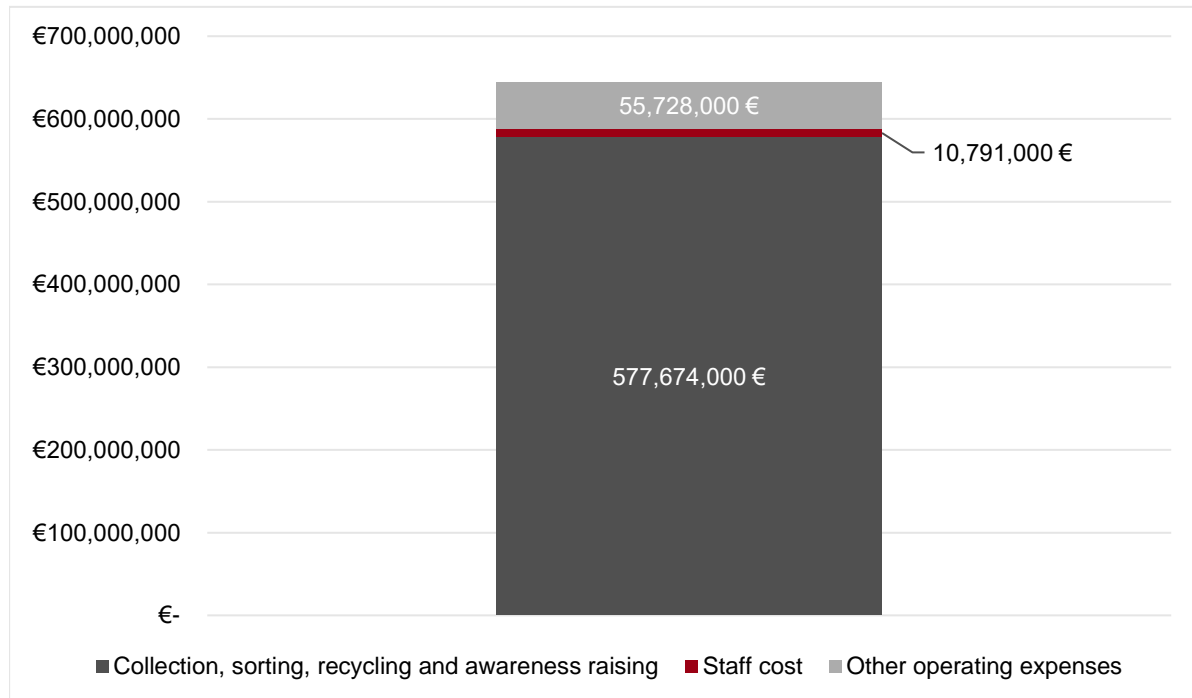
³⁰ Calculated only on the basis of total revenue from green dot fees. Potential contributions from existing financial reserves have not been considered.

³¹ Calculated only on the basis of total revenue from green dot fees. Potential contributions from existing financial reserves have not been considered.

Administrative costs

In 2019 Ecoembes spent a total of 10,791,000 € for wages, salaries and social charges. This represents approximately 2% of Ecoembes' total operating expenses in 2019 (Ecoembes 2020b).

Figure 31: Ecoembes expenses 2019



Source: (Ecoembes 2020b)

3.4.4 Technical Performance

Innovation potential

As part of its activities Ecoembes is actively engaging in the study, trial and development of best practices in the packaging sector and subsequent recycling. This includes among other things an open innovation program in which 'circular' projects or business ideas are identified and generated in order to be supported, developed and accelerated once their technical and economic feasibility is verified.

Another tool used by Ecoembes to promote innovation in packaging techniques and eco-design measures is the development of a dedicated company waste prevention plan which members can join to fulfil their respective legal obligations. Between 2018 and 2020, 2,234 companies participated in the Ecoembes prevention plan, together representing 90% of the packaging placed on the market. As part of the prevention plan 6,831 waste prevention measures have been collectively implemented, resulting to savings in raw materials, water and energy consumption, and reductions in greenhouse gas emissions (Ecoembes 2020a).

Best Practice: Circular Lab

One of Ecoembes' main instruments for promoting innovation is the so-called Circular Lab, which was created in 2017 in order to promote sustainability in the packaging design phase, the improvement of efficiency in the processes of collection, sorting and recycling, as well as to increase citizens commitment to recycling. Within the Circular Lab Ecoembes is working in collaboration with companies and producers to develop new solutions in the field of Eco-design as well as in identifying new sustainable materials and incorporating recycled components into production processes. As part of this collaboration the lab, among other things, developed the tool Pack-CD which helps companies to predict and modify the environmental impact of their packaging before manufacturing, also offering recommendations for potential design improvement (Ecoembes 2020c). The Lab is further involved

in the development of a so called “SmartWaste” management network that encompasses the use of new smart collection containers, garbage trucks connected by GPS that determine routes and weight to manage their routes in real time, optimised and automated waste sorting processes as well as digital management systems for recyclers that allow for an automated quality control of outbound materials (Ecoembes 2020d).

Awareness creation

Ecoembes frequently engages in campaigns that aim to increase the awareness about the importance and benefits of separate collection and recycling of packaging waste in the Spanish population. These campaigns usually take place on a large-scale national level and are promoted via TV, outdoor advertising and social media accounts on Facebook, Instagram, LinkedIn and Twitter. As a result Ecoembes is well known across the Spanish population and awareness for the correct disposal of packaging waste assumed to be comparatively high (Personal Communication 2021). In addition, Ecoembes supports local authorities in the development and implementation of regional campaigns, of which a total of 361 were conducted in 2019.

Although the influence of these campaigns is usually difficult to quantify, a study on recycling habits, which was commissioned by Ecoembes in 2019, shows that 80.2% of Spanish households claim separate their waste at home, with at least one container destined for plastics and beverage cartons (Ecoembes 2020a). Furthermore, the increase in packaging disposed of per capita in the yellow and blue garbage cans, which increased by 31% between 2015 and 2019, also indicates an improvement in consumer awareness and/or disposal behaviour, as the amount of packaging POM increased by only 8% over the same period (Ecoembes 2021c, 2021a).

According to its Website Ecoembes spends on average 3.6% of its income on information and awareness campaigns. Given a total income of 577,674,000 € in 2019 this results in average annual costs of 19,502,352 € or 10.38 €/tonne of packaging POM.

Stakeholder satisfaction levels

Although some producers have always expressed their dissatisfaction with Ecoembes' monopoly and the resulting lack of choice on their side, these producers have usually represented a minority in the past. However, with the steep increase in fees, satisfaction levels among all producers have dropped dramatically. According to the interviewed market experts, this is also strongly related to a perceived lack of transparency of the system especially with regard to the calculation of green dot fees for different packaging fractions, which are suspected to not always reflect the actual costs for the collection and recycling of the products POM. Instead, it is assumed that some major players are currently profiting from the calculated prices as the costs for certain packaging fractions are being offset by the revenues from other fractions (Personal Communication 2021).

3.4.5 Key Take-Aways

Contributions for producers will significantly increase in the coming years

While the producer contributions have remained unchanged for the last 10 years, in 2019 the Ecoembes Board of Directors approved the increase in the contributions by 25% on average in both 2020 and 2021 with contributions for packaging made from flexible plastics almost doubling over the two-year period. While the increase in contributions is partly related to higher volumes of packaging waste managed by the local authorities, other factors are believed to be the depleted financial reserves as well as the strong bargaining position of local authorities, which - within the framework of their cooperation agreements with Ecoembes – may be able to charge comparatively high fees for their collection and sorting services.

High recycling rates, but insufficient recycling quality

The recycling quality achieved by the recycling facilities does often not allow for closed-loop recycling (e.g. of PET). Instead, a high share of packaging waste either downcycled into flakes (e.g. for use in multilayer plastics), sent for thermal treatment or disposed at a landfill site. A major driver for the low

recycling quality is assumed to be sorting process, which according to the conducted interviews often still takes place on a manual level.

High investments in innovation and legal obligation for waste prevention support producers in improving their products and reduce waste

Ecoembes actively invests in fostering innovation and eco-design as part of its dedicated Innovation Centre, it is actively testing and developing best practice solutions in the field of packaging and recycling techniques. This approach is substantially supported by the legal obligation for large producers to prepare a waste prevention plan and the corresponding sector plan developed by Ecoembes.

Lack of transparency with regard to reporting and the calculation of fees

Apart from Ecoembes there is no other institution or organisation involved in the reporting of statistical data on the collection, sorting and recycling of household packaging waste in Spain. On the part of some stakeholders, this has led to concerns about the veracity and validity of the reported data. Furthermore, the calculation of contributions for different packaging fractions is opaque, leading to the assumption that they might not always reflect the actual costs for the collection and recycling of the products POM. Instead, it is assumed that some major players are currently profiting from the calculated prices as the costs for certain packaging fractions are being offset by the revenues from other fractions.



3.5 United Kingdom (Batteries)

Table 14: United Kingdom - EPR key performance indicators at a glance

	Indicator	Value (2019)
Environmental	Collection rate	45.36%
	Waste collection per capita	0.27 kg
	Recycling and treatment rate	97.4%
Economic	Cost for producers per tonne POM	1,700 €
	Cost for collection per tonne collected	n/a
	Cost for waste recycling and treatment (per tonne recycled)	1,528 €
Technical	Stakeholder satisfaction levels	Medium
	Innovation potential	Medium
	Awareness creation potential	Low

3.5.1 Overview

National transposition of Directive 2006/66/EC on Batteries

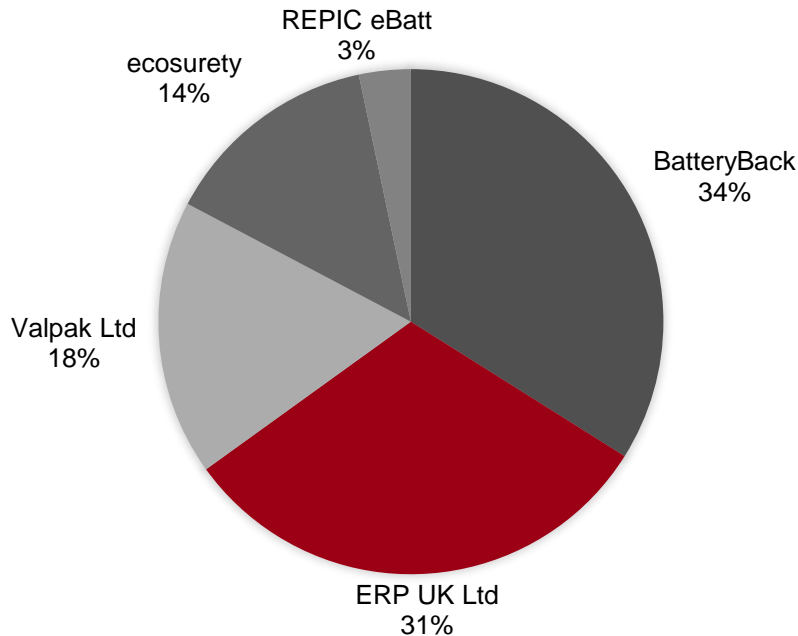
In order to transpose producer responsibility for portable batteries as per Directive 2006/66/EC into national law, the UK introduced the Waste Batteries and Accumulators Regulations in April 2009, which came into force in 2010 (UK Government 2009). Under the Regulation, all producers of portable batteries, or a third party acting on their behalf, must finance the net costs arising from the collection, treatment and recycling of the waste portable batteries POM (UK Government 2009). In the original legislation, portable batteries were defined as batteries that “can be hand-carried by an average person without difficulty”. A revision came into force in 2016 and further introduced a 4 kg threshold for portable batteries (GOV.UK 2015). To comply with this obligation, all producers that place more than 1 tonne per year on the UK market are required to join a battery compliance scheme. Small producers that place less than 1 tonne per year on the market only have registration and reporting obligations and are not required to join a compliance scheme.

Actors and responsibilities

As of 2019, there were five approved battery compliance schemes in the UK, which together provided compliance services for 599 producers. In addition, there are about 1,400 small producers, who jointly represent around 0.4% of portable batteries POM (UK Environment Agency 2020). The PROs are responsible for annually registering the members with the competent environmental authority and provide information to the environmental regulator about the batteries that have been placed on the market by their members in the current year and the 2 previous years. The PROs are furthermore responsible to collect evidence notes for the collection, treatment and recycling of waste portable

batteries according to the market share of the clients. The evidence notes must also be provided to the competent environmental authorities. The competent environmental authorities in the UK include the Environment Agency (England), the Northern Ireland Environment Agency (Northern Ireland), the Scottish Environment Protection Agency (Scotland) and Natural Resources Wales (Wales).

Figure 32: PRO market share (based on batteries POM by their customers)



Source: (UK Environment Agency 2020)

3.5.2 Environmental performance

Collection infrastructure

A large share of the collection of waste batteries in the UK takes place at the level of retailers and distributors. All retailers and suppliers, which sell or supply over 32 kg of portable batteries per year are required set up a collection point in order to take back portable batteries. The take-back service needs to be provided free of charge and is to be set up at all premises from where batteries are supplied. There are no regulatory requirements regarding the type of collection container except that it needs to be suitable for safe storage of all kinds of portable batteries (i.e. not only those types of batteries sold/distributed). Retailers and distributors that fall under the 32 kg/year threshold, as well as any other sites (e.g. school, offices, other public buildings), can voluntarily set up collection points for batteries but may have to arrange collection and transport themselves (GOV.UK 2021a). Collection points for portable waste batteries are in most cases also available at municipal recycling centres run by the local authorities. It is estimated that there are well above 50,000 collection points for waste portable battery in the UK. This translates into one collection points for every 1,333 UK residents.

Organisation of transport & logistics

When collection from a collection point is required, the respective operator can call a PRO to organise the logistics. The PROs are free to choose how they collect batteries but must cooperate to ensure that waste batteries are picked up from local authorities and those retailers that are obliged to take back waste batteries. PROs usually commission a registered transport company certified to collect hazardous waste including batteries. The corresponding contracts are put out to tender on a regular basis. The transport company collects the waste and transports it to an approved battery treatment facility. The PROs can then decide to store the batteries at a licensed site or deliver them to an approved battery treatment operator (ABTO) or approved battery exporter (ABE) contracted by the respective PRO for further sorting and subsequent recycling. Economic operators involved in the transport of waste batteries

are required to hold a waste carrier certificate and comply with the law on moving and transferring hazardous waste (GOV.UK 2021b, 2021c).

In addition to PROs, the regulatory framework on waste batteries in the UK also allows other economic operators to participate in the collection, treatment and recycling of waste batteries. Therefore, any registered and licensed waste collector can independently participate in the collection and treatment of waste batteries even if not contracted by a PRO.

Challenge: Cherry-picking of high-yield collection points

Notably, the UK currently has no regulatory mechanism to support or coordinate the distribution of collection points between PROs and other economic operators involved in the collection of waste batteries. As a result, cherry-picking of particularly high-yield collection points is commonplace, with access to these collection points mainly depending on personal relationships or economic incentives.

The UK regulation does neither prescribe a minimum amount of batteries to be picked up nor a minimum frequency for collection. However, the Environment Agency recommends collecting batteries at least once a year. As for some collection points, annual collection results in a very low collection volumes and collection points usually communicate the need for collection to the PROs on an ad-hoc basis, this suggestion is not always adhered to by the PROs.

Reporting, validation and monitoring process for data on battery collection

Under the UK Waste Batteries and Accumulators Regulations, the PROs are required to report the total amount in tonnes of waste portable batteries that they have collected during a relevant compliance period (1 year) to the competent environmental authority. The numbers have to be provided in writing quarterly and furthermore specify the total amount in tonnes and the amount in tonnes by reference to the chemistry type (UK Government 2009). The data on the amount of batteries collected from the collection points is provided to the PROs by the contracted waste collectors. For the submission of data on the collected volumes there is no validation required from the PROs. Instead PROs have to provide the competent authority with batteries evidence notes, which are issued by ABTOs and ABEs on all waste portable batteries accepted³² for sorting and treatment/export. Batteries sent to a storage facility instead of being delivered for recycling are therefore usually not reported, meaning that only the respective PROs know how many batteries were actually collected.

Apart from the evidence notes received as a result of their own activities, PROs can buy battery evidence notes from other economic operators, which have engaged in the collection and recycling of waste batteries independently as well as from other PROs, which have collected more than they would be legally required to collect within a given reporting period. However, the amount of evidence notes that can be traded between PROs is limited to 10% of their collection requirements (UK Environment Agency 2011).

For their part, ABTOs and ABEs must also report to the competent authority the quantity and composition of waste portable batteries accepted each quarter on behalf of each PRO. The data provided is used by the competent authority to monitor the compliance of PROs, ABTOs and ABEs by comparing it to the scheme returns, checking if both the totals and the battery chemistry match for total quantity of batteries delivered to ABTOs/ABEs. The data is also compared to the scheme's viable plans for the predicted quantity of waste batteries to be collected and delivered to ABTOs/ABEs each quarter as well as the quantity of evidence notes expected to be issued. The results of this monitoring approach are then used for specific risk profiling activities and to plan compliance checks.

Compliance visits to ABTOs/ABEs are carried out by the competent authority to ensure compliance with conditions of approval, the accuracy of evidence issued and to check if the waste batteries are treated and recycled in accordance with the required standards set out in the UK's regulatory framework. During compliance checks, topics such as battery origins (UK batteries), sampling and inspection of inputs/mixed loads, storage and materials, output records, evidence notes, material throughput,

³² Batteries accepted for treatment are first sorted and must then be recycled within a period of 12 months.

quarterly reports and any significant changes are addressed and discussed with the operators (UK Environment Agency 2011).

Enforcement of correct input sampling is important because many ABTOs/ABEs receive inputs from various sources, not necessarily limited to portable batteries (<4 kg). In order to distinguish between the amount of portable and non-portable batteries received, they are therefore required to regularly conduct a sampling exercise and measure the average percentage of portable batteries within their total input. However, experts suspect that some ABTOs may have an incentive to selectively choose certain batches of batteries for sampling that have a high percentage of portable batteries, as this produces more recycling evidence, that can be sold for a profit. This in turn results in an increased percentage of portable batteries reported as delivered for treatment (Personal Communication 2021).

After quality assurance, the Environment Agency publishes quarterly breakdowns of the overall POM and collection volumes by 3 chemistry groups (lead-acid, nickel–cadmium, others) on the UKs National Packaging Waste Database (UK Environment Agency 2011, 2021).

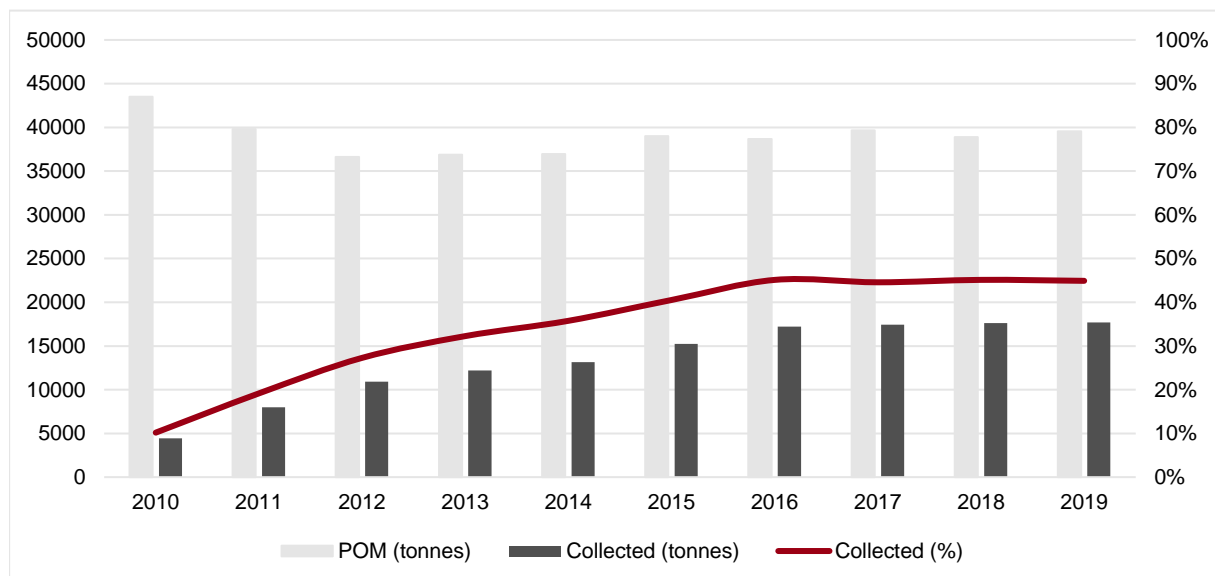
Collection rate and achievement of the EU collection target

The UK collection rate is calculated from the weight of waste portable batteries for which the PROs provided recycling evidence notes to the UK environment authority and the average amount of portable batteries placed on the UK market by scheme members and small producers during the reporting period and the two previous years. According to the latest data published by the UK Environment Agency, the EPR scheme for waste batteries collected 45.36% of the 38,963.553 tonnes batteries POM in 2019 and the two previous years. This is equivalent to about 0.27 kg per capita or 17,675.61 tonnes of waste batteries (UK Environment Agency 2020). According to the data the UK achieved the EUs collection target of 45% for 2019 with precision.

Development of the collection rates between 2010 and 2019

Since the first compliance period in 2010, the UK's collection rate has steadily increased from an initial 10% to 45% in 2016, after which it has remained constant (Baldé et al. 2020; eurostat 2020d). During the same period, the amount of portable batteries that were POM in the UK remained relatively stable, decreasing from 43.49 tonnes in 2010 to 38.99 tonnes in 2015 and slightly rising again to 39.54 tonnes in 2019 (eurostat 2020d; UK Environment Agency 2020). This indicates that UKs collection efficiency has remained at a constant level since 2016.

Figure 33: Waste portable batteries collection in the UK



Source: (UK Environment Agency 2021)

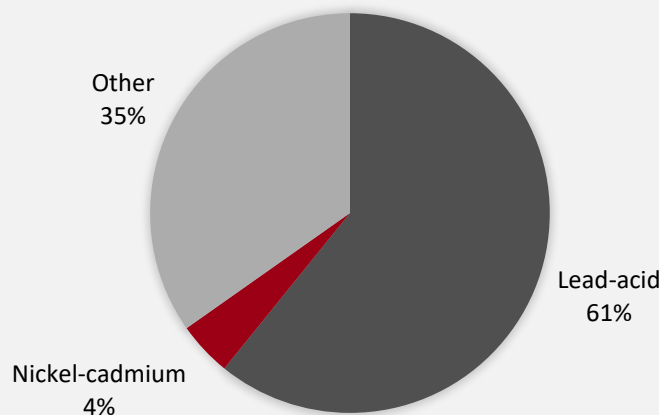
One of the reasons behind the unchanged collection rates in the UK is assumed to be the widespread practice of storing part of the collected waste batteries instead of taking them immediately for recycling

(see above). According to expert interviews the stored batteries are only ever sent for recycling if the respective PRO is at risk of not meeting the required collection targets at the end of the reporting period. Any quantities of batteries collected in excess of the collection target will remain in storage to ensure that the collection targets can be met in future reporting periods and thus avoid potential penalties, sanctions or even withdrawal of approval for non-compliance. The PROs state that, in the absence of any other safety mechanism, this is the only way to ensure the achievement of collection target (Personal Communication 2021).

Challenge: Lead-acid batteries as a hand-brake for higher collection rates

The share of lead-acid batteries POM in the UK has historically been higher than in most countries but slowly decreased over time (8% until 2012, 6% in following years, 5% in 2017 and 3% in 2019). This is partly due to the introduction of the 4 kg threshold per portable battery, which decreased the amount of portable lead-acid batteries POM by nearly 20% (EPBA 2020). However, despite the reduction of lead-acid batteries POM, the data for collected portable batteries still shows a very high share of lead acid batteries. In 2019, 61% of all collected portable batteries were lead-acid batteries, representing an astonishing 880% of the lead-acid batteries POM in the same year. The disproportionate share of lead-acid batteries collected may on the one hand be attributed to the comparatively long lifespan of lead-acid batteries (7-8 years), meaning that many of the batteries collected today were sold at the very start of the EPR scheme, where the data of battery sales was still incomplete. On the other hand, experts suggest that even today many of the lead-acid batteries POM are not correctly declared by the producers or even illegally imported to the UK for recycling, thus resulting in large data inaccuracies with respect to the total volumes POM (Personal Communication 2021).

Figure 34: Waste portable batteries collected in 2019 by chemistry



Source: (UK Environment Agency 2020)

The high share of lead-acid batteries in the UK market for waste portable batteries is likely to act as a significant barrier for achieving higher collections and treatment rates for other battery chemistries, as the treatment of lead-acid batteries is more profitable, thus resulting in lower prices for the respective recycling evidence. This in turn incentivises PROs to preferably generate or buy evidence notes for treatment of this type of batteries instead of other batteries to help them keep their prices at a low level.

Treatment capacities

The UK currently has 56 registered ABTOs for waste portable batteries and 14 ABEs (UK Environment Agency 2021). However, not all ABTOs are actually involved in the recycling of waste portable batteries. Instead, they often only act as sorting facilities, which then pass sorted battery fractions on to recycling and treatment facilities. Up to and including 2020, there was only capacity in the UK for the physical

recycling of lead-acid batteries. All other battery types were exported for recycling. However, in January 2021, recycling company WasteCare opened the UK's first household battery recycling facility. The plant can process 25,000 tonnes of household batteries per year, which according to WasteCare is sufficient to recycle all of the UK's spent alkaline and zinc-carbon batteries eliminating the need to export them.

According to the experts interviewed, the lack of recycling capacity for non-lead acid batteries is a direct consequence of the high share of lead-acid batteries in the total collection volume and the resulting low collection volumes for other chemistries. For a long time, this has not allowed recycling plants for battery chemistries other than lead-acid batteries to operate at full capacity thus making their operation unprofitable. However, with the rising costs for lead-acid battery evidences (3.5.3), PROs in the UK are becoming increasingly involved in the collection of other battery chemistries, making the development of corresponding recycling capacities in the UK, such as that of Waste Care, increasingly economically viable (Personal Communication 2021).

Treatment requirements

According to the UK Waste Batteries and Accumulators Regulation (2009), the treatment and recycling of waste batteries has to take place using best available techniques that protect health and the environment and comply with community legislation, in particular in regards to health and safety and waste management standards. It has to include the removal of all fluids and acids and must take place at sites with impermeable surfaces and suitable weatherproof covering or in suitable containers (UK Government 2009). Furthermore, the recycling of waste batteries is required to meet the following minimum recycling efficiencies and associated requirements (UK Government 2009):

- Recycling of 65% by average weight of lead-acid batteries, including recycling of lead content to the highest degree that is technically feasible while avoiding excessive costs;
- Recycling of 75% by average weight of nickel-cadmium batteries, including recycling of the cadmium content to the highest degree that is technically feasible while avoiding excessive costs; and
- Recycling of 50% by average weight of other waste batteries.

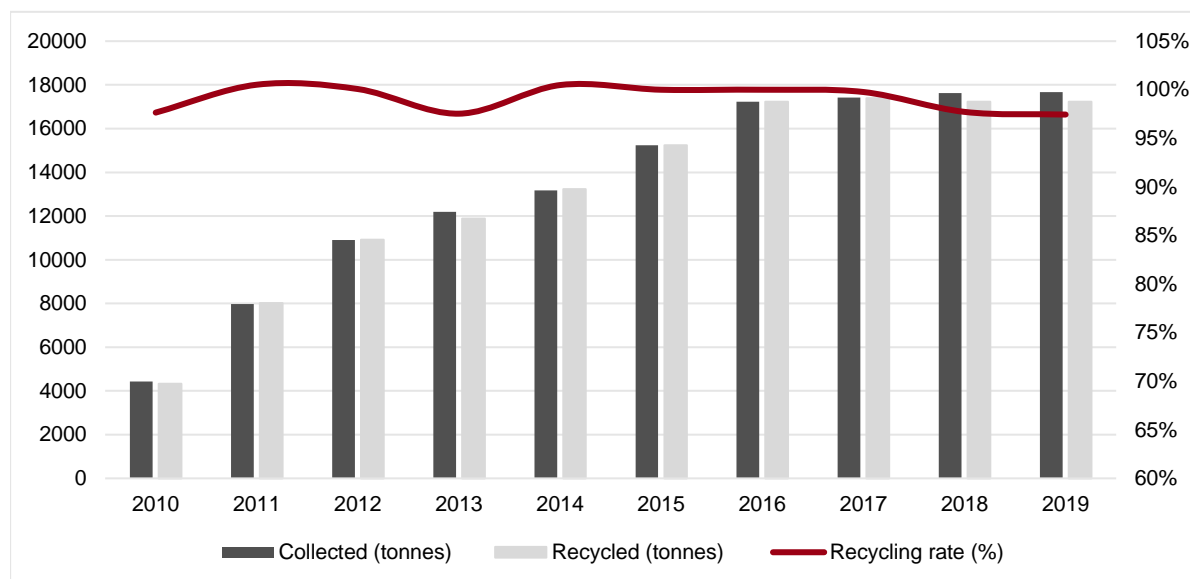
Achievement of recycling/preparation for re-use targets per waste category in 2019

Apart from the overall collection target of 45%, the UK system does not prescribe specific recycling targets for batteries of different chemistries. Due to the fact that the collection rate is calculated based on the treatment evidence provided by the PROs, the reported figure for waste portable batteries delivered to ABTOs or ABEs differs only slightly from the reported amount of batteries collected (17,675.61 vs. 17,593.98), thus resulting in a recycling rate of 97,4%. The difference in the reported amounts is most likely to be caused by internal movements of waste portable batteries within the ABTOs/ABEs.

Development of the recycling/preparation for re-use rates between 2010 and 2019

As mentioned above the UK only reports those portable batteries as collected for which the PROs can provide evidence notes from ABTO/ABEs. As a result, the amount of batteries received by the treatment operators is almost identical to the amount reported as collected. Minor discrepancies in the numbers are most likely due to waste flows within the treatment operators' facilities.

Figure 35: Rate of collected waste portable batteries by ABTOs/ABEs



Source: (UK Environment Agency 2021)

3.5.3 Economic performance

Cost for producers

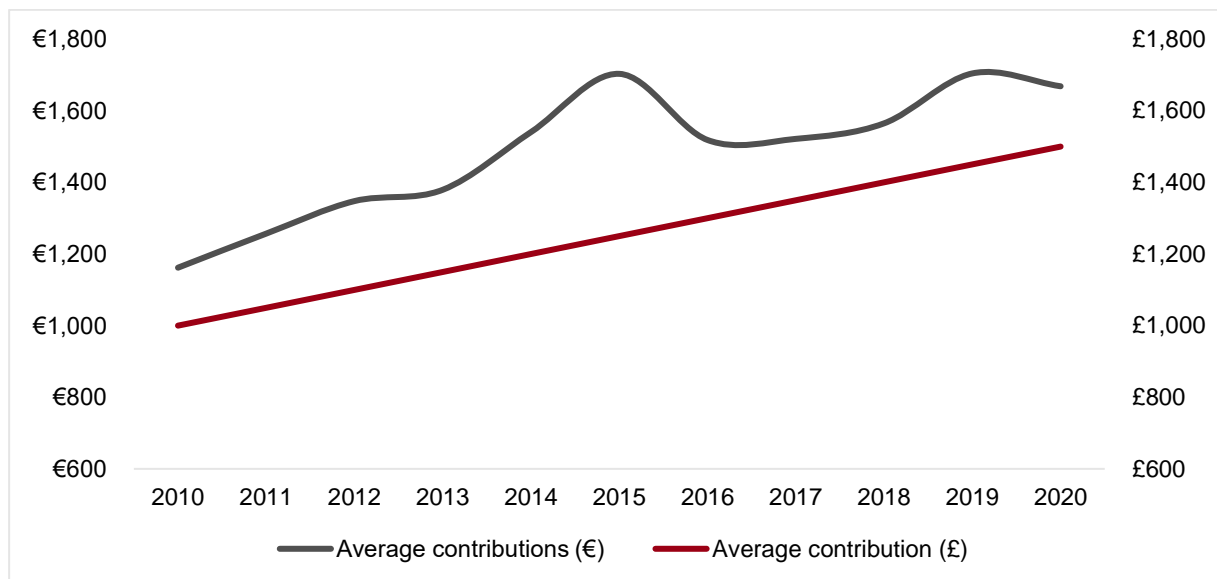
Large producers of portable batteries (> 1 tonne POM per year) are obliged to join a PRO through which they finance the collection, treatment, recycling, consumer information, monitoring by environmental authorities and service fees of the compliance scheme according to their market share. A producer's share is equal to the specified percentage of the average annual quantity in tonnes of portable batteries placed on the market for the first time in the UK during the relevant period. To cover the cost of the compliance services offered by the PROs producers had to pay an average contribution of 1,450 £ (1,704 €³³) for each tonne of portable batteries POM in 2019. In addition to that costs that occur as a result of the compliance services, these costs also cover an annual subsistence charge of 90,000 £ for operating a battery compliance scheme as well as an annual fee of 600 £ for each members of a compliance scheme that PROs have to pay to the Environment Agency to cover their administrative cost associated with battery compliance.

Challenge: High demand of recycling evidence results in disproportionate prices

According to cost-approximations provided by market experts the contributions have increased by roughly 50% since the UK compliance scheme for portable batteries came into force in 2010 (Figure 36). Apart from the increased collection targets, the steep increase of contributions is strongly correlated to the high share of portable lead-acid batteries available within the UK market. While the high availability and low cost of recycling lead-acid led to relatively low system costs in the early years, the amount of available lead-acid batteries has decreased over the years (see 3.5.2). In turn, the demand for recycling evidence (for all battery chemistries) has increased sharply, leading to a bidding war between PROs to secure the available evidences. Due to the high demand for recycling evidence the parties which have control or access to waste batteries or the actual volumes of collected batteries (lead-acid or other) can sell recycling evidence at prices that by far exceed the cost for collection, sorting and recycling. This is especially true for lead-acid batteries where, despite their low recycling cost, prices are currently reaching levels that exceed those of other chemistries. Should this trend continue it is to be expected that PROs will increasingly start to invest the collection and recycling of other battery chemistries (Personal Communication 2021).

³³ Data represents the approximate market price as assumed by market experts. Prices in Euro where calculated based on the applicable exchange rates at the end of 2019 (<https://www.boerse.de/historische-kurse/Pfund-Euro/GB0008283987>)

Figure 36: Average PRO contributions for portable batteries between 2010 and 2020³⁴



Cost for collection and logistics

Data on the cost for the collection and logistics of waste portable batteries is not available for the UK. However, it is assumed that the cost for collection and logistics per tonne of portable batteries collected have remained relatively stable during the last decade as the organisational structures have remained more or less unchanged.

Cost for waste recycling and treatment

According to cost approximations provided by UK market experts, PROs in the UK pay on average 1,300 £ (1,528 €) for the recycling and treatment of one tonne of portable batteries. As mentioned above the high demand for recycling evidence has a significant influence on the prices charged. The lack, until recently, of recycling capacities for battery chemistries other than lead-acid in the UK is thought to have additionally increased the cost of recycling and treatment, as this required additional export logistics (Personal Communication 2021).

3.5.4 Technical performance

Innovation potential

Within the UK EPR scheme for waste portable batteries, innovation mainly takes place at the level of services offered by PROs that go beyond mere compliance. These services include, among others, data collection and reporting services for producers of spent batteries. They can be directly attributable to competition between PROs for higher market shares and members. In terms of technological innovation, there has been a clear focus by UK compliance schemes in recent years on investing in new recycling capacity in the country. Again, some of this investment can be attributed to competition between PROs. For example, WasteCare, which established the UK's first recycling facility for household batteries in early 2021, is also the owner of the one of the UK's five PROs. Additional technological innovations as well as incentives for improved recycling qualities or eco-design approaches have not been identified and/or cannot be attributed directly to the EPR scheme in the UK.

Awareness creation potential

UK law requires PROs to finance the net cost of information campaigns that encourage higher collection and recycling rates and ensure that end-users of portable batteries are fully informed of the correct disposal of waste batteries, the collection and recycling facilities available to them, their role in contributing to the recycling of waste batteries, as well as the meaning of the symbol of the crossed-out

³⁴ Data represents the approximate market price developments as assumed by market experts. Prices in Euro where calculated based on the applicable exchange rates at the end of each reference year (<https://www.boerse.de/historische-kurse/Pfund-Euro/GB0008283987>)

wheeled bin shown in Schedule 5 of the regulation and the chemical symbols “Hg”, “Cd” and “Pb”. The regulation does not specify how these goals must be achieved, nor does it set a minimum level of investment for communication (UK Government 2009).

Despite the above-mentioned information requirements, the UK’s EPR system for batteries is currently showing a clear lack of coordinated, large-scale information campaigns (e.g. via internet, TV, radio) aimed at reaching a wide range of end-users. Instead, PROs tend to take a broad definition of what counts as information and focus on activities that are directly connected to their own collection. This includes, among other things, the design of waste battery collection boxes (or information materials associated with their boxes) or information on collection activities and services on their own website. Some PROs also engage in information campaigns or “collection competitions” in schools, where children are taught about correct disposal of batteries and are encouraged to bring waste batteries to school so they can be directly collected by the PROs.

Challenge: Commons-dilemma disincentivises PROs to invest in large-scale awareness creation measures

According to interviewed experts, the lack of coordinated approach may be explained by both the strong competition between PROs and the large geographical spread of collection points to be managed by a single PRO, making it very difficult for PROs to guarantee that larger, more diffuse campaigns will result in a higher return-rate of batteries at their own collection points and not benefit their competitors instead. Jointly financed information campaigns between multiple PROs, which might be able to mitigate the individual financial risks for the schemes, have so far not been initiated in the UK. As such, the competitive, fragmented nature of information campaigns suffers from a commons-dilemma that disincentivises competing PROs to invest in awareness creation measures that do not directly affect their own collection rates (Personal Communication 2021).

Stakeholder satisfaction levels

Producers and other stakeholders in the UK are becoming increasingly aware of the need to reform the current EPR system for spent batteries in the country. Although most producers are in general satisfied with the services provided by the PROs the steep rise in contributions has led to reduced levels of stakeholder satisfaction of the recent years.

3.5.5 Key take-aways

The UK’s EPR scheme is capable of achieving the EU’s collection targets

Starting from almost zero in 2010, the UK’s competitive EPR scheme was able to quickly ramp up collection rates and achieve the EU target of 45% in the course of only 6 years. However, as competition between the PROs incentivises them to keep the compliance costs for their customers as low as possible, there is currently no visible tendency of increasing collection rates above the minimum requirements. Higher collection rates would at the moment likely require an increase of the minimum collection targets, which would need to be backed up by more ambitious regulatory requirements and higher targets. The upcoming revision of the regulation should serve as an important step in this direction.

Lead-acid batteries serve as a hand brake for higher collection rates and a driver for costs

The high abundance of lead-acid batteries and low costs connected to their recycling initially enabled PROs in the UK to charge very low prices for their compliance services. However, due to the increasing competition for the access to waste batteries and the evidence notes for treatment respectively, prices for producers increased drastically in recent years - notably even more drastically as other waste operators learned that evidence notes for lead-acid batteries can be sold to PROs for prices that exceed the actual recycling costs. As long as the price for lead-acid evidence is cheaper than that of other batteries, PROs are incentivised to continue generating or buying evidence notes for lead-acid batteries. This results in an overproportionate share of lead-acid batteries collected and recycled. The vague definition of what counts as a portable battery (and is therefore subject to the compliance obligation)

combined with potential gaps in the enforcement of correct battery input sampling at the level of ABTOs/ ABEs further increases the disproportionate share of lead-acid batteries reported.

Reducing the amount of available portable lead-acid batteries would likely lead to a significant boost in the collection of other battery chemistries, which in turn would also incentivise the build-up of additional national recycling facilities in the UK. A potential approach to reduce the lead-acid share would be to revise the definition of portable batteries, excluding those battery chemistries for which recycling is economically feasible without further subsidies. To a certain extent, the issue is already addressed in the EU's current draft of the new battery regulation, which defines portable batteries as sealed, below 5 kg in weight, not designed for industrial purposes and neither an electric vehicle battery nor an automotive battery.

Competition for the access to waste leads to high operational risks for the PROs

As there is currently no clearing mechanism for waste batteries in the UK, competition for access to waste batteries between PROs is high. As a direct result, cherry-picking of particularly high-yield collection points is commonplace, with access to these collection points mainly depending on personal relationships or economic incentives. Together with the high prices for evidence notes, this incentivises some PROs to deliberately over-collect and sell evidence to other PROs for a profit.

Due to the high uncertainty in accessing waste batteries, PROs in the UK further tend to store a certain proportion of their collected batteries. Batteries in storage are only delivered for recycling if the required quotas cannot be met. In this way, they can ensure that they meet their collection obligations without running the risk of being sanctioned by the competent authority. However, as batteries sent for storage are not reported as collected, the actual collection rate of spent batteries in the UK is higher than the one being reported by the environment agency.

To ensure a level playing field between PROs in a competitive setup and to avoid deliberate over-/under-collection as well as a fair access to waste, it might be necessary to establishing a clearing mechanism for waste batteries.

The current organisation of the UKs EPR regime leads to insufficient communication measures

Large-scale communication campaigns aimed at raising awareness about the correct disposal and recycling of spent batteries do not currently exist in the UK. Although the PROs are well aware of the need for improving consumer awareness to achieve higher collection rate, individually financed campaigns, which are not guaranteed to have a direct impact on the own collection rates, are not feasible in the current system. To enable large-scale campaigns in a competitive environment, coordinated financial efforts are therefore needed between the different PROs (e.g. according to market share of the respective producers). The collective budget could then be managed by an independent third party. Furthermore, the regulative requirements for communication could be revised to set measurable requirements for the PROs.



3.6 Switzerland (Batteries)

Table 15: Switzerland - EPR key performance indicators at a glance

	Indicator	Value (2019)
Environmental	Collection rate	63.68%
	Collection per capita	1.75 kg
	Recycling & treatment rate	83%
Economic	Cost for producers per tonne POM	3,245 €
	Cost for collection per tonne collected	586 €
	Cost for waste recycling and treatment per tonne recycled	3,787 €
Technical	Stakeholder satisfaction levels	Medium
	Innovation potential	Low
	Awareness creation potential	High

3.6.1 Overview

National transposition of the Directive 2006/66/EC on Batteries

Take-back obligations for waste batteries in Switzerland were first introduced in 1986 and are regulated by the Substances Ordinance. In order to finance the increasing costs for the treatment of waste batteries, a voluntary financing mechanism was introduced by battery producers in 1991. The voluntary financing was changed to an obligatory Advance Recycling Fee (ARF) in 2011 to be aligned with the requirements for EPR as defined in the Batteries Directive 2006/66/EC. Under the current ordinance “on the reduction of risks associated with the handling with certain particularly dangerous substances preparations and articles” (ChemRRV), all producers of batteries as well as producers of vehicles and/or appliances containing batteries (that are not already charged with a fee) must finance the net costs arising from the collection, treatment and recycling of the batteries they place on the market as well as the costs required for the administrative work done by the Federal Office for the Environment (BAFU) and the costs for communication and awareness raising (BAFU 2021).

According to the ChemRRV, all batteries, irrespective of weight, are subject to the obligation to register and pay fees. In the case of industrial and automotive batteries, the obligation of paying ARF may be waived in case the industries or companies can provide evidence of environmentally sound disposal that fully covers the end-of-life costs of battery disposal. As a result, producers are exempt from paying an ARF for the majority of lead-acid batteries sold in Switzerland because the recycling of these batteries is self-financing and does not need subsidies in form of an ARF. Instead of paying a full ARF, exempted companies need to pay a contribution that covers the administrative costs incurred by the centralised compliance scheme INOBAT that is charge of coordinating collection, treatment and reporting of waste batteries in Switzerland (BAFU 2021).

Producers of both chargeable and non-chargeable batteries are required to report the quantity of batteries placed on the market to an independent organisation commissioned by the BAFU', in particular indicating the types of batteries and pollutants contained therein. This report needs to be provided to the responsible organisation by March 31st each year. The organisation provides forms for reporting in written or electronic form. It also forwards the reports received to the BAFU in accordance with the BAFUs requirements (BAFU 2021; INOBAT 2020b).

Actors and responsibilities

The BAFU commissions a suitable private organisation to coordinate collection, administration and use of the ARF for a contractual period of 5 years. As part of the last award procedure in 2016, the mandate was awarded to ATAG Wirtschaftsorganisationen AG. Since January 1st 2017, the administrative management and assurance of producer responsibility has thus been implemented by ATAG Wirtschaftsorganisationen AG under the brand name "INOBAT Batterierecycling Schweiz". INOBAT is legally obliged to submit an annual report on its activities to the BAFU. This report must contain, amongst others, information on (BAFU 2021): a) the quantity of batteries subject to the ARF placed on the market in the reporting year, with details of the types and their pollutant contents, as well as the return rate of batteries subject to the fee; b) a statement of the use of the fee by amount, purpose and recipient; and c) a list of producers exempted from the obligation to pay the fee. Moreover, the BAFU possesses the authority to issue instructions to INOBAT and may request any necessary information and inspection of files.

3.6.2 Environmental Performance

Collection infrastructure

Consumers are required to hand over waste batteries for disposal at designated battery collection points. Battery collection points include the locations of all first-time distributors (e.g. physical sites of distributors/importers and manufacturers) of batteries in Switzerland, municipal collection points as well as private collection points of authorised companies. In addition, shops, companies, gas-station, etc. may also set up voluntary collection points. For smaller quantities, INOBAT provides postage-free packaging materials for transport by post. In the aggregate, the collection network for waste batteries in Switzerland is well developed and encompasses over 11,000 individual collection points (1 for every 795 residents) (INOBAT 2021a).

To ensure that used batteries can be collected, stored and transported with the necessary degree of safety, INOBAT provides the collection points with ADR-compliant containers. Transport containers can be obtained from the transporters for a deposit. When used batteries are collected, the containers are replaced by the transporter free of charge.

Organisation of transport & logistics

The transporters are contacted directly by the respective collection points, whenever collection of waste batteries is required. INOBAT publishes a list of registered transport companies online. The list is sorted by postal code so that collection points can choose the transport company closest to them. Any transport company can become a qualified carrier of used batteries and register with INOBAT by meeting the criteria set out in the information sheet for transporters (INOBAT 2021c). Upon request by a collection point and regardless of the quantity stored, transport companies are responsible for collecting used batteries within a reasonable period of time. If necessary, the companies must also provide the collection points with SDR/ADR-compliant transport containers for waste batteries (classified as special waste/hazardous goods). These are provided to transporters by INOBAT with the transport companies being responsible for their temporary storage. There are currently 68 transport companies registered with INOBAT. Following the collection, the transporters are responsible for delivering the collected waste batteries to a suitable battery recycling plant.

Reporting, validation and monitoring process for data on battery collection

To verify the quantity of batteries collected, all parties involved in the collection of waste batteries are required to fill a waste consignment note for the collection of waste batteries whenever they are collected

and delivered for recycling. Each consignment note has a unique identification number and is provided by the responsible transport company upon collection. Amongst others, these notes contain information on the respective collection point, a description and amount of collected batteries, details on the responsible transport company as well as information on the recycling plant to which the batteries are delivered. For each separate collection, one waste consignment note per waste code and delivery needs to be filled and carried along.

Following the delivery to the recycling facility transporters registered with INOBAT may submit a request for compensation to INOBAT for the transport of batteries subject to a fee. In order for the request to be approved by INOBAT, it needs to contain the date of delivery, the quantity of batteries collected in kg per collection point and the identification numbers of the consignment notes for each delivery to the recycling company.

According to the ChemRRV, the recycling facility is required to report the quantities of batteries were accepted for recycled export in the previous year to INOBAT by the 30th of April on an annual basis. The numbers have to be validated by providing the identifiers of the corresponding waste consignment notes. INOBAT reports the numbers as part of its annual report. In order to monitor the recycling standards, INOBAT is also able to carry out its own audits at the facility. Compliance with the legal (environmental) requirements, however, is monitored by the BAFU.

Collection rate and achievement of the EU collection target

The collection rate of waste batteries in Switzerland is calculated for all used batteries subject to fees and is based on the quantity of batteries POM and the quantity collected by consumers and handed over to a recycler registered with INOBAT for environmentally sound disposal. According to the latest data published by INOBAT, the take-back scheme for waste batteries collected 63.68% of the 5,469 tonnes batteries POM and subject to a fee in 2019 and the two previous years. This is equivalent to about 1.75 kg per capita or 3,111 tonnes of waste batteries subject to fees (INOBAT 2020b). According to this data, Switzerland surpassed the EUs collection target of 45% by almost 19%. However, the BAFU is aiming for an even higher return rate of 80% (Bundesamt für Umwelt 2007).

Challenge: Low return rates for lithium batteries

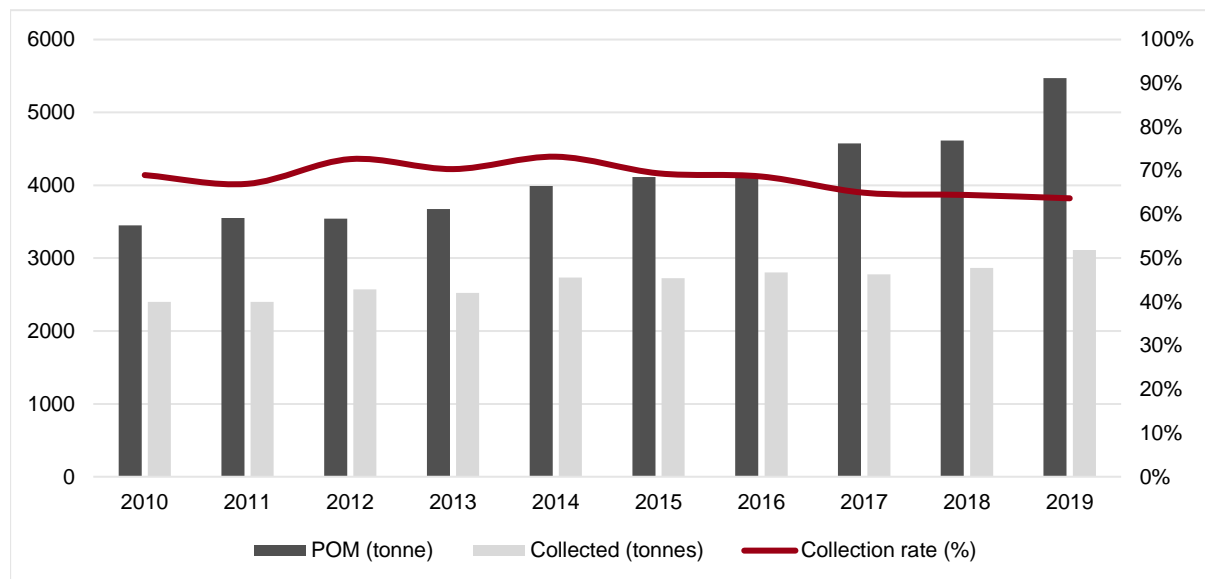
Despite the relatively high overall collection rate INOBAT is currently confronted with low return rates for lithium batteries (20%) whose domestic sales have increased massively in recent years. The low return rates are probably due to the long life of lithium batteries (~7-12 years), which means that many POM batteries have not yet reached the end of their life. As INOBAT includes lithium accumulators, such as lithium batteries in industrial vehicles, that would technically qualify as industrial batteries under the EU Batteries Directive, the reported share lithium of lithium batteries in Switzerland (2019: 15%) is furthermore higher than that of PROs in other countries (EPBA 2020; INOBAT 2020b). Due to the above-mentioned concerns, INOBAT is, in addition to the overall return rate, also publishing a separate return rate for lithium batteries.

Development of the collection rates between 2010 and 2019

Since 2000, Switzerland consistently achieves a high collection rate well above 60% (EPBA 2020). However, since 2012 the collection rate is declining as the amount of batteries POM is increasing at a faster rate while collection remained almost constant. This development might partly be explained by the steep increase of lithium battery sales and the comparatively low return rates. Additional reasons for the leakage of waste batteries from the collection system are assumed to be (undeclared) export batteries in appliances, incorrect disposal of batteries as domestic waste or storage of batteries in private households. Switzerland historically achieved a high collection rate well above 60% since 2000 (EPBA 2020). However, since 2012 the collection rate is declining as the amount of batteries POM is increasing faster while collection remained mostly unchanged. As mentioned above this development might partly be explained by the steep increase of lithium battery sales and the comparatively low return rates of the same. Additional reasons for the leakage of waste batteries from the collection system are assumed to

be (undeclared) export batteries in appliances, incorrect disposal of batteries as domestic waste or storage of batteries in private households.

Figure 37: Collection rate for waste batteries in Switzerland



Source: (INOBAT 2021e)

Achievement of recycling targets per waste category in 2019

Apart from the collection target of 80%, the Swiss regulation does not specify recycling targets for different battery chemistries. Due to the fact that the collection rate is calculated based on the waste consignment notes signed by the battery treatment operators upon receipt, the reported figure for waste batteries and accumulators delivered for recycling is usually equal to the amount collected, thus resulting in a recycling rate of 100% (Figure 38).

Treatment capacities

There is only one operator suitable for the recycling of batteries in Switzerland: BATREC Industry AG in Wimmis. According to expert interviews, 100% of the waste batteries collected in Switzerland are treated at this facility (Personal Communication 2021).

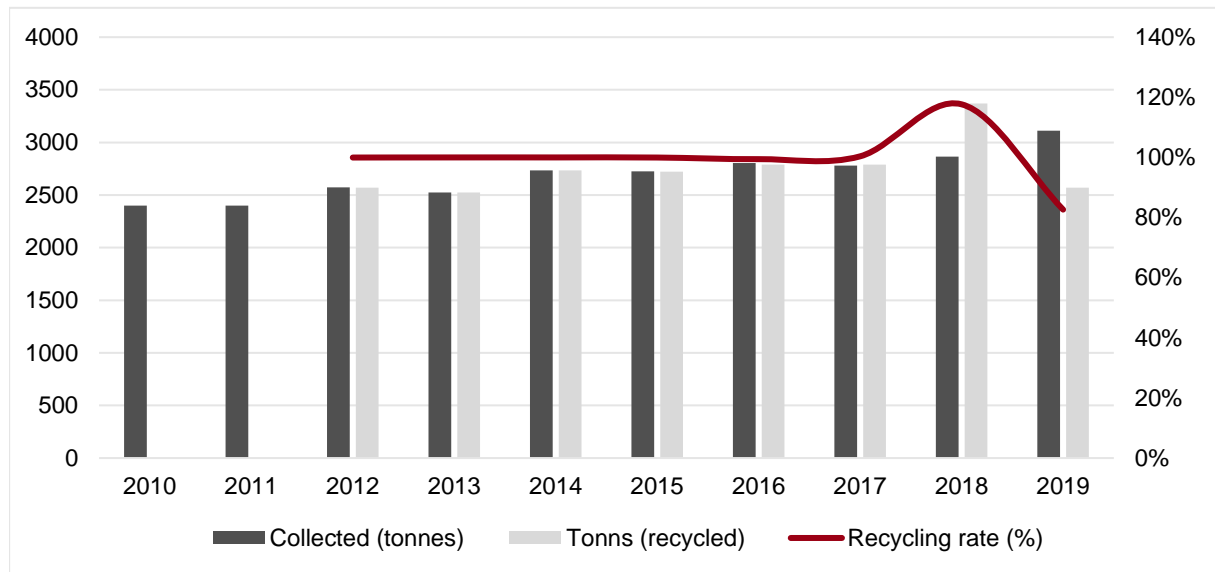
Treatment requirements

The BATREC plant in Wimmis is a specialised high-temperature recycling plant for household batteries. The recycling plant recovers iron, manganese, zinc and mercury and captures residual pollutants. Plastic components are utilised by means of co-incineration. Nickel-cadmium, lithium-ion and lead-acid batteries are sorted before treatment and handed over to specialised companies, for recycling (located abroad). The export of waste batteries for recycling is only permitted to OECD- and EU Member States provided that it complies with Swiss standards at the respective treatment site. The export does require a permit from the BAFU.

Development of the recycling rates between 2010 and 2019

As mentioned above, the recycling rate of collected batteries in Switzerland is usually close to 100%. In 2019, however, the share of collected waste batteries that was recycled dropped significantly compared to the previous year. This may be explained by the fact that in 2018 additional stocks of used batteries were used up as a result of the changes in INOBATs compensation structure (see Figure 38) and that BATREC'S pyrolysis plant was less available in 2019 (INOBAT 2020b).

Figure 38: Development of battery recycling rates in Switzerland



Source: (INOBAT 2021e)

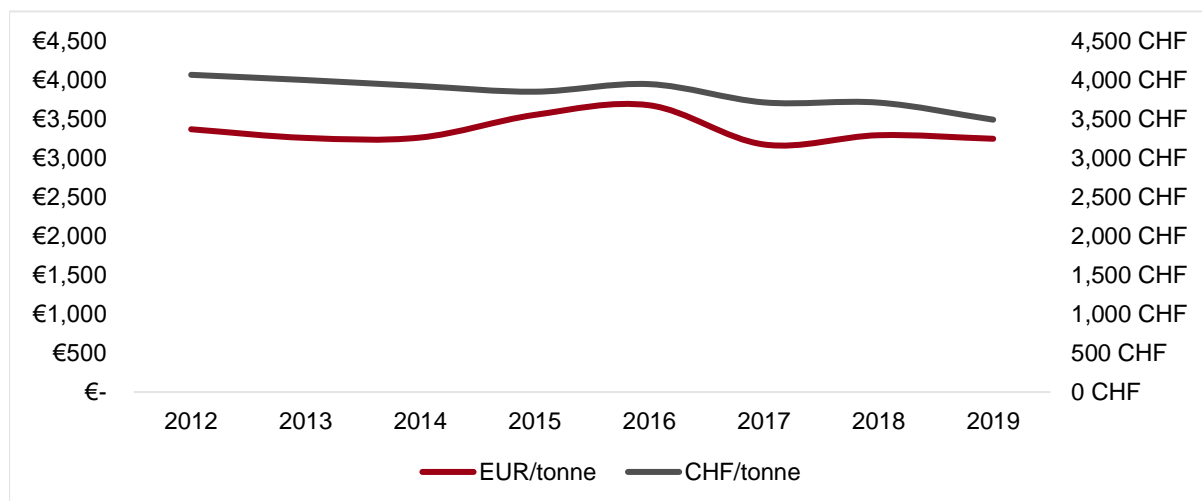
3.6.3 Economic Performance

Cost for producers

The level of the ARF charged by INOBAT on batteries that are subject to fees is determined by the BAFU and issued in an ordinance in annual intervals. The BAFU is calculating the magnitude of the ARF based on a cost estimate for the relevant year as well as the real costs of the previous year. Based on the ordinance, INOBAT publishes the valid fee tariff for each battery chemistries per piece and weight. If INOBAT has accumulated reserves that exceed one quarter of its annual income, the reserves must be reduced, resulting in a reduction of the ARF.

Based on the total ARF revenue generated and the quantity of all batteries subject to a fee placed on the market, battery producers had to pay an average contribution of 3,244.67€ per tonne POM in 2019 (INOBAT 2020b). When only considering the contributions for the 4 most commonly used battery chemistries (Nickel-Cadmium, Lithium-Ion, Alkaline Manganese, Lead-acid) producers were required to pay 2.445,97€ per tonne POM on average (Figure 40).

Figure 39: Development of ARF revenues per tonne of batteries POM in Switzerland³⁵

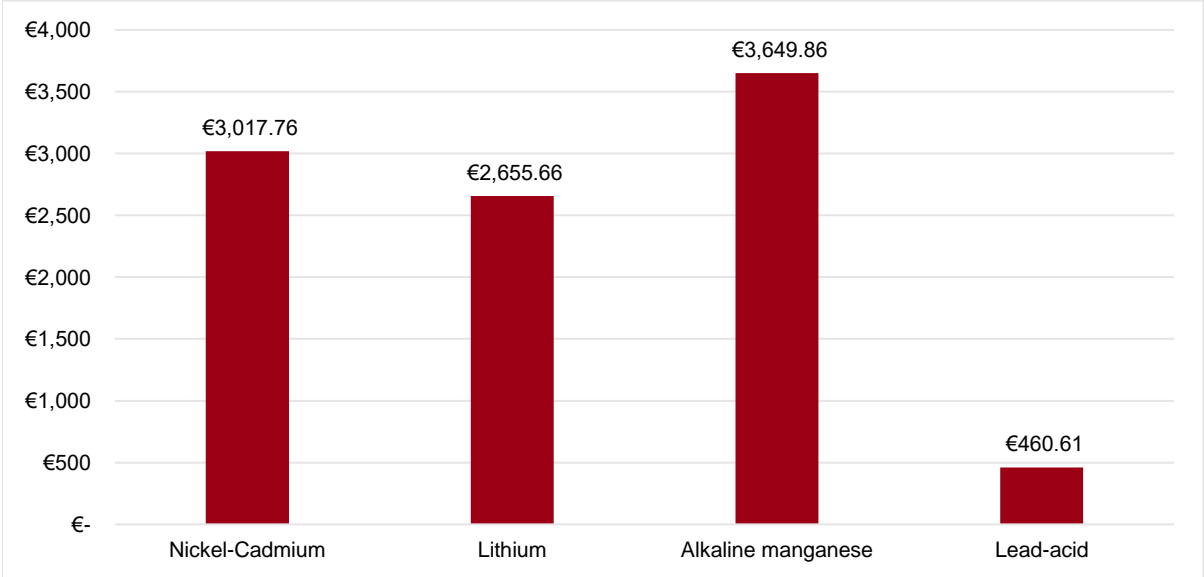


Source: (INOBAT 2020b)

³⁵ Prices in Euro where calculated based on the applicable exchange rates at the end of each reference year (<https://www.boerse.de/historische-kurse/CHF-EUR/CH0009688802>)

The use of revenues from ARF is regulated in the ChemRRV. According to the ordinance, INOBAT may only use the fee to finance the collection, transport and recycling of batteries, as well as to ensure that these activities are carried out in accordance with the best available techniques. Furthermore, the ARF may be used for the implementation of information campaigns, in particular with regard to promoting the return of batteries. However, a maximum of 25 per cent of the annual fee income may be used for this purpose. The revenues are also used to pay for the administrative costs arising from both INOBATs activities and the related tasks of the BAFU.

Figure 40: Average ARF per tonne for 4 reference battery chemistries in Switzerland



Source: (INOBAT 2021b)

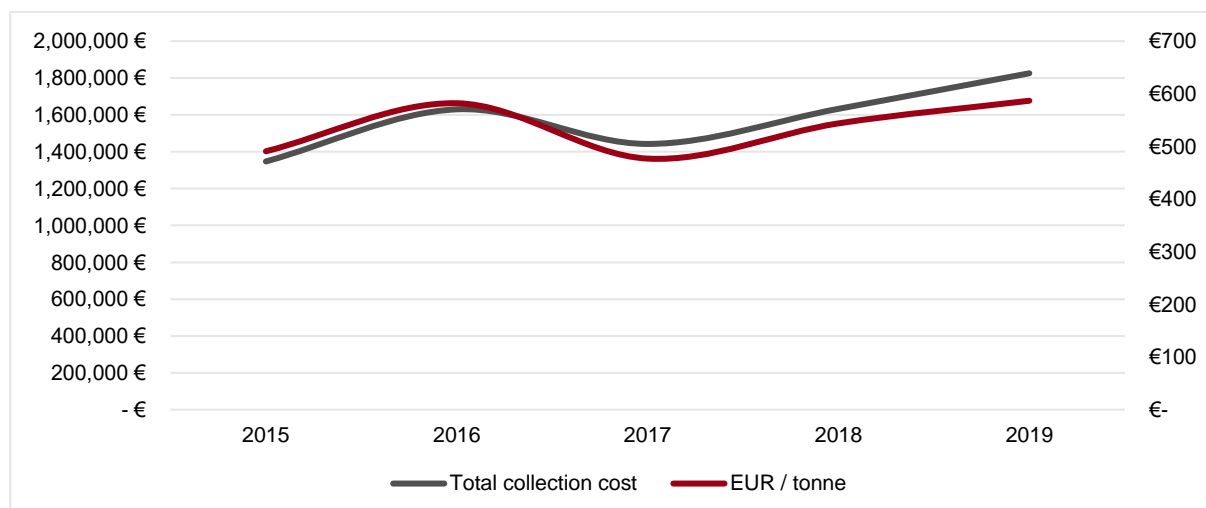
Cost for collection and transport

In 2019, INOBAT spent a total of 1.825.751€ (587€ per tonne of batteries collected) for the collection and transport of waste batteries, which represents about 13% of INOBAT total expenditures. The majority of collection and transport cost are comprised of compensations for the transport operators. The collection quantity and transport distance to the nearest recycling facility determine the amount of compensation for the collection and transport of waste batteries (Batrec Industrie AG in Wimmis). Due to the higher safety requirements, the collection of Lithium-Ion batteries is compensated at a higher rate.

As opposed to most other countries, the Swiss compliance scheme also compensates the collection points of waste batteries on the condition that they collect a minimum amount (350kg) of batteries subject to fees. The compensation is based on the amount of collected batteries and ranges from 226€ to a maximum of 280€ per pick-up.

The strong correlation between overall cost and cost for collection per tonne (Figure 41) suggest that the overall collection efficiency has remained mostly unchanged over the recent years. However, in 2019, collection efficiency seems to have improved slightly. The rise in total cost for collection and transport is likely correlated to the increased collection volumes (Figure 37).

Figure 41: Cost for collection (total and per tonne of batteries collected) in Switzerland³⁶



Cost for waste recycling and treatment

Until 31st December 2018, INOBAT paid a standard recycling tariff based on the average recycling costs of all battery types. In order to better reflect the producer costs, INOBAT started compensating recycling costs individually according to battery chemistries on 1st January 2019 (INOBAT 2020b). In 2019 the total cost paid by INOBAT for battery recycling amounted to 9,736,360 €, about 3,787 € per tonne of waste batteries accepted for treatment. This represents about 71% of INOBATs total expenditures.

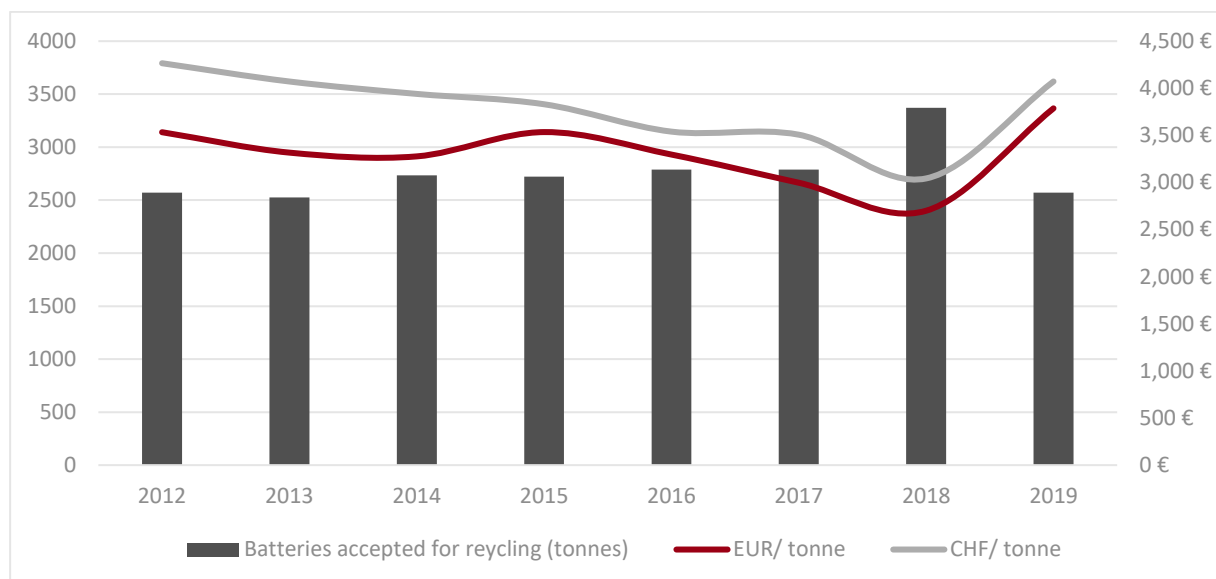
Challenge: Quasi monopolistic position of a battery recycling operator

According to a statement from the BAFU, the operating costs of the Batrec plant are relatively high compared to foreign plants. As potential reasons, the authority cites the relatively low capacity of the plant (initially around 3,000 t/year, today around 5,000 t/year) as well as the technical necessity of operating the plant continuously with 36 employees. Other reasons given are the amortisation of the investments and the energy costs (Bundesamt für Umwelt 2007). The interviewed experts also suggest that BATREC may be able to charge higher prices than recyclers that operate in competitive environments, due to its quasi-monopolist market position (Personal Communication 2021).

Although in 2019, compared to the previous year, significantly less tonnes of used batteries were accepted for recycling (see Figure 42), the total costs continued to rise slightly, thus results in increased costs per tonne of recycled batteries. According to INOBAT, the increase in costs is mainly due to an increase in reserves. According to INOBAT's annual financial report, these reserves were built up mainly for the recycling of lithium batteries (+4.2 million Swiss Francs in 2019) for which increased collection rates are expected in the intermediate future (INOBAT 2020b).

³⁶ Prices in Euro where calculated based on the applicable exchange rates at the end of each reference year (<https://www.boerse.de/historische-kurse/CHF-EUR/CH0009688802>)

Figure 42: Recycling costs per tonne of waste batteries accepted for recycling in Switzerland³⁷



Administrative costs

The administrative costs incurred from INOBATs activities in 2019 amount to approximately 746,000 € which represents about 5% of INOBATs' total expenditure.

3.6.4 Technical Performance

Innovation potential

Facilitating innovation does not fall directly within INOBAT's mandate and hence, the organisation does not earmark a dedicated share of its budget for product or service innovation. However, some innovations were achieved with regards to the safe collection and transport of lithium batteries. Here, INOBAT started providing a steel barrel for the collection of visibly damaged or heated lithium batteries in 2015, as well as lithium batteries originating from model building to the transport operators. In 2019, INOBAT also accompanied a pilot project on the upcycling of lithium batteries in order to gain experience on potential recovery processes. The aim was to examine whether this could represent a new form of recycling of used batteries that may become eligible for compensation in the future.

Awareness creation

INOBAT may use up to 25% of the annually collected ARF for information campaigns and awareness creation. In 2019, INOBAT invested a total of 1,305,557 € (10% of the total expenditures) for communication measures. The campaigns focus primarily on the target group of 16-34 year olds, as according to INOBAT, battery consumption is particularly high at this age and personal recycling habits are acquired and consolidated (INOBAT 2020b).

Since 2012, INOBAT is financing the nation-wide "Battery-Man" campaign, which is managed by an external advertising agency. The campaign utilises various outlets, ranging from TV spots and social media channels (Instagram, tic-toc, YouTube, Facebook). In addition, relevant information about battery recycling as well as competitions are posted/organised on a monthly basis (INOBAT 2020a). With the support of the BAFU, INOBAT also works with schools to develop and revise learning modules on the life cycle of batteries, with a focus on battery recycling (INOBAT 2021d).

The large scale information campaigns have already led to a high level of public awareness with regard to INOBAT and its activities, with a high share of the population being aware of how and where to correctly dispose of waste batteries (EPBA 2016).

³⁷ Prices in Euro were calculated based on the applicable exchange rates at the end of each reference year (<https://www.boerse.de/historische-kurse/CHF-EUR/CH0009688802>)

Stakeholder satisfaction levels

Despite good collection and recycling results, large producers in particular have expressed their dissatisfaction with the Swiss EPR system. This is mainly related to the contributions charged by INOBAT, which are significantly higher than in other European countries.

3.6.5 Key Take-Aways

The Swiss EPR scheme is achieving high collection rates at relatively high costs for producers

Switzerland is continuously achieving high collection rates of over 60% for all waste batteries subject to fees. Although the collection rate has, due to the increase of batteries POM and the low return rates for lithium-Ion batteries, slightly decreased over the recent years, it is still higher than in most European countries and EU Member States. Potential drivers for this high rate are the dense collection network, the economic incentives provided for the collection points and the large expenses for awareness creation for on the correct disposal of batteries among the population. However, with an average fee of 3,245 € per tonne of batteries POM, the costs for producers are comparatively high. Since INOBAT is furthermore building up large financial reserves (more than 24 million Swiss Francs in 2019), it may also be assumed that the level of producer fees currently exceeds the necessary costs of the EPR system.

The monopolistic market position of the recycling facility may lead to higher cost

With a share of about 71% of INOBAT's total expenditure, the cost of battery recycling in Switzerland is comparatively high. It can be assumed that the quasi-monopolistic position of the only battery recycling plant in the country is a major driver for the high costs, as the operator is able to charge higher prices than recycling operators in a competitive environment.

In its role as a monopolist scheme, INOBAT can effectively conduct large-scale information campaigns

The continuous information and awareness campaigns run by INOBAT manage to successfully reach the majority of the Swiss population (especially within the younger target group), likely boosting the return rate of waste batteries throughout the country. With an average share of 10% of the total expenditures, the cost-share for these campaigns are significantly higher than in other European countries. However, as a monopolist the INOBAT does not run into the risk of producers dropping out of the system due to higher costs.

4 Promoting an Effective EPR Landscape in Europe and the EU

4.1 Strengths and Weaknesses of Different Schemes

Our analysis of the implementation of EPR for WEEE, waste packaging and waste batteries in six European countries suggests that the success of both competitive and monopolistic systems is strongly influenced by the respective socio-economic context as well as the national implementation modalities. The enormous differences in the schemes' scopes, distribution of tasks, definitions, methods, data qualities, etc. do not allow for a direct comparison of the presented performance indicators. Yet, the analysis allows to draw some conclusions in regards to the overarching strengths and weaknesses of the different schemes as well as for EPR in general.

4.1.1 Competitive and Monopolistic Schemes

Competition can create real leverage for innovation and efficiency increases

Regardless of the waste stream, all competitive systems analysed as part of the case studies show a strong focus on driving innovation and improving the efficiency of the services offered to producers. These measures typically include additional services beyond mere compliance reporting (e.g. in terms of data collection) as well as collaborative approaches together with manufacturers and waste managers that seek joint solutions for eco-design, improved recyclability of products or increased efficiency in the collection and sorting of waste streams. These measures are usually associated either with economic incentives or with strengthening the market position of the respective PROs. Measures that would result in higher contributions for producers are often more difficult to promote as they entail the risk of losing customers to other PROs.

Monopolistic EPR systems, on the other hand, tend to focus on promoting system-level innovations (e.g., additional reporting tools, collaboration with universities, support for entrepreneurs) aimed at improving overall collection/recycling performance or reducing overall waste volumes. These measures can be effective (e.g. BeWEEE), however, they tend to be costly and may significantly increase the administrative burden for some stakeholders. In addition, their benefits need to be communicated clearly in order to create wide-spread acceptance.

Producers tend to be more satisfied in competitive systems regardless of the system-level performance

The results of the interviews and case studies suggest that producers are generally more satisfied with competitive EPR schemes. Notably, it is usually not the system-level performance of the scheme that is decisive, but rather the lack of availability of options to choose between the best price-service level ratio. Several interviewees stressed that producers often feel neglected by monopolistic PROs. In competitive systems, on the other hand, producers generally feel that they are treated as customers, which is directly related to the fact that they have the option of switching PROs if their performance is perceived to be inadequate. This not only provides a strong incentive for competing PROs to respond to the needs of their customers, but also leads to producers becoming more actively involved in their PRO's work. This difference in customer satisfaction becomes particularly visible when the costs of a scheme increase. While price increases are of course not welcomed by producers in either competitive or monopolistic systems, such an increase usually leads to a significant decrease in customer satisfaction especially in monopolistic systems, which is likely related to the fact that the increased costs cannot be compared with those of other PROs.

Competition can keep costs for waste management operations low

Although it is difficult to determine the effective impact of competition between PROs on prices for the collection, sorting (if applicable) and recycling of waste, the price developments analysed as part of the case studies show that competitive tendering of waste management activities implemented by multiple PROs can lead to prices close to the actual cost for the services provided. This is also driven by the PROs' strong self-interest in minimising their operating costs in competitive environments in order to not lose customers. Accordingly, this self-interest is often less pronounced in monopolistic systems.

Monopolistic systems further pose a higher risk of price collusion between the parties entrusted with waste management (e.g. operators, municipalities) and the PRO, as contributions can be more easily passed on to the producers without them having the possibility to switch to another PRO (as occurred, for example, in Germany prior to the opening of the market for competition in 2003).

Ultimately, however, both competitive and monopolistic EPR systems require appropriate monitoring and enforcement measures to effectively ensure reasonable costs for waste disposal.

Competition for the access to waste may lead to inefficiencies and higher costs

The case studies show that, under certain circumstances, strong competition for access to waste among multiple PROs can lead to significant inefficiencies in terms of system-level costs and collection rates. In the absence of a functioning clearing mechanism, some PROs may intentionally overfulfill their obligations and speculate on selling the excess quantities at a profit to other PROs that can otherwise meet not their collection quotas. The problem is further exacerbated by a systematic "cherry-picking" of particularly high-yield and easy-to-reach collection points.

Monopolistic schemes tend to deliver more effective awareness raising campaigns

Launching large-scale information and awareness campaigns tends to be easier in monopolistic EPR systems, as observed in the case studies. For one, this can be attributed to the fact that the costs associated with implementing the campaigns can be passed on directly to the producers without fear of them turning to competitors. In addition, monopolistic PROs can be sure that awareness raising measures directly benefit their own operations.

Although most PROs operating in a competitive environment acknowledge that jointly implementing awareness raising measures would benefit them all, these activities are typically only implemented, if mandated by national legislation. This can be attributed to the fact that large scale awareness campaigns entail the risk of free-riding, which may translate to competitive disadvantages for individual PROs. Such dilemma-like situations can only be solved by targeted regulatory interventions.

A lack of transparency in monopolistic EPR schemes increases the risk of market power abuse

A monopoly – regardless of whether it operates on a for-profit or not-for-profit basis – accumulates significant market power and must therefore be well regulated to prevent potential abuse and inefficiencies. In this context, it is particularly important to ensure transparency about the relevant activities of PROs (e.g. tendering and calculation of producer contributions). However, even in relatively well-regulated monopolistic systems such as Belgium and Spain, there are still gaps in this regard. Stakeholders have, for instance, reported their discontent in regards to a lack of transparency in the evaluation of tenders, calculation of producers' contributions or reported figures. This in turn can lead to a lack of trust on the part of stakeholders.

4.1.2 EPR in General

The impact of for-profit/non-profit business models on the performance of the EPR systems is difficult to discern

The analysed country case studies did not provide evidence for any negative or positive impact of for-profit/non-profit business models on the performance of EPR systems. However, in case there is an impact, this would likely not only apply to the business models of PROs but also to the business models of all other companies involved in waste management. The question of whether a PRO should adopt a

for-profit or non-profit approach is therefore arguably too narrow and should instead be applied to the entire waste management chain.

While the usual motivation for choosing a non-profit business-model is to avoid the risk of excessive profits and consequently higher prices for producers, the case studies show that a similar effect may well be achieved in a monopolistic non-profit setup, e.g. by building up substantial reserves (see Recupel Belgium).

Improved regulatory frameworks continue to be offset by a lack of enforcement

Both, monopolistic and competitive systems need to be well regulated. This is especially important for ensuring that allocated responsibilities are implemented in a level playing field (i.e. prevention of free-riding) and monitoring of environmental performance indicators. While legal frameworks for EPR have improved in all analysed case studies and across all waste streams, there is often still a noticeable lack of enforcement (reporting to the enforcement agencies, declaration of products subject to participation, treatment, etc.). Although this generally applies to all three waste streams considered as part of this study, it is particularly relevant in the case of WEEE collection and recycling, where improper disposal, informal treatment and illegal exports still account for a large share of WEEE available on the market.

Batteries in WEEE appliances are becoming an increasingly pressing issue

One issue that is currently not adequately addressed in neither monopolistic nor competitive systems and the corresponding national legislations is batteries contained in WEEE appliances. This has become an increasingly pressing issue as many producers (especially smaller ones) are unaware that batteries in WEEE equipment need to be registered under the respective national EPR schemes for batteries, thus leading to major inaccuracies in the reported numbers. Further challenges arise from the fact that built-in batteries are increasingly difficult to remove for the end-consumers. As a result, these batteries usually end up in WEEE recycling facilities along with the WEEE which they belong to, thus causing additional costs for dismantling and recycling. Another challenge in this regard is that many consumers do not dispose of small WEEE devices (e.g. mobile phones or tablets) but hoard them instead, fearing that personal data stored on the devices could be accessed. Hence, many of these devices and the built-in batteries remain in households and are unavailable for collection even at the end-of-life.

Quality in the recycling of packaging is often not sufficient

Both packaging case studies analysed as part of the study show that, despite sufficient technological capacities, the quality of the materials recycled from packaging waste (especially plastic packaging) are often insufficient to allow for a closed-loop-recycling. A key driver for this development is the fact that recycling rates set by the EU currently represent the only central reference value for PROs. In contrast, the quality of the output recyclates is a neglected steering mechanism. To achieve a higher recycling quality, recycling facilities would require a higher quality of sorted packaging fractions. Although most sorting plants would be technically capable of delivering higher quality products, this would be accompanied by a decrease in the quantities sorted and subsequently recycled. An increase in quality is therefore only possible once the specified recycling rates have been reached.

Lack of clarity regarding batteries and packaging subject to system participation

Regardless of whether there is competition between PROs, the case studies show a noticeable need to refine the definition of products subject to system participation. As the WEEE Directive 2012/19/EU implemented the so called 'Open Scope', according to which all EEE is subject to system participation unless specific exclusions are applied, this is especially true for batteries and packaging. For batteries, this concerns the distinction between portable and industrial batteries. According to the Battery Directive, portable batteries are button cells, battery packs or accumulators that are sealed, can be carried by hand and are not intended for industrial or automotive use. However, the UK additionally introduced a threshold of 4 kg for portable batteries as the EU definition is insufficient to accurately distinguish them from industrial batteries. The threshold of 5 kg added in the current draft of the new Battery Regulation may therefore be a step in the right direction.

With regard to packaging, there is a need for improvement especially in the definitions of commercial and transport packaging, which are not covered by the two analysed EPR systems in Germany and

Spain. The lack of a precise definition of when exactly packaging qualifies as transport or industrial packaging creates potential loopholes for non-compliance and also causes unnecessary confusion, especially for smaller manufacturers.

4.2 Strengthening the Prospect of Competitive EPR Schemes

In order to address the identified challenges for EPR and competitive schemes in particular, the following section provides a number of recommendations on how to ensure compliance and improve the performance of schemes across all three priority waste streams. The recommendations are based upon the best practices analysed as part of the case studies, the insights gathered through the interviews, as well as the results of an expert workshop with various representatives from the industry, PROs, industry associations and academia (cf. chapter 1.2 for details on the methodology).

4.2.1 Fair Allocation and Balancing of Obligations

Establish a coordination body independent of private interests

An effective implementation of EPR in a competitive environment – regardless of the respective waste stream – requires for coordination between both, different PROs and PROs and other stakeholders of the system. In this respect, the establishment of a coordinating body such as the one for WEEE in Italy (CdC RAEE) or for packaging in Germany (ZSVR & Gemeinsame Stelle) has already proven to be an effective tool to coordinate joint actions and improve the environmental, economic and technical performance of the respective systems.

A primary function of the coordinating body in competitive systems should be to ensure a level playing field for all PROs by coordinating and monitoring the allocation of collection responsibilities. Depending on the waste stream and national specificities, this can be achieved either through direct allocation of collection areas and/or collection points or through non-competitive coordination of tender areas. In addition, the coordination body should serve as an intermediary between the interests of PROs and those of local authorities, thus supporting, for example, the conclusion of specific agreements with the municipalities. To address the risk of free-riding and potential competitive disadvantages, the coordinating body should also be responsible for coordinating the planning, management and implementation of collaborative activities across PROs in areas such as awareness raising and system-level innovation. The implementation of awareness raising measures by a joint coordination body would also have the advantage that the level of awareness and recognition of a single body within the population would be considerably higher than that of a multitude of individual efforts by multiple PROs. Further competences that may be taken over by a coordinating body are the definition of minimum standards for the collection, sorting and recycling of waste as well as the monitoring of compliance checks/audits to ensure that the defined standards are met.

It is critical in this regard that all PROs are legally obliged to participate in the coordinating body and that its central responsibilities and tasks are clearly defined in the respective national transposition of the EU directives. The coordination body should be managed and governed independently from private interests and supervised by the competent national authorities. As described by the All Actors Approach (AAA) that was recently proposed by the WEEE Forum, it would also be conceivable to involve representatives of other relevant actors involved in the collection and treatment of waste in order to cover a broader range of collection channels and waste volumes (WEEE Forum 2020). Other stakeholder groups such as producers, retailers, local authorities, social economy enterprises, brokers, dealers and traders, as well as households and end-users may assume an observing role consulting the coordination body in strategic questions.

Establish a public central registry

Creating transparency regarding the companies participating in EPR schemes and the quantities of products POM/collected is essential in order to counteract fraudulent activities, falsified declarations or free riders in both monopolistic and competitive EPR schemes. Regardless of the waste stream, it is therefore recommended to establish a public registry that monitors the compliance of producers, distributors and PROs.

Registered companies shall be obliged to register and report the quantities and types of products they place on the market to the Central Registry at least once a year. In order to check the accuracy of the data and to avoid falsified declarations, PROs shall also report the quantities registered with them to the registry so that the data for the corresponding period can be compared with each other. The reporting of the respective data should be carried out electronically and on the basis of uniform specifications, which should, ideally, be jointly defined by the registry, the PROs and the producers. To keep the administrative effort for producers/distributors to a minimum, it is recommended that the registries should be run electronically and harmonised between Member States as far as possible (e.g. for product groups or reporting requirements)³⁸.

The information on registered producers/distributors should be publicly available (online), as this has been shown to have a push effect on producers to be compliant and may increase the risk to be identified as a free-rider (e.g. by a competitor). This can also significantly increase the coverage of the overall EPR scheme and limit free-riding to a minimum. On account of the protection of business confidentiality, quantities of products placed on the market by individual companies cannot be published. However, aggregate quantities of the volumes POM (across all producers), collected and recycled should be published to allow for improved market transparency.

Based on the collected volume data, the registry might, if not done by other independent bodies, also be responsible for calculating the market shares of the respective PROs. The data should be transmitted annually to the coordination body of the PROs to ensure a fair allocation of obligations and collection areas/sites.

Although it would potentially be viable to embed the tasks of the central registry within those of the coordinating body described above, this would likely require greater involvement of national competent authorities within the coordinating body.

Refine the definition of batteries subject to system participation

Most large industrial and automotive batteries (e.g. lead-acid) are relatively easy to collect and profitable to recycle. As such they are already exempt from a mandatory system participation under the current EU Directive 2006/66/EC. However, examples like the UK show that the definition of portable batteries alone is not sufficient to allow a clear distinction between portable and industrial batteries, currently resulting in both inaccurate waste statistics and higher costs for the schemes. The current revision of the Battery Directive (or Regulation) and the associated introduction of a 5 kg upper limit will likely not be sufficient in this respect either.

Additional harmonised labelling requirements (e.g. through a QR code), as proposed in the current draft of the revised EU Battery Directive, may represent a potential solution for this problem. However, this would likely lead to additional expenses on the part of the producers. Furthermore, the problem remains that some industrial batteries merely consist of a pack of small batteries which, when taken apart, would no longer be distinguishable from portable batteries.

It is therefore recommended to consider the option of introducing an open scope EPR for batteries, which, similar to the open scope EPR for WEEE, would by default cover all batteries as long as there is no explicit exemption. Following the case of Switzerland, exemptions may be granted if the industry sectors or individual producers can provide evidence of an environmentally sound management approach that fully covers the end-of-life costs of battery disposal. In this regard, it is important that the conditions for the issuing of exemptions are clearly defined and that compliance with these conditions

³⁸ as being implemented by the COMMISSION IMPLEMENTING REGULATION (EU) 2019/290 for WEEE.

is regularly verified by a competent authority. To keep an oversight of the market and ensure that the independent battery take-back solutions do not lead to an increase in free-riding, the quantities of exempted batteries placed on the market and collected should also continue to be reported to a central registry.

Cover batteries in small EEE as part of the EPR for WEEE

To address the increasingly pressing issues of batteries included in EEE, it is recommended to cover batteries that are sold together with EEE only within the respective EPR schemes for WEEE. As batteries sold together with small EEE in most cases end up in a WEEE recycling facility anyway, this approach would on the one hand help to better reflect the costs for the disposal of the batteries in the context of WEEE recycling and on the other hand reduce the complexity for producers, who so far may have to register both, the batteries and the EEE products, with different schemes. The reduced complexity would likely help to reduce the number of unregistered and unreported batteries, while at the same time addressing the issue of batteries not being handed over/reported to the battery PROs by WEEE treatment facilities. A similar approach is already applied in countries like Canada where only separately sold batteries are required to be covered by an EPR scheme.

Incentivise the reporting of previously undocumented WEEE

The case studies from Belgium and Italy show that a significant amount of WEEE is either formally treated but not reported to the PROs or informally treated. In both cases, these WEEE streams are not documented by the EPR scheme and are therefore not included in the respective collection results. In order to reduce the share of undocumented WEEE streams, it is recommended to establish additional instruments that facilitate and simplify the reporting of recycled WEEE for licensed treatment operators without a contract with the PROs while at the same time avoiding the informal treatment of WEEE by establishing proper enforcement mechanisms.

With regard to the reporting of WEEE treated by licensed waste management operators, it is advisable to establish easy-to-use tools along the lines of the BeWEEE tool used in Belgium. This would allow waste management operators without a direct contract with a PRO to report the quantities of WEEE collected, recycled or exported with minimal administrative effort. In a competitive system, it is important to ensure that instead of individual reporting tools, a uniform solution is used at national level. In addition, reports should be sent directly to a coordinating body of all PROs. For this approach to work it will most likely be necessary to introduce both, additional reporting obligations for those companies without a direct contract with the PROs and appropriate enforcement measures. Waste management companies that have a contract with one or more PROs and already report the relevant figures should be exempt from the reporting obligation via the tool.

Informal treatment operators such as metal scrap dealers on the other hand should be obliged to separate and report all WEEE received at their facilities as part of the scrap dealers' operating licenses (WEEE Forum 2020). Once the WEEE has been separated from the metal scrap it has to be handed over to a formal WEEE treatment operator. This approach requires strong enforcement to avoid non-compliance or the creation of new parallel unreported flows of WEEE mixed with scrap. Scrap dealers may also be provided with financial incentives for handing over collected WEEE to formal recycling facilities, bridging the cost difference between the raw material prices and the additional costs for professional treatment vis-à-vis informal processing. A similar approach is already implemented in Switzerland, where the share of WEEE treated as metal scrap has been reduced to almost zero (Baldé et al. 2020).

To further facilitate the reporting of undocumented WEEE flows, it is also recommended that PROs jointly and periodically carry out a detailed material flow analysis for WEEE, aiming to quantify both registered and unregistered WEEE flows. Similar studies have already been conducted in Belgium, Italy and the UK.

4.2.2 Awareness Creation, Research and Innovation

Define measurable obligations for awareness raising and innovation

In order to foster joint activities of PROs in the areas of awareness raising and innovation promotion, it is recommended to define measurable benchmarks that go beyond vague requirements to carry out these activities. It is important that the requirements are designed in such a way that PROs are actively motivated to take cooperative action, making individual approaches either more expensive or insufficient to meet the requirements. Possible obligations may include, for instance, minimum investments into nation-wide awareness-raising campaigns or funding of research projects that promote system-level innovations. These should be determined independent of the number of PROs involved as it would make cooperative approaches financially much more attractive. Funding requirements could be aligned with the PROs' market shares. The definition of measurable requirements is also advisable in cases where joint activities are already organised by a coordinating body to ensure a consistent quality and scope of the corresponding activities.

Create and maintain an overview of market dynamics and trends

The market for packaging, EEE and batteries is extremely fast-paced. New market developments and products, such as the rapid increase in the sales of lithium batteries, wireless headphones and multi-layered to-go packaging, can pose a significant challenge to the performance of national EPR schemes. While some of these challenges can arise with a significant delay (e.g. lithium batteries) others have to be dealt with immediately (e.g. to-go packaging).

In order to allow for continuous performance improvements of national EPR schemes, it is thus paramount to create and maintain an understanding of both, current market dynamics and expected future developments regardless of the respective waste stream. Facilitated by a coordination body PROs should therefore regularly engage in the development of market studies that aim to identify what products are currently put on the market or expected to be put on the market in the near future. The studies should also aim to address the expected lifespans associated with these products and the corresponding requirements for effective collection, sorting and recycling. This would also provide an opportunity to better link the end-of-life phase of products with the beginning of life, e.g. by investing in new technologies/innovations to effectively treat certain products at an early stage, before the corresponding products are disposed of in larger quantities.

Introduce quality targets for the recycling of packaging waste

To address low-quality packaging waste recycling, and especially plastic packaging, it is recommended to complement the quantitative recycling targets with additional qualitative targets as part of the national transposition of the Packaging Directive. This measure should aim to incentivise PROs and recyclers to increase the quality of recyclates, even if this initially leads to lower recycling rates. In this context, it is recommended to redefine the recycling quotas for plastic packaging in direct relation to the corresponding quality and/or use of the recyclates. In this way, lower recycling rates could, to a certain extent, be compensated by higher quality

Alternatively, it would also be possible to subsidise a higher quality of recycling on the part of the plant operators. For the provision of the necessary financial resources, a fund should be set up similar to that used for the joint organisation of awareness campaigns. All PROs would need to pay into this fund, which may be handled by a joint coordinating body.

In order to meet the future demand for recycled materials that results from the increasing requirements of the EU regarding the use of recycled materials in products, it is also recommended to improve the link between the industry and the recyclers, for instance, by promoting the use of online marketplaces for recycled materials on which producers can easily find and buy available stocks. In this context, it is important to set quality standards for plastic recyclates with different quality levels according to envisioned application.

4.2.3 Implementation of Eco-modulated Fees

Article 8a (4) of Directive 2008/98/EC states that all Member States shall take the necessary measures to ensure that the financial contributions paid by the producer in collective schemes are eco-modulated. Further, the WFD specifies that modulation should consider the products' "durability, reparability, re-usability and their recyclability and the presence of hazardous substances hereby taking a life-cycle approach and aligned with the requirements" (European Parliament and Council 11/22/2008). If implemented well and set at sufficiently high levels, eco-modulation may create strong incentives for eco-design.

In competitive systems, the implementation of modulated fees can pose challenges, as the products registered with the respective PROs do not directly correspond to the waste collected. Hence, there is a possibility that PROs catering to producers selling long-lived, repairable and eco-friendly products face financial deficits, as they would receive lower producer contributions due to the fee modulation while the costs for collection, sorting and recycling of mixed waste would likely remain unchanged. In contrast, PROs could generate a surplus if they serve mainly producers whose products do not meet the modulation criteria, as they would be required to charge higher contributions while continuing to pay the same for the collection and treatment as other PROs.

The following section provides recommendations on how to effectively implement modulated fees as per Article 8a (4) of the amended Directive 2008/98/EC in competitive EPR schemes and is supplemented by possible options for implementation into practice.

Start simple

For fee modulation to provide real eco-design incentives for producers and encourage waste prevention and recycling, it is essential to design the implementation mechanisms as simple as possible for both producers and authorities. It is therefore recommended to start with a very limited set of universal product categories and eco-modulation criteria that are applicable to many products and thus also relevant to producers. With regard to eco-modulation criteria it is further important that these are easily measurable, verifiable and achievable. The list of criteria and products can be expanded gradually, considering the lessons learned from previous evaluations.

Aim for harmonisation

Eco-modulation as an incentive for producers to invest in better product design can only be successful if the implementation and criteria are harmonised at EU level. Individual solutions from country to country would lead to considerable complications and costs for producers, which would most likely nullify the desired incentive effect and may further risk the functioning of the EU's single market. To create the necessary preconditions for a harmonised approach, it is recommended to define an EU-wide catalogue of modulation criteria, which also includes a clear definition for recyclability, durability, reparability, re-usability etc. In accordance with Article 8a No. 6 of the WFD, the joint development of such a catalogue of criteria could take place at the level of dedicated EPR dialogue fora in the Member States where all stakeholders involved in the implementation of EPR schemes are represented.

Harmonisation is also required with regard to the evidence that is to be provided by manufacturers verifying in how far their respective products meet the criteria for fee modulation. It is therefore recommended to develop standardised reporting requirements. The necessary documents should be standardised across the EU and companies should be able to request and submit them electronically so that the administrative burdens are kept to a minimum.

Due to the significant differences between the national EPR systems, it is recommended that the base contributions charged should continue to be set by PROs at national level. However, the amplitude of modulation should be harmonised at EU-level to ensure a level and fair playing field between PROs and provide consistent financial incentives for producers. These incentives should not be set too low, as this would limit the scope for producers to save money on modulated fees by investing more in the product (e.g. its recyclability). Considering that real contributions cannot be discussed under anti-trust regulations in many countries, the magnitude of the modulation should be expressed in % of the standard contribution (or set centrally) and further depend on the respective harmonised product

categories. In order to avoid competition at the level of the modulated element, it is moreover necessary to ensure that the additional revenue/loss of revenue is either matched by additional expenditure/savings or evenly distributed among all PROs.

Option 1: malus-only approach

The payment of maluses and bonuses for the production and distribution of “good” or “bad” products will likely lead to a significant increase in complexity of the systems for all parties involved. Furthermore, in a competitive system the payment of bonuses bears the risk that lower or higher revenues of some PROs are matched by constant costs for the collection/sorting/recycling of the mixed waste streams, which would lead to a significant distortion of competition.

In order to reduce complexity and maintain a level playing field in the fee modulation, it is therefore recommended to consider a simple "malus-only" approach. Here, the financial incentives for producers and distributors would only be set through additional fees for "bad" products while producers of "good" products would continue to pay the standard fee of their PRO. In order to avoid that PROs with a particularly high number of "bad" producers benefit from the additional revenue from the modulated fees, all revenues from malus payments should be provided to a central fund that is administered by a coordinating body or other bodies independent of private interests. The financial resources of the fund can subsequently be used to finance shared obligations of all PROs, including, among others, awareness raising campaigns, the financing of a central registry or activities related to research and innovation. To ensure that the financial resources are only used for activities that are directly related to waste management, it is essential that the activities to be financed via such a fund are clearly defined as part of the respective national legislation. It is also important to note that the fund is only intended to complement and not replace the existing joint commitments of the PROs.

Option 2: modulated obligations

An approach that would impose both bonuses and maluses in a competitive system would be the modulation of collection and recovery quotas for the respective PROs in the form of "modulated obligations". In a system with modulated obligations, the bonus and malus payments of producers/distributors and the resulting higher/lower revenues for the PROs would be compensated by correspondingly higher/lower collection quotas. As a result, PROs with many "good" producers would receive less contributions from their producers but would also be required to collect less waste, while PROs with many "bad" producers would have higher revenues matched by higher collection quotas.

The modulation of the collection rates should be calculated by a central registry on the basis of the market shares of the PROs and the products/product categories reported by their producers. On the basis of the calculated collection quotas, a coordination body should then allocate the collection areas/collection points in a competition-neutral manner.

4.2.4 Cost-efficient Delivery of Waste Management Services

According to Article 8a of the WFD, all Member States must ensure that the national implementation of EPR obligations is designed in such a way that ensures that the financial contributions paid by the producer are sufficient to comply with the obligations of Article 8a (4) while not exceeding “the costs that are necessary” to do so (i.e. they need to comply with the Necessary Cost Principle).

The concept of necessary costs implies that some waste management activities and associated costs are necessary for the efficient management of waste streams, while others may be considered "unnecessary" and therefore should not be financed by producers. Although recent studies have already attempted to address possible approaches to determining necessary costs, it remains very difficult to establish a harmonised definition of what should be considered necessary due to the varying national

approaches to implementing EU Directives and the multitude of influencing factors that need to be considered.

Avoid a concentration of market power at all levels of waste management

As described in the case studies, the concentration of market power of individual stakeholders (or stakeholder groups), such as municipalities with the sole responsibility for waste collection (e.g. packaging in Spain), waste management operators with a national monopoly or waste operators with a stake in a monopolistic PRO (e.g. historical packaging EPR scheme in Germany), can result in high prices for waste management services that are not necessarily in relation to the actual costs incurred. If a PRO is owned by a disposal company (vertical integration), this could in the worst case even lead to the available disposal capacities for other PROs being kept artificially low, driving up prices accordingly.

It is therefore recommended to limit the influence of powerful individual actors as much as possible by allocating responsibilities for certain activities between several actors. If such an allocation of responsibilities is not possible (e.g. because the size of the country cannot accommodate multiple actors), targeted regulations are required. These should aim to reduce the potential for power abuse, for instance, by increasing transparency about the incurred costs (e.g. through publicly available audited financial statements), demonstrating that the costs of the commissioned services are reasonable (e.g. by procuring those services through competitive tender) and allowing for a stronger involvement of relevant stakeholders in the design of services (eunomia 2020).

Determine necessary costs by comparing prices of equivalent services

An effective means of ensuring that the costs of waste management services do not exceed a necessary level is to ensure that prices can be compared with equivalent services. While in a well-regulated and independently governed competitive framework, competition (e.g. between PROs, collectors, recyclers) provides all market participants with a basis for cost comparison and thus ensures that the corresponding services are offered at the necessary cost level, monopolistic constellations usually lack appropriate benchmarks against which costs can be compared.

Following the recommendations of the latest Report by Eunomia, monopolistic setups would therefore require the development of artificial benchmarks that would allow for a comparison with other similar entities, on a per household, per capita or per tonne collected basis, taking into account factors likely to lead to variation in costs, such as the type of service and specific local considerations (e.g. local wage costs, capital costs, local geography, housing stock and waste composition) (eunomia 2020). However, setting such benchmarks is expected to be a very complex task and might suffer from a lack of comparable data.

5 Conclusion

First introduced in the 1990s by Germany, Sweden and France the concept of EPR has been continuously improved and adopted by an increasing number of countries worldwide. The current landscape and performance of EPR schemes, however, is extremely heterogeneous and differs vastly amongst European countries and EU Member States, with some EPR schemes consistently performing above average, meeting the increasingly ambitious targets set out at EU level (e.g. in terms of collection rates), and others that continue to underperform.

The case studies developed as part of this study demonstrate that the performance of EPR schemes for WEEE, waste packaging and waste batteries is strongly influenced by both, the respective socio-economic context and the national implementation modalities. Although the significant differences in scope, distribution of tasks, definitions, methods, data quality, etc. do not allow a direct comparison of the performance indicators, a range of overarching strengths and weaknesses of the different schemes as well as for EPR schemes in general have been identified:

Competitive schemes

- can **create real leverage for innovation and efficiency increases** as PROs have a strong incentive to improve the services offered to their clients. However, innovations are usually associated with either economic incentives or competitive advantages. Measures that would result in higher contributions for producers are often more difficult to promote as they entail the risk of losing clients to other PROs.
- tend to **result in higher customer satisfaction**, where it is usually not the system-level performance of the scheme that is decisive, but rather the availability of options to choose between the best price-quality ratio.
- can **keep costs for waste management operations low** as the tendering of waste management activities implemented by multiple PROs leads to prices close to the actual cost for the services provided. This development is also driven by the PROs' strong self-interest in minimising their operating costs in competitive environments in order to not lose customers.
- **may lead to inefficiencies and higher costs when there is competition for the access to waste** as certain actors may intentionally overfulfill their obligations and speculate on selling the excess quantities at a profit to other PROs that can otherwise not meet their collection quotas. The problem is further exacerbated by a systematic "cherry-picking" of particularly high-yield and easy-to-reach collection points.

Monopolistic schemes

- tend to run **more effective information and awareness campaigns**. The main reasons for this are that the associated costs can be passed on directly to the producers without fear of them turning to competitors, and the certainty that the respective measures will directly benefit their own business.
- accumulate significant market power and thus entail the **risk of power abuse**. Although the abuse of a monopolistic market position can be avoided by appropriate regulation and sufficed transparency, even relatively well-regulated monopolistic systems such as Belgium and Spain, still show gaps in this regard.

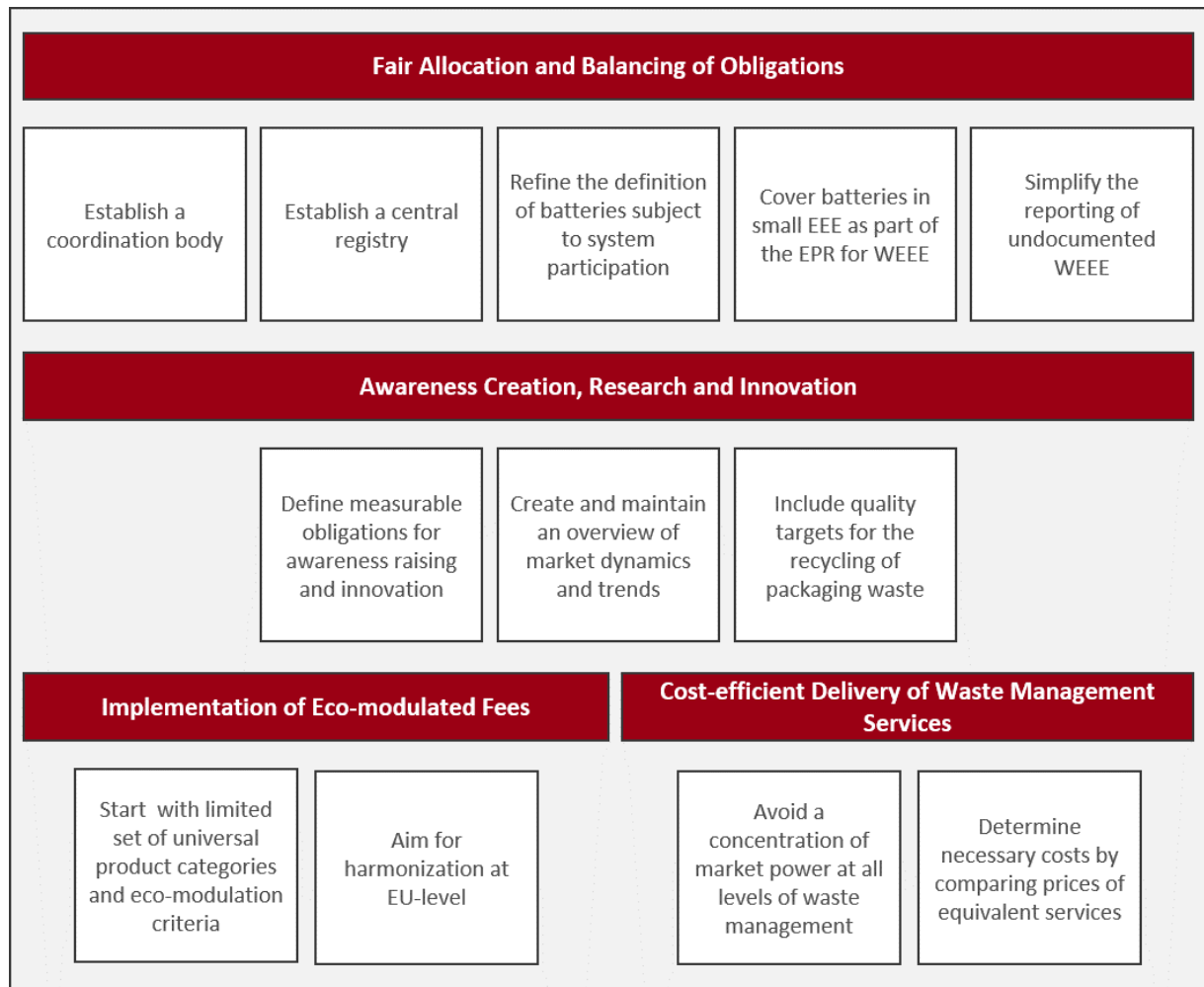
EPR schemes in general

- need to address the **issue of Batteries included in small EEE**, as there is still a lot of uncertainty on the part of producers as to whether these batteries need to be registered in the respective national EPR systems, which in turn leads to large inaccuracies in the reported figures.

- have to **improve the output quality for the recycling of plastic packaging waste**, as - despite sufficient technological capacities - the quality of the materials recycled from plastic packaging waste is often insufficient to allow for a closed-material-loop.
- currently **lack clarity regarding products subject to system participation**. This is especially true for batteries and packaging.
- still show a **lack of enforcement** that can potentially offset the regulatory frameworks which have noticeably been improved in all analysed case studies and across all waste streams over the last decade. Although the lack of enforcement generally applies to all waste streams considered as part of this study, it is particularly relevant in the case of WEEE collection and recycling, where improper disposal, informal treatment and illegal exports still account for a large share of WEEE available on the market

To address the identified shortcomings in the light of regulatory requirements for competitive EPR schemes in Europe and the EU this study developed a range of recommendations for effective implementation of existing and upcoming EPR requirements. It is intended that these recommendations may serve as inputs for upcoming EPR guidelines or regulatory reforms, supporting the improved and harmonised implementation of EPR across the EU and other European countries. An overview of the recommendations is provided in Figure 43:

Figure 43: Recommendations for the effective implementation of existing and upcoming EPR requirements



Annex

Annex I. Key Performance Indicators

Table 16: Key performance indicators for EPR schemes

	Indicator	Definition	Data sources
Environmental	Collection rate	Collected quantities per quantities POM per year [%]	National registries, statistical offices, industry reports, annual reports, reports from public authorities
	Collection per capita	Collected quantities per inhabitant per year [kg]	National registries, statistical offices, industry reports, annual reports, reports from public authorities
	Recycling/treatment rate	Quantities of waste recycled/treated per quantities POM and year [%]	National registries, statistical offices, industry reports, annual reports, reports from public authorities
Economic	Cost for producers per tonne	Advance Recycling Fees (ARF) vs. fees for amounts collected/treated; costs per tonne of product POM [€/tonne]	Annual reports of PROs (monopolistic schemes), reports from public authorities and expert estimates (competitive schemes)
	Cost for collection per tonne	Costs for waste collection [€/tonne]	Annual reports of PROs (monopolistic schemes), reports from public authorities and expert estimates (competitive schemes)

	Cost for recycling/treatment per tonne	Averaged costs for recycling/treatment of waste [€/tonne]	Annual reports of PROs (monopolistic schemes), reports from public authorities and expert estimates (competitive schemes)
	Indicator	Definition	Data sources
Technical	Stakeholder satisfaction levels	Mainly customers of PRO(s) (i.e. producers) and public authorities with general performance of the system and cost effectiveness; services provided by the PRO(s) going beyond compliance, e.g. consulting and customer support	Expert interviews, focus group discussions, industry reports, annual reports, reports from public authorities
	Innovation potential	Magnitude of investments in innovation, e.g. through dedicated funds; targets, indicators or other incentives for eco-design (e.g. eco-modulated fees, carbon taxes); progress on innovation and eco-design reflected in the system; the scheme's ability to adapt to market changes	Expert interviews, focus group discussions, industry reports, annual reports, reports from public authorities, regulatory requirements
	Awareness creation potential	Number of sensitization campaigns conducted within the last 5 years; impact of sensitization campaigns and their geographic coverage; investments in awareness creation within the last 5 years	Expert interviews, focus group discussions, industry reports, annual reports, reports from public authorities, campaign websites, social media channels

Annex II. Interview Guides

Table 17: Interview guide for scoping interviews

Question	Answer
<p>1. What is your opinion on the current effectiveness and future development of EPR schemes for [waste packaging, WEEE, waste batteries] in the EU?</p> <p>Where do you see the biggest needs for improvement?</p>	<ul style="list-style-type: none"> •
<p>2. In your opinion, what are the most impactful factors influencing the effectiveness of...</p> <p>...EPR schemes at the national level?</p> <p>...types of PROs at the organisational level?</p>	<ul style="list-style-type: none"> •
<p>3. In your view, what criteria can capture the performance of different types of...</p> <p>...EPR schemes at the national level?</p> <p>...types of PROs at the organisational level?</p>	<ul style="list-style-type: none"> •
<p>4. Do you see an EPR scheme/setup in any EU country that would perform best or worst according to your criteria and should be further evaluated in regards to its effectiveness?</p>	<p><i>Please explain which elements of each case study should be examined in more detail</i></p>

<p>5. How do you perceive the attitudes / interests of different stakeholders towards EPR schemes? What are their typical core interests?</p>	<p><i>Please elaborate</i></p> <table border="1"> <thead> <tr> <th data-bbox="775 296 1126 355">Stakeholder groups</th> <th data-bbox="1126 296 2069 355">Attitudes / Interests</th> </tr> </thead> <tbody> <tr> <td data-bbox="775 355 1126 459">Recyclers</td> <td data-bbox="1126 355 2069 459"></td> </tr> <tr> <td data-bbox="775 459 1126 563">Producers</td> <td data-bbox="1126 459 2069 563"></td> </tr> <tr> <td data-bbox="775 563 1126 667">Authorities</td> <td data-bbox="1126 563 2069 667"></td> </tr> <tr> <td data-bbox="775 667 1126 770">Collection points/ municipalities</td> <td data-bbox="1126 667 2069 770"></td> </tr> <tr> <td data-bbox="775 770 1126 874">Retailers</td> <td data-bbox="1126 770 2069 874"></td> </tr> <tr> <td data-bbox="775 874 1126 1043">Consumers</td> <td data-bbox="1126 874 2069 1043"></td> </tr> </tbody> </table>		Stakeholder groups	Attitudes / Interests	Recyclers		Producers		Authorities		Collection points/ municipalities		Retailers		Consumers	
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<p>6. In your experience, what are advantages and disadvantages of EPR schemes with multiple (competitive) PROs vs. single (monopolistic) PROs?</p>	<p><i>In terms of the performance criteria mentioned before and different stakeholder groups</i></p>															
<p>7. In your experience, what are advantages and disadvantages of for-profit vs. non-profit PROs?</p>	<p><i>In terms of the performance criteria mentioned before and different stakeholder groups</i></p> <table border="1"> <thead> <tr> <th data-bbox="775 1297 1126 1348">Types of PROs</th> <th data-bbox="1126 1297 2069 1348">Advantages/disadvantages</th> </tr> </thead> <tbody> <tr> <td data-bbox="775 1348 1126 1348"></td> <td data-bbox="1126 1348 2069 1348"></td> </tr> </tbody> </table>		Types of PROs	Advantages/disadvantages												
Types of PROs	Advantages/disadvantages															

	Non-profit	
	For-profit	
8. In your experience, what are advantages and disadvantages of PROs with different ownership structures?	Types of PROs	Advantages/disadvantages
	State owned	
	Producer owned	
	Producer controlled (board)	
	Privately owned (independent)	
	Privately owned (vertically integrated)	
9. What current/upcoming policy frameworks and legislative initiatives currently affect/will influence the operations, the setup and	<i>Please refer to the criteria considered in questions 3 and the types of systems/schemes mentioned in questions 6-8</i>	

effectiveness of different EPR schemes and types of PROs in the EU?																
10. How do you think these frameworks and initiatives will affect/be perceived by different stakeholder groups?	<table border="1"> <thead> <tr> <th data-bbox="770 320 1120 384">Stakeholder groups</th> <th data-bbox="1120 320 2076 384">Attitudes / Impacts</th> </tr> </thead> <tbody> <tr> <td data-bbox="770 384 1120 491">Recyclers</td> <td data-bbox="1120 384 2076 491"></td> </tr> <tr> <td data-bbox="770 491 1120 598">Producers</td> <td data-bbox="1120 491 2076 598"></td> </tr> <tr> <td data-bbox="770 598 1120 705">Authorities</td> <td data-bbox="1120 598 2076 705"></td> </tr> <tr> <td data-bbox="770 705 1120 812">Collection points/ municipalities</td> <td data-bbox="1120 705 2076 812"></td> </tr> <tr> <td data-bbox="770 812 1120 919">Retailers</td> <td data-bbox="1120 812 2076 919"></td> </tr> <tr> <td data-bbox="770 919 1120 1201">Consumers</td> <td data-bbox="1120 919 2076 1201"></td> </tr> </tbody> </table>	Stakeholder groups	Attitudes / Impacts	Recyclers		Producers		Authorities		Collection points/ municipalities		Retailers		Consumers		
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Collection points/ municipalities																
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11. In your opinion, how will the introduction of minimum requirements mentioned in Article 8a of the Waste Framework Directive affect the operation and enforcement of EPR schemes in general and in [country]?	<p><i>E.g. in regards to fee modulation, publication of financial contributions paid by producers, equal treatment, scope of cost coverage, necessary cost, national body independent of private interests (monitoring compliance of competing schemes)</i></p> <p><i>Focus on competitive PRO setups.</i></p>															

<p>Do you expect any particular / different challenges from those in a competitive or single PRO environment?</p> <p>If so, do you have any suggestions how to address/solve those?</p>	
<p>12. In your opinion, how will the introduction of the proposed Single-use Plastics Directive affect the packaging EPR schemes in general and in [country]?</p> <p>Do you expect any particular/different challenges from those in a competitive or single PRO environment?</p> <p>If so, do you have any suggestions how to address/solve those?</p>	<p><i>Focus on packaging & competitive PRO setup in regards to scope of cost coverage e.g. costs of cleaning up litter, awareness raising, costs of waste collection for those products that are discarded in public collection systems)</i></p>
<p>13. Other</p>	<p><i>Comments and suggestions for case studies, interview partners etc.</i></p>

Table 18: Interview guide for case study evaluation

Question	Answer
Environmental Performance	
Collection	
Via which channels is packaging waste collected in Germany (e.g. collection centres, retailers, collection points; etc)	
<p>In your experience what is the impact of / are the main reasons for leakage of packaging waste in Germany towards inadequate disposal channels? E.g. illegal export, incorrect disposal, informal collection and recycling.</p> <p>How much of packaging waste is approximately lost due to this and how much waste is estimated to be available for collection? How to make it visible and accounted towards national targets (all actors approach)?</p>	
What are the main obstacles to reach higher collection levels of packaging waste in Germany?	
<p>How and by whom is the collection of packaging waste monitored in Germany?</p> <p>Who pays for the monitoring and inspection?</p> <p>How violations are dealt with (e.g. fines for illegal behaviour/theft)</p>	
Are there any financial incentives from PROs/ the clearing house (if any) / authorities for consumers that aim improve access to and collection of packaging waste? Do you feel them appropriate?	
Recycling & treatment	

<p>In your opinion, how well developed is the recycling infrastructure/ capacity for packaging waste in Germany (number of recycling and treatment facilities; quality of recycling)?</p> <p>How does this affect the overall performance of the EPR scheme in terms of environmental and economic effectiveness?</p>	
<p>How would you describe the quality of recycling for packaging waste in Germany?</p> <p>What do you perceive as the most pressing issues to this regard?</p>	
<p>How and by whom is the recycling and treatment of packaging waste monitored in Germany?</p> <p>Who pays for the monitoring and inspection?</p> <p>How violations are dealt with (e.g. fines for illegal behaviour/theft)</p>	
<p>Economic Performance</p>	
<p>Cost for producers (e.g. tonne of product/ product category)</p>	
<p>Do the producers cover the cost of the whole value chain (collection points, transportation from collection points to treatment plants, treatment)? If not, who else is responsible for financing the system?</p>	
<p>How have prices for producers developed over the last 15-20 years (depending on stream)?</p> <p>What were the main drivers for this development?</p>	
<p>What additional services – beyond pure compliance - are you offering your customers (e.g. support for local communication, expert help etc.)?</p>	
<p>What are the main factors influencing the producer-fees charged by PROs</p>	
<p>Cost for collection</p>	
<p>What are the key requirements for the collection of packaging waste set by policy makers or others e.g. municipalities (e.g. type of collection containers)?</p>	

Are there any measures in Germany that aim to prevent a “cherry picking” of collection points/ areas (e.g. PROs only collecting in “easy” areas and disregard non-profitable areas)?	
For packaging waste and battery: What are the minimum collection volumes to be picked up?	
How have prices for the collection of packaging waste developed over the last 15/20 years? In your opinion, what were the main drivers for this development?	
Is the vertical integration (of collectors/recyclers/PROs) allowed and if so how does this influence the competition in your opinion	
Cost for recycling and treatment	
What are the regulatory requirements for the selection of recyclers and treatment facilities? E.g. only local recyclers, EU/international tendering procedures Is it possible to export waste for recycling?	
Are recyclers/waste processors directly contracted by PROs? Is there a tendering process for the selection of recycling and treatment facilities? If so, please briefly outline the tendering process → how does it influence the cost for the recycling of packaging waste?	
How and by whom are the recycling and treatment facilities monitored? What are the monitoring requirements?	
How have prices for the recycling and treatment of packaging waste developed over the last 15/20 years? What were the drivers?	
Administrative costs (overhead of PROs)	

What type of costs are included in the PRO's overheads (e.g. personal; communication; etc.)?	
Can you give us an indication on how much of PRO's annual costs are spend for overhead? (e.g. in %)	
Technical Performance	
Stakeholder satisfaction levels (mainly customers of PROs)	
How much and which influence do producers have on the PRO/ PROs? What would you regard as the most effective measure (considering the huge number of customers of a PRO)? Do you think this can be effectively implemented in a single PRO?	
Innovation potential	
Are you aware of any product innovations or new approaches for the handling and processing of packaging waste that have emerged as a direct or indirect result of the EPR scheme in Germany? If so, please provide examples and elaborate	
Awareness creation potential	
How would you rate the general public awareness and behaviour of consumers regarding the correct disposal/ recycling of packaging waste in Germany? Please indicate your answer on a scale from 1 (low awareness) to 10 (high awareness). Please elaborate.	
In case there are awareness campaigns (e.g. for proper handling of waste), how effective would you describe these campaigns and why?	

How to assure effective but also efficient consumer awareness campaigns? What is being required in your opinion? What works well according to your experience?	
Legal framework and organisation	
Is there an approval procedure for waste management operators (collectors, recyclers) (existence of detailed specifications by the authorising authority)	
What are the regulatory requirements for the collection of packaging waste set by policy makers or others e.g. municipalities (e.g. type of collection containers, collection standards, etc.)?	
What are the regulatory requirements for waste collectors with regard to reporting of collected waste	
What are the regulatory requirements for the recycling and treatment of packaging waste set by policy makers or others e.g. municipalities	
What are the requirements for recyclers in regards reporting the amount of recycled waste?	
Is there a mandatory legal requirement for PROs to invest a certain amount in communication and awareness raising? If so, how much do PROs are required to invest?	
Are the fees for packaging waste in Germany modulated? Who sets the criteria? How to ensure a level playing field among PROs in competitive market (no link of contracted POM quantities and collected waste quantities)?	
In your opinion, are there any major gaps/ challenges with regards to the EPR regulation and its enforcement for packaging waste in Germany?	

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