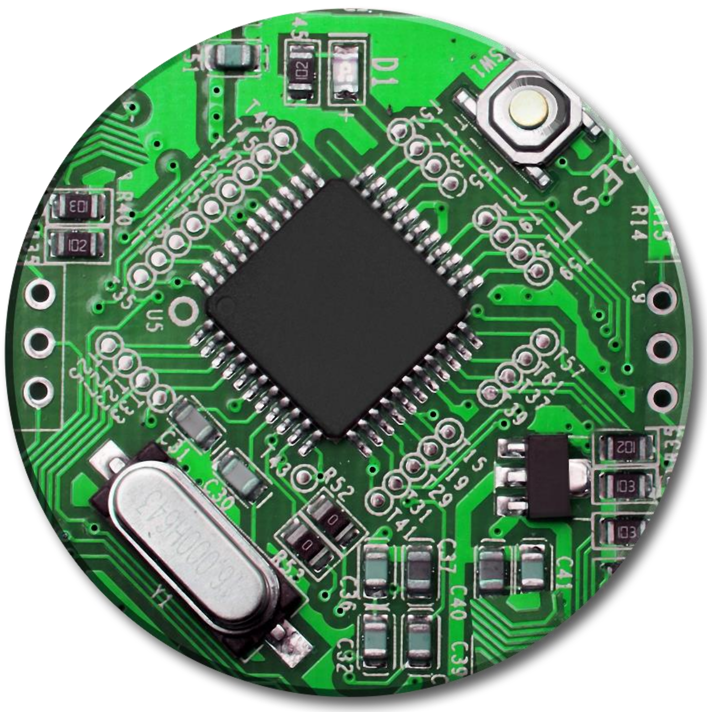

Towards more meaningful and robust WEEE management targets that foster circularity in the EU economy

Research in advance of a new WEEE Act and the Circular Economy Act

Brussels, 23 May 2025

Content

Executive summary

Directive (EU) 2024/884 requires the Commission to "assess the need for a revision of this Directive and, where appropriate, present a legislative proposal in that respect, accompanied by a thorough socioeconomic and environmental impact assessment", no later than 31 December 2026. To support the European Commission in defining achievable as well as ambitious targets that foster the circular economy, the WEEE Forum[1], an international association representative of not-for-profit entities that manage the collection and recycling of waste of electric and electronic equipment (WEEE) responsibly, on behalf of producers of electrical and electronic equipment, seeks to formulate recommendations on potential future targets for WEEE collection and on the method to calculate the collection rate, supportive of the circular economy. These recommendations thus also fit in the scope of the new Circular Economy Act that the Commission plans to adopt in 2026.

The existing legislative framework, primarily governed by Directive 2012/19/EU, sets collection targets, aiming either at 65% of the average weight of EEE put on the market (POM) in the three preceding years, or 85% of the quantity of WEEE generated in the actual year. Additionally, the directive mandates specific recovery and recycling/reuse targets for the different categories of EEE (see Annex).

This study conducts a thorough and comprehensive assessment of the current WEEE collection rate calculation methodologies and proposes a new approach to set the WEEE collection targets within the European Union (EU). The study applied a multi-phase approach, including data collection, model development and sensitivity analysis. Moreover, interviews with experts and stakeholders were conducted to validate assumptions and explore new target-setting approaches.

The analytical model concludes that **the current POM-based collection target is not fit for purpose**, i.e. it does not use accurate estimates of WEEE generation. This results in an unachievable target mainly due to the recent strong growth in quantity of electrical and electronic products placed on the market with long lifetimes. This kind of target should therefore no longer be used to monitor infringements by Member States.

In contrast, **the WEEE generated method provides a more robust metric** for setting collection targets, because it is less impacted by sudden market changes, by considering the different WEEE product lifetime distributions. However, the existing Excel tool for this method is complex and not aligned with the Eurostat metrics. Only eight EU Member States have adopted this calculation method. Moreover, the higher 85% EU target for collecting WEEE generated remains difficult to achieve for most Member States.

This study proposes to simplify the WEEE generated calculation method by aligning data inputs with Eurostat reporting and using lifetime distribution on a WEEE category level instead of product level. In addition, the study recommends making the target more realistic and performing regular EU-wide studies on product lifetimes and market shares to further enhance the method's relevance and precision.

Next to improving the existing WEEE management targets, new ideas for targets were explored with the ambition of extending the current focus on collection to a more holistic view on WEEE management and supporting the circular economy.

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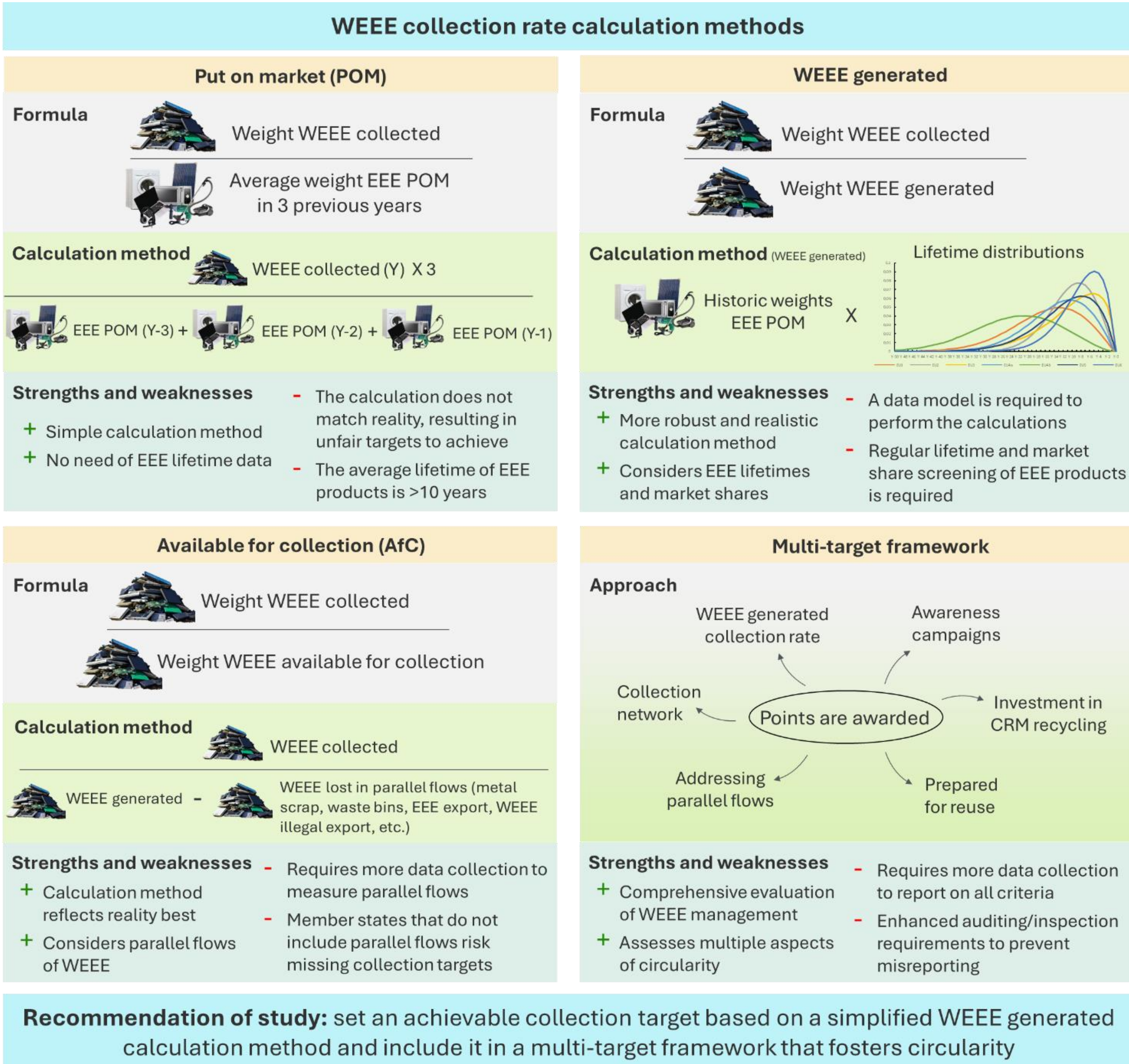
[1] The WEEE Forum a.i.s.b.l. is an international association representing 51 EEE producer responsibility organisations across the globe. Together with their members, they are at the forefront of turning the extended producer responsibility principle into an effective electronic waste management policy approach, through their combined knowledge of technical, business and operational aspects of collection, logistics, de-pollution, processing, preparing for reuse and reporting of e-waste.



The study argues that a **multi-target framework** is a good solution which not only includes collection targets but also contains targets regarding collection services, preparation for reuse, reducing parallel flows, increasing critical raw materials (CRM) recycling and awareness campaigns. This framework thus looks beyond the collected quantities of WEEE and promotes the importance of improving WEEE management overall. By implementing such a framework, countries can select the most relevant, cost-effective WEEE management strategies and tailor their actions to local needs. This system also allows to track progress on multiple dimensions of WEEE management.

On top of the multi-target framework, the study also recommends further applying the **'all actors' principle**, ensuring that everybody in the value chain that has access to WEEE or that plays a role in governing or enforcing WEEE programmes, i.e. producers, distributors, retailers, municipalities, consumers, recyclers, inspection and enforcement agencies, and refurbishers are held accountable for WEEE management. Clear and consistent definitions of roles and responsibilities of all the actors in the EEE value chain, along with enhanced enforcement mechanisms, will ensure compliance and improve overall WEEE management.

Publication information

The project was commissioned by the WEEE Forum in September 2024 to perform a study into new or revised WEEE minimum collection rates in the context of the impact assessment of a new WEEE Act. The project task force consisted of ElektroEko, Recyclia, Ecolec, Erion, Fundación Ecotic, Ecotic Romania, Zeos, Electrão, Recupel, Stichting Open and PVcycle.

The authors acknowledge the delegates of the producer responsibility organisations in the WEEE Forum for providing input during the project and in the writing phase. Special gratitude is extended to the project team members of WEEE Forum who provided continuous support during the project: Pascal Leroy and Lucía Herreras.

Disclaimer

This document has been developed in collaboration with the WEEE Forum. The findings, interpretations and conclusions expressed herein are a result of a collaborative process facilitated and endorsed by the WEEE Forum but whose results do not necessarily represent the views of the entirety of its members, partners or other stakeholders.

Abbreviations

WEEE	Waste of electrical and electronic equipment
POM	Put on market
EEE	Electrical and electronic equipment
EU	European Union
EC	European Commission
AFC	Available for collection
PRO	Producer responsibility organisation
CRM	Critical raw materials
MT	Million tonnes
JRC	Joint Research Center

1 Introduction

1.1 The importance of WEEE management

The quantity of WEEE annually generated in the EU is growing rapidly (+12% in the period 2013-2022), making it one of the fastest expanding waste streams (European Commission, DG Environment[2]). This category encompasses a wide variety of devices including, among others, mobile phones, computers, televisions, refrigerators, household appliances, lamps, medical devices, and photovoltaic panels. E-waste contains a complex mix of materials, some of which are hazardous and can lead to significant environmental and health issues if not properly managed. Additionally, modern electronics often contain CRM[3], which the EU requires for its digital, green and energy transition and the supply of which is uncertain. Enhancing the collection, treatment, and recycling of electrical and electronic equipment at their end of use, as well as preparation for reuse, refurbishing, remanufacturing, repurposing to prolong the lifetime of products will reduce the EU's material dependency and support the transition to circularity.

1.2 Existing legislative framework

The existing legislative framework for WEEE in the EU is primarily governed by the current WEEE directive, 2012/19/EU. This directive sets out comprehensive regulations for the collection, treatment, recovery, and recycling of WEEE. It establishes targets for the collection of WEEE in each member state, either 65% of the average weight of EEE placed on the market in the three preceding years, or 85% of the quantity of WEEE that is generated.

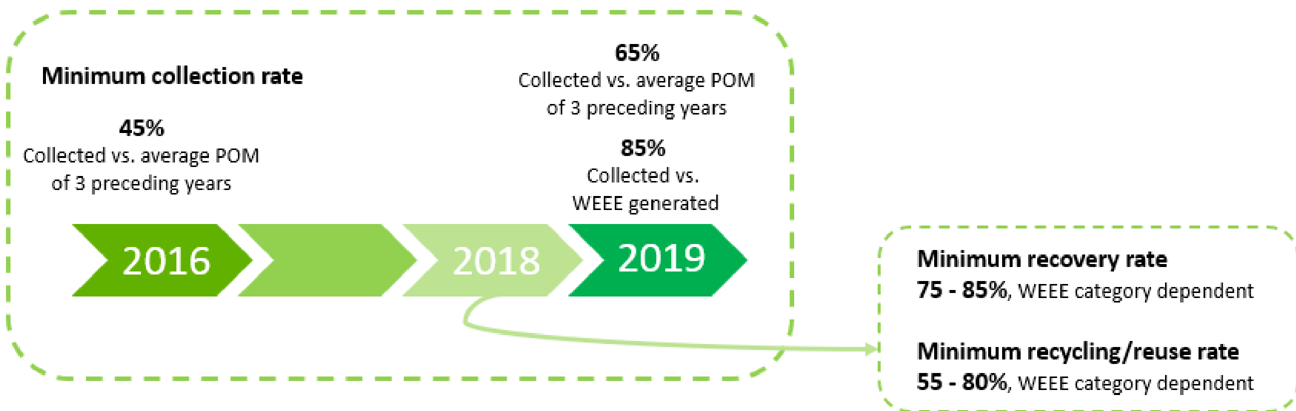


Figure 1.1 Targets in WEEE directive

Additionally, the directive mandates specific recovery and recycling/reuse targets for the different categories of EEE. For instance, large household appliances must achieve a recovery rate of 85% and a recycling/reuse rate of 80%, while small appliances and consumer electronics have slightly lower targets, with a recovery rate of 75% and a recycling/reuse rate of 55% (Figure 1.1). These measures aim to enhance resource efficiency, reduce environmental impact, and support the EU's transition to a circular economy.

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[2] European Commission, DG Environment. (n.d.). Waste electrical and electronic equipment (WEEE) (Link)

[3] Critical raw materials (CRM) are raw materials of high economic importance for the EU, with a high risk of supply disruption due to their concentration of sources and lack of good, affordable substitutes (e.g. lithium, cobalt etc.) (Link)

1.3 Objectives and structure of the report

The scope and objectives of this study are centred around a comprehensive review of the methodologies for setting WEEE collection and management targets. Firstly, the study analyses the two existing methodologies to monitor their effectiveness. This includes a screening of the current status of POM and WEEE generated collection rates, as well as a forward-looking assessment of these methodologies to determine if Member States will realistically be able to achieve the established targets. Secondly, the study explores and evaluates new approaches for setting targets that are more realistic and easier to use, with an increased focus on supporting the circular economy. Finally, the study compiles a list of additional recommendations for a new WEEE Act.

The report is structured in the following chapters. Chapter 2 explains the adopted approach. Chapter 3 examines the current status and challenges in WEEE management. Chapter 4 discusses the perspectives and priorities of the WEEE Forum. Chapter 5 formulates recommendations for alternative collection targets by exploring various new methods and their implications. The report concludes with recommendations for a new WEEE Act (Chapter 6) and a summary of the key findings (Chapter 7).

2 Approach

This study is structured in several phases to ensure a thorough analysis of WEEE collection and management targets and the development of robust recommendations. The approach is visualized below, which includes testing a broad set of ideas on the key ambitions set forward in the study, prioritization by WEEE Forum, impact modelling and a SWOT analysis.

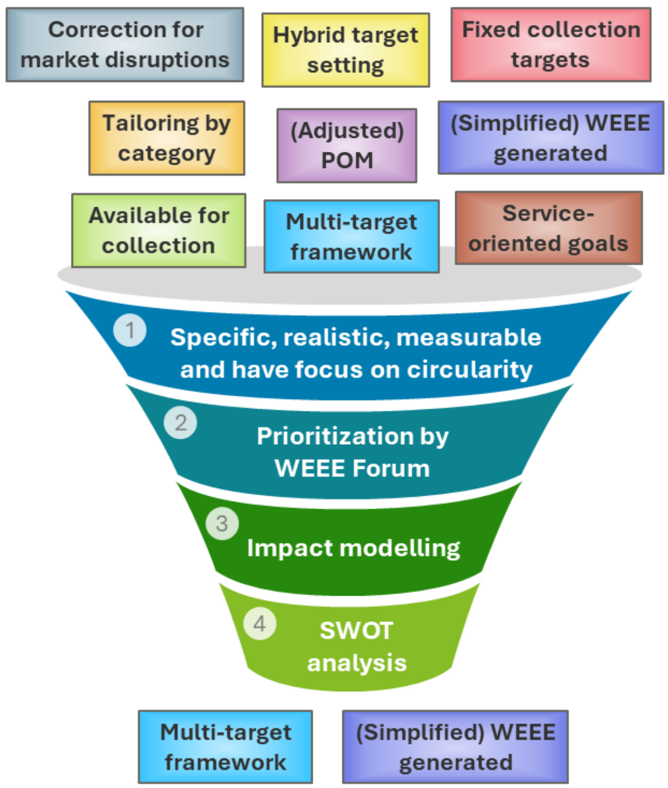

Figure 2.1 Methodology funnel followed in this study to make a final recommendation of WEEE management targets

2.1 Data Collection

The initial phase involved extensive data collection, which included conducting a literature review and mapping available data. Data on collection and POM quantities were gathered from sources such as Eurostat, the WEEE Forum database, and the WEEE generated tool Excel files[4] for each Member State, as shown in Table 2.1. When duplicates existed in the data, e.g. the POM data were available for a specific country, category and year in multiple datasets, the priority selection was applied as follows: priority was given to Eurostat data, followed by the WEEE Forum data, and then WEEE generated tool data. Throughout this report, the term 'collection quantities' refers to the quantities that have been officially reported as being collected. It is important to note that these reported quantities may not necessarily reflect the actual quantities collected. WEEE can also be collected in parallel flows that are not officially reported as being collected.

[4] The "WEEE generated calculation tool" is an integral part of the methodologies for determining the quantity of WEEE generated by weight in each Member State, as established by Commission Implementing Regulation 2017/699 (Link).

Table 2.1 Data collected for POM and collection quantities

Priority	Source	Granularity	POM/Collection	Year
1	EUROSTAT	EU 6(+1)[5] categories	POM & Collection	2018-2022
2	WEEE Forum	EU 6(+1) categories	POM & Collection	2010-2023
3	WEEE generated tool	EU 6(+1) categories	POM	1980-2022

The seven EEE categories included in the database are listed in Table 2.2:

Table 2.2 EEE categories and examples of equipment per category

Category	Examples of equipment
Cat. 1: Temperature exchange equipment	Fridges, freezers, A/C, heat pumps dryers and other temperature exchange equipment
Cat. 2: Screens, monitors and equipment containing screens	Laptops, tablets, TVs and monitors
Cat. 3: Lamps	Lightning equipment, fluorescent lamps, LED lamps and other Lamps
Cat. 4a: Large equipment (excluding PV)	Kitchen equipment, washing machines & dryers, household heating & ventilation, professional equipment and other large equipment
Cat. 4b: PV (including converters)	PV & inverters
Cat. 5: Small equipment	Small kitchen equipment, small household equipment, small consumer electronics, household tools, and other small equipment
Cat. 6: Small IT and telecommunication equipment	Printers, desktop PCs, mobile phones, gaming consoles and other small IT & telecommunication equipment

The data were fed into a model that includes the quantities of electrical and electronic products placed on the market in the period 1980 – 2022 for the EU27 (Figure 2.2)[6]. The quantities increased significantly from 1980 to the early 2000s, followed by a slight decline and another strong increase after 2015. This trend is inter alia associated with changes in the growth rates of the economy, population trends, geopolitics, introduction of new technologies and more effective reporting mechanisms.

These POM data were combined with the lifetime distribution data to estimate the quantities of WEEE that are generated. The lifetime data were based on the Weibull distributions of EEE products from the EU WEEE generated tool. The full approach for calculating WEEE generated quantities is detailed in Annex 2.

[5] PV is treated as a separate category in the model

[6] The historical dataset stops at 2022, which is the latest year for which data is reported on EU27 granularity in Eurostat during the timeframe of the study (Link).

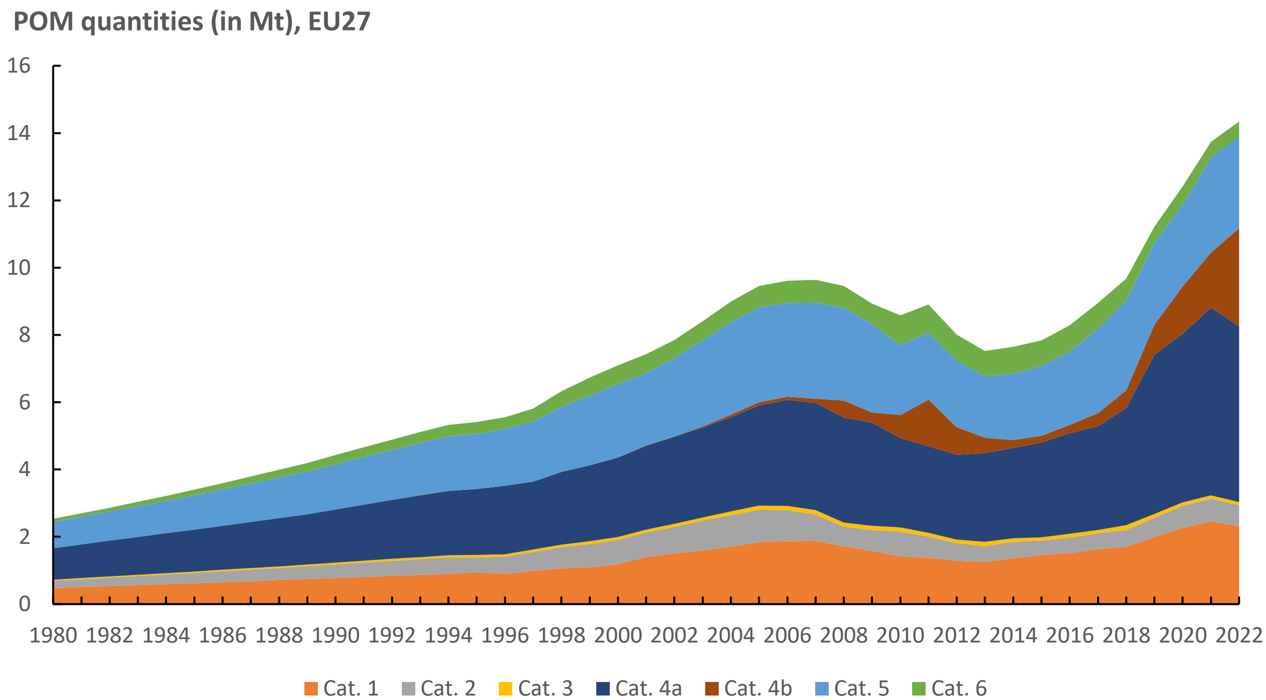

Figure 2.2 POM historic quantities, EU27 (1980-2022)

Additionally, interviews with chief executives of PROs in the WEEE Forum and other experts were conducted to complete the data collection and validate assumptions. These interviews covered a range of topics, including novel concepts for calculating collection rates, experiences with the WEEE generated calculation method, lifetime studies on EEE products, material flows and missing waste streams.

2.2 Development of the models

Based on the data collected, a model was developed at the EU level to visualise the existing situation and assess the collection rates based on POM and WEEE generated. This model also forecasts future trends building on historical data and the following assumptions, which are also summarized in Table 2.3.

- Trends in POM quantities: the annual average growth rates for the period 2013-2022 were used as starting values for 2023. The values for the following years were modelled to level off in a linear fashion over time towards a level of one-third of the historic growth by 2030. This moderated growth projection was motivated by factors such as stagnation of population growth[7], expected market stabilisation[8], and a greater focus on reuse and repair that will reduce the growth rate of new sales.
- Trends in WEEE generated quantities: projections are calculated based on the forecast POM values and life cycle curves from the WEEE generated tool.

[7] Eurostat forecast the EU population to reach its peak before 2030 followed by a slow decline (Link)

[8] E.g. after years of strong growth, Solar Power Europe forecasts the future EU PV market growth to be limited (Link)

- Trends in collection quantities: the average annual growth rate of the past 10 years (5.43%) is used as starting value for 2023. The values for the following years are modelled to linearly move towards the annual average growth rate of WEEE generated in 2030 (4%).

Table 2.3 Assumptions on growth rate for POM and collection quantities

	POM							Collection	WEEE generated
	Cat. 1	Cat. 2	Cat. 3	Cat. 4a	Cat. 4b	Cat. 5	Cat. 6	All	All
	Historic annual growth rate								
2013-2022	6.23%	2.20%	0.66%	8.00%	23.01%	3.62%	-4.92%	5.43%	
	Assumption on growth rate								Based on POM
2023	6%	2%	1%	8%	23%	4%	-5%	5%	2%
2024	5%	2%	1%	7%	20%	3%	-4%	5%	2%
2025	5%	2%	0%	6%	17%	3%	-4%	5%	2%
2026	4%	1%	0%	5%	14%	2%	-3%	5%	3%
2027	3%	1%	0%	4%	12%	2%	-3%	5%	3%
2028	3%	1%	0%	4%	10%	2%	-2%	4%	4%
2029	2%	1%	0%	3%	9%	1%	-2%	4%	4%
2030	2%	1%	0%	3%	8%	1%	-2%	4%	4%

Additionally, another model is created to compute the collection rates at the category level, including data from 14 countries for which the model has a complete view on the collection quantities at the category level in the period 2013-2022. The 14 countries included in the model are Austria, Belgium, Czechia, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Poland, Portugal, Slovenia, and Spain. It was found that this 14-country model represented the collection rates of the whole EU27 well, as depicted in detail below in Figures 2.3 and 2.4.

For this category-level model, similar assumptions are made regarding the growth rate of collection (Table 2.4):

- Trend towards 2030: the average annual collection growth rate of the past 10 years is used as starting value for 2023. The values for the following years linearly move towards the WEEE generated growth rate of 2030 for each category.
- For PV panels, the historic collection annual growth rate was based on the past 3 years, instead of 10 years, since the PV collection data in the model is only robust as of 2019.

Table 2.4 Assumptions on growth rate for collection quantities per EEE category

	Collection						
	Cat. 1	Cat. 2	Cat. 3	Cat. 4a	Cat. 4b	Cat. 5	Cat. 6
	Historic annual growth rate						
2013-2022	7.1%	-3.9%	9.2%	12.8%	37.5%	9.8%	3.5%
	Assumption on growth rate						
2023	7.1%	-3.9%	9.2%	12.8%	37.5%	9.8%	3.5%
2024	6.5%	-3.2%	7.8%	11.8%	34.8%	8.7%	2.4%
2025	6.0%	-2.4%	6.3%	10.7%	32.2%	7.5%	1.2%
2026	5.5%	-1.7%	4.9%	9.7%	29.5%	6.3%	0.0%
2027	4.9%	-1.0%	3.4%	8.6%	26.8%	5.2%	-1.1%
2028	4.4%	-0.2%	2.0%	7.6%	24.1%	4.0%	-2.3%
2029	3.9%	0.5%	0.5%	6.6%	21.4%	2.9%	-3.4%
2030	3.3%	1.2%	-0.9%	5.5%	18.8%	1.7%	-4.6%

The outcome of this model, which is based on 14 countries, closely follows the 2022 data reported in Eurostat for all Member States when comparing the POM collection rates[9], as shown in Figure 2.3. Therefore, the 14-country model is seen as a good predictor for the whole EU27 when looking into trends at the category level. The outcome of the model has stronger differences with the 2022 WEEE generated collection rate data in Eurostat (Figure 2.4). The main reason for this is that a few countries reported significantly different WEEE generated quantities to Eurostat compared to the results of the WEEE generated tool.[10]

[9] POM collection rate is the value obtained by dividing the quantity of WEEE collected by the quantity of EEE POM in the three preceding years on the territory of a Member State

[10] The reported WEEE generated quantities of Spain and Luxembourg to Eurostat were significantly lower compared to the outcome of the WEEE generated tool (>20%).

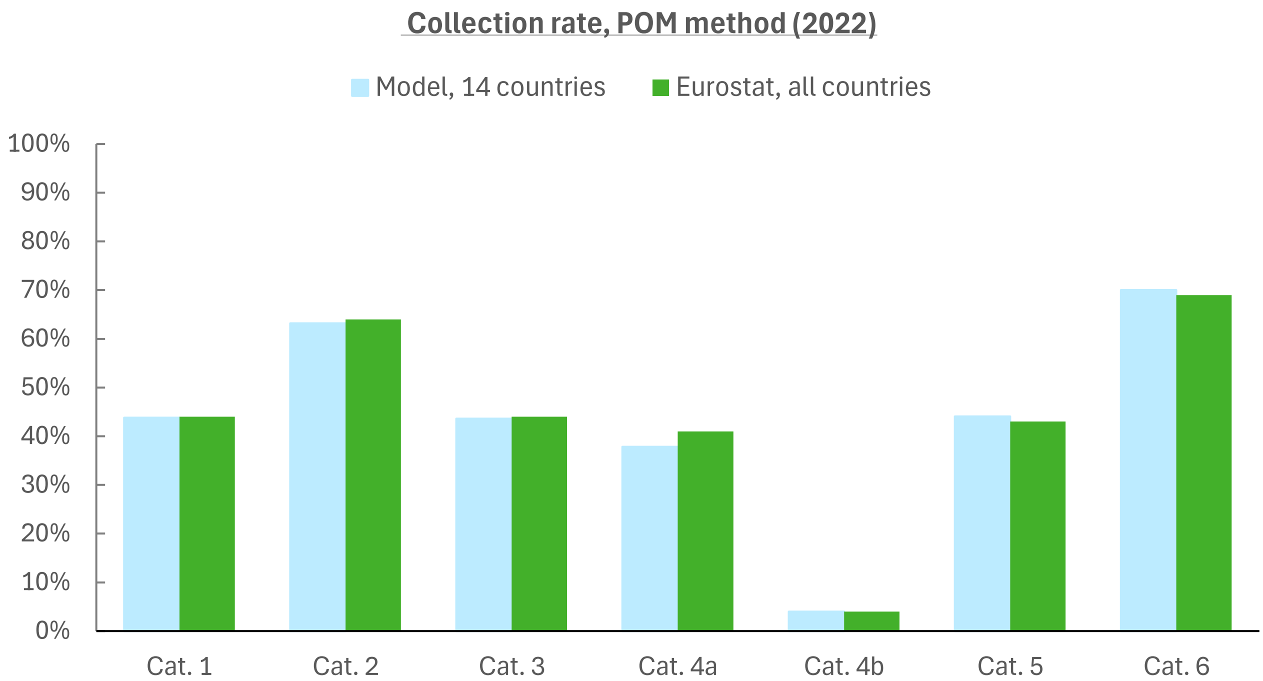

Figure 2.3 Comparison of 2022 POM collection rates: 14-country model vs. all-countries Eurostat

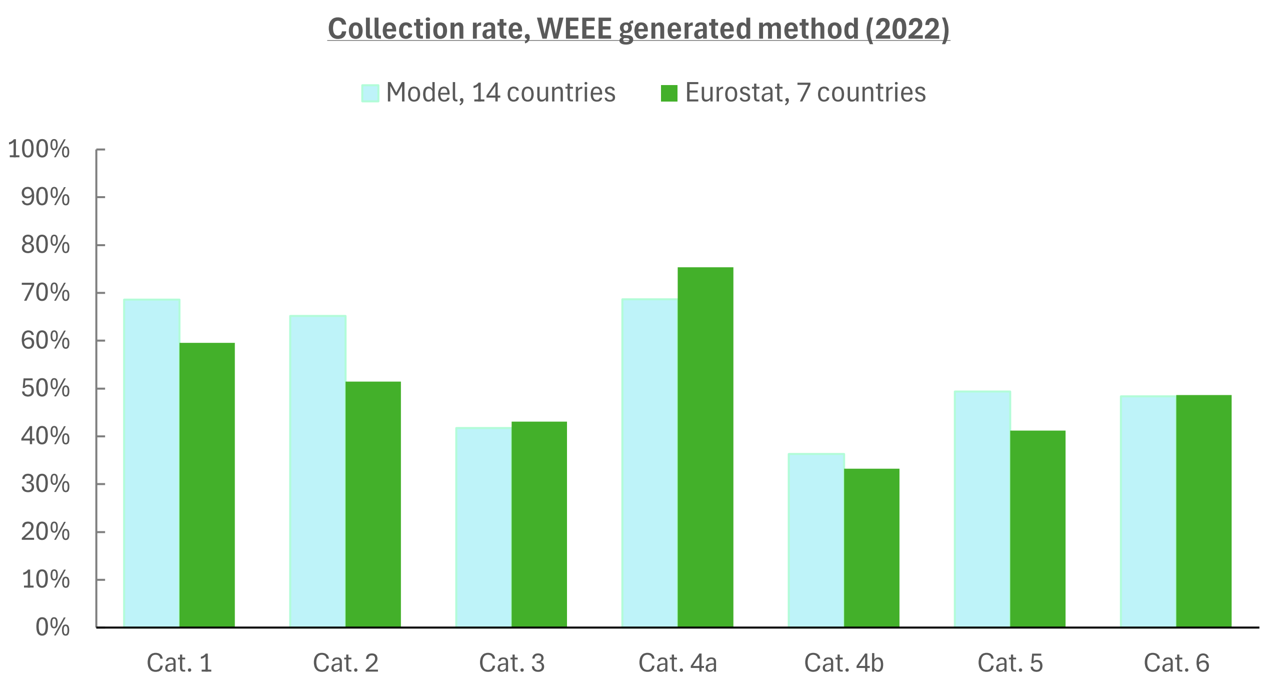

Figure 2.4 Comparison of 2022 WEEE generated collection rates: 14-country model vs. 7-countries that reported in Eurostat[11]

[11] The 7 countries that reported WEEE generated quantities in Eurostat are Cyprus, Denmark, Finland, Hungary, Luxembourg, Netherlands and Spain.

Sensitivity analysis

After building the two models, a sensitivity analysis was conducted to assess the impact of changes in the assumptions regarding the growth rate of the POM quantities forecast and the lifetime values. The POM quantities were adjusted to account for potential variations in market entry estimates, while the lifetime values were adjusted to reflect different assumptions about product longevity. These changes were systematically applied to evaluate the model's responsiveness to varying input scenarios and to test the reliability of the results. The analysis provided valuable insights into how fluctuations in these key variables could influence overall outcomes, ensuring a more thorough understanding of potential uncertainties.

2.3 SWOT analysis of different methodologies

Based on literature review and data research, a long list of ideas was developed to establish new WEEE collection and management targets. These ideas were categorized into four main areas: improvements to existing collection target concepts, actions that foster an all-actors approach, new targets, and new financing models. This list of ideas was then prioritized by a task force composed of experts and chief executives of PROs in the WEEE Forum, which resulted in the prioritization of six ideas. The task force subsequently validated the strengths and weaknesses of each idea and ultimately selected the most suitable method to be elaborated and put forward as a recommendation to the European Commission services.

3 Current status and challenges in WEEE management

This chapter explores the current status and challenges in WEEE management within the EU27, focusing on the collection rates achieved with the POM and WEEE generated calculation methods. It also presents forecasts for the collection rates up to 2030 for the EU27, both overall and by category. This analysis is used to evaluate the effectiveness of the existing methodologies for calculating the WEEE collection rates, identify areas for improvement, and guide the proposal of new approaches to enhance the accuracy and efficiency of WEEE management.

3.1 Current status at European level

The examination of the current status takes into account historical data (2013-2022) on POM, WEEE generated and collection quantities, providing an overview of trends over time. It also includes an analysis of the collection rates calculated using both existing methodologies, enabling a detailed assessment of how these rates have evolved over the years. Furthermore, the analysis identifies how many EU Member States have successfully met their WEEE collection targets in recent years, offering insights into the effectiveness of the current regulations.

POM and WEEE generated quantities

Based on the data in the model, it is observed that the EEE POM quantities experienced a significant increase from 2013 till now (98%). In contrast to POM quantities, the calculated WEEE generated quantities have remained relatively stable from 2013 to 2022, with only a slight increase (12%), as illustrated in Figure 3.1. In other words, while a lot more EEE is being placed on the market, the long EEE lifetimes result in only a slight increase of WEEE that is currently generated. In 2013, the WEEE generated quantities were still in line with the POM quantities, which is related with the evolution of the historic POM numbers. The POM quantities peaked around 2005 after which they declined (see Fig. 2.2), which has resulted in similar quantities for POM and WEEE generated in 2013. Due to the increase again in POM quantities after 2013, the difference with WEEE generated started growing again.

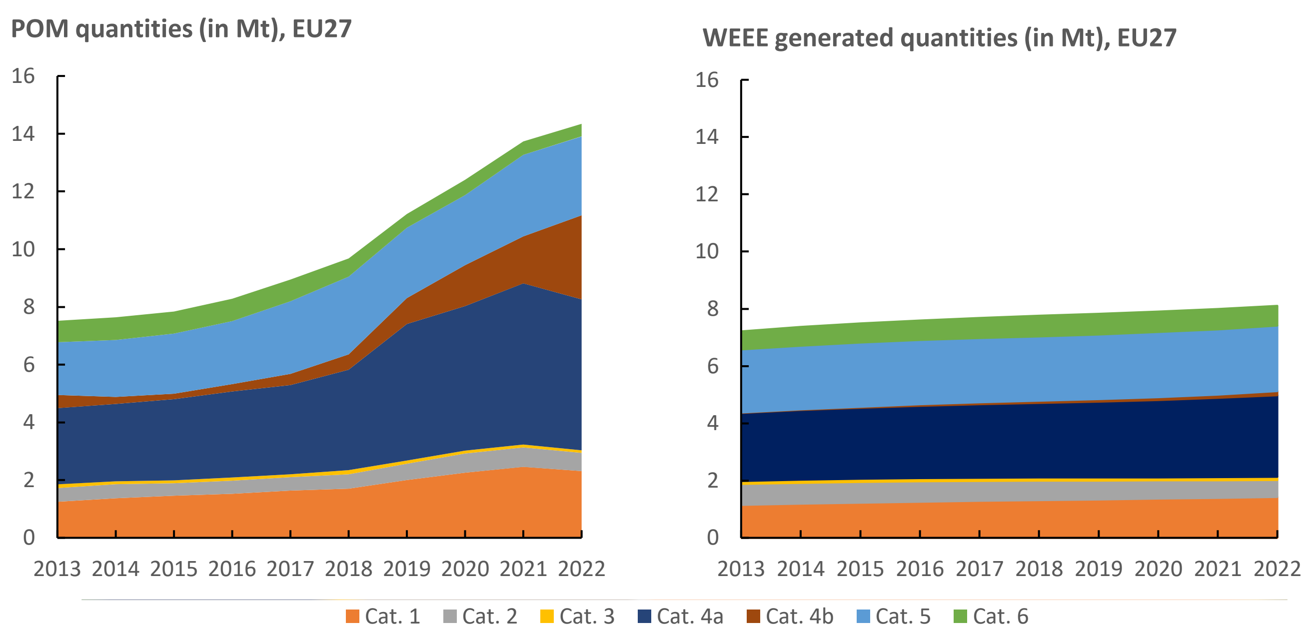

Figure 3.1 POM and WEEE generated quantities per EEE category (in Mt), EU 27 (2013 - 2022)

Collection results

In contrast to the WEEE generated quantities, the collection quantities did increase significantly between 2013 and 2022 (65%) (Figure 3.2).

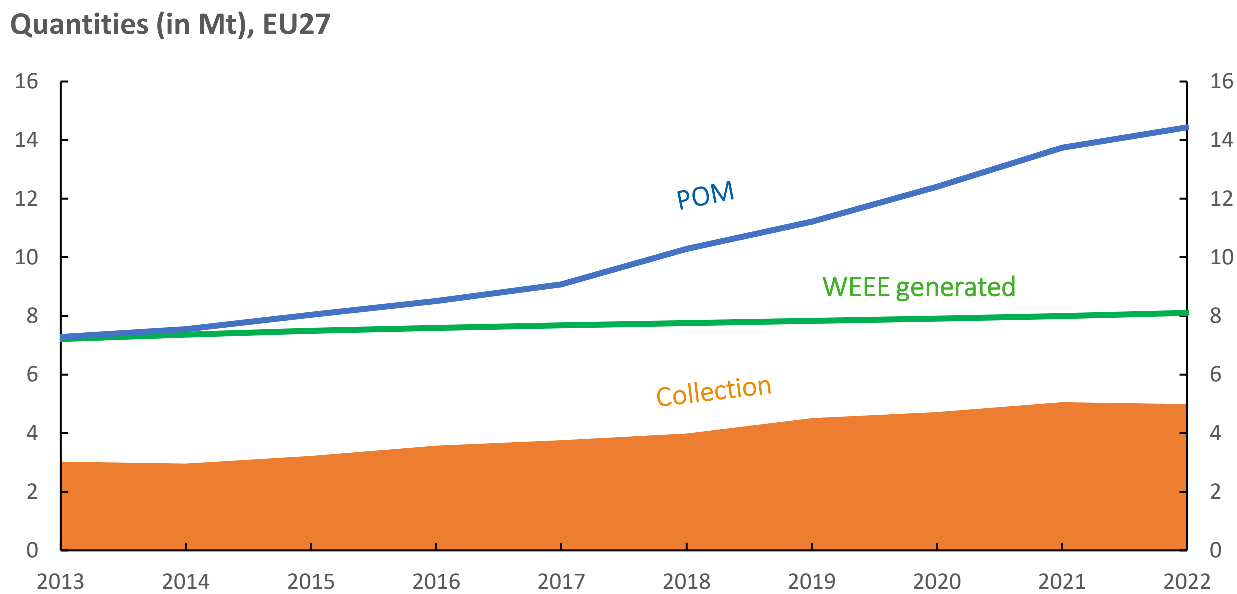

Figure 3.2 Collection, POM and WEEE generated quantities (in Mt), EU27 (2013-2022)

The different trends between POM, WEEE generated and collection lead to diverging collection rates from the two calculation methodologies (see Figure 3.3). Over time, the WEEE generated collection rate has shown an increasing trend, growing from 42% in 2013 to 62% in 2022. In contrast, the POM collection rate remained stable between 2016 and 2019 and afterwards even started to decline towards 2022. The POM collection in 2022 (40%) is only slightly higher compared to 2013 (38%).

This analysis demonstrates that the current POM collection rate calculation does not reflect reality, which is that the collection results have improved significantly over the past ten years. The low POM collection rate is due to the strong increase in quantity of electrical and electronic products placed on the market over the last decade in combination with the long average lifetime of EEE that is 14,5 years[12], while the current POM calculation method only considers the average POM of the previous three years.

The continued use of this method is therefore worrying as it is already causing infringements from the Commission to Member States, who may face penalties because of this.[13]

[12] The average lifetime of EEE products of 14,5 years is calculated based on the category lifetime values of the WEEE generated calculation in combination with the category weight distributions in the POM volumes.

[13] In the July infringement package of 2024, the European Commission has pursued legal action against Member States for failing to comply with their obligations (Link)

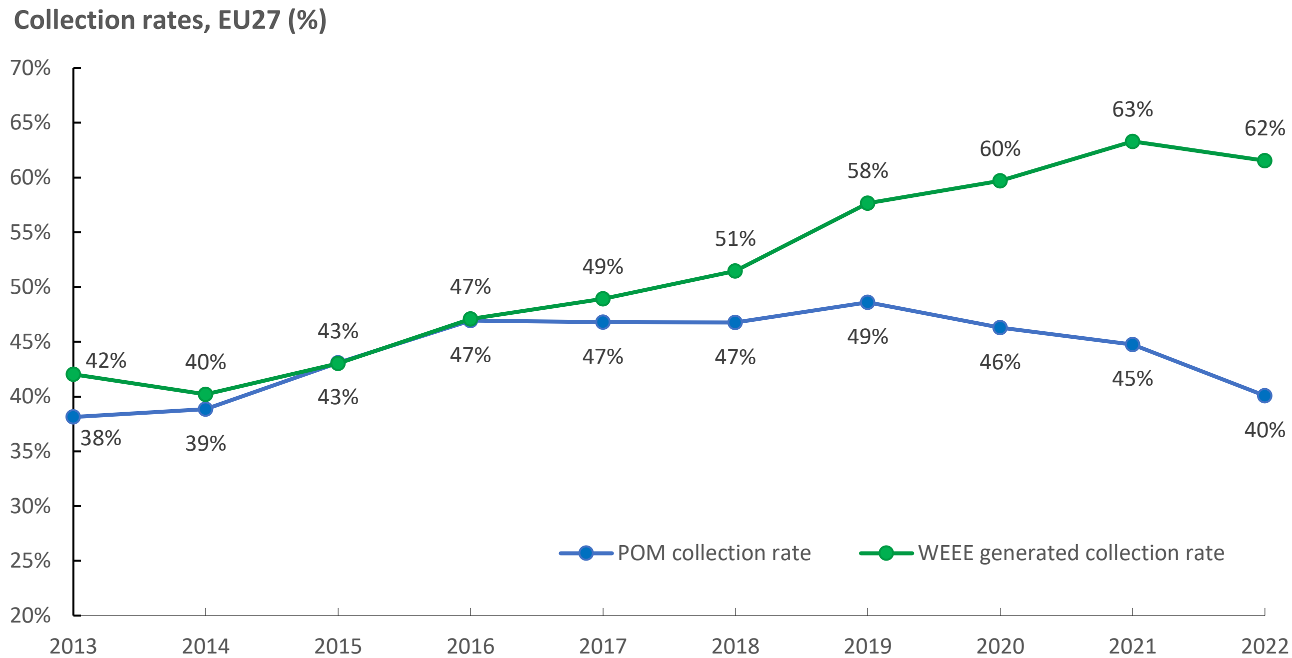

Figure 3.3 POM and WEEE generated collection rates, EU27 (2013-2022)

Nevertheless, even with the collection result improvements of the last decade, the collection rate results remain well below the targets set by the WEEE Directive, i.e. 65% for the POM collection rate and 85% for the WEEE generated collection rate. Figure 3.4 highlights the considerable gap between the current collection rates and the EU targets, emphasizing the challenge of achieving full compliance. From 2013 to 2021, the POM collection rate method distance to the target was smaller than the WEEE generated collection rate method, making the POM target a more interesting target for Member States at the time. However, after 2019, this distance began to increase and as of 2022, the distance to the WEEE generated target has for the first time become the smallest.

The high 85% target for the WEEE generated method and the associated bigger distance to the target was a main reason for Member States not to make use of the WEEE generated method in the past. The complexity of the tool and the lack of data granularity required also contributed to the preference of the POM calculation method.

The inability to still not meet the 85% target when using the WEEE generated method can be largely explained by the presence of parallel flows, which divert WEEE away from official collection systems. Parallel flows include WEEE that is lost in metal scrap processing, municipal waste disposal and legal or illegal exports. These parallel flows are further analysed in the next subchapter.

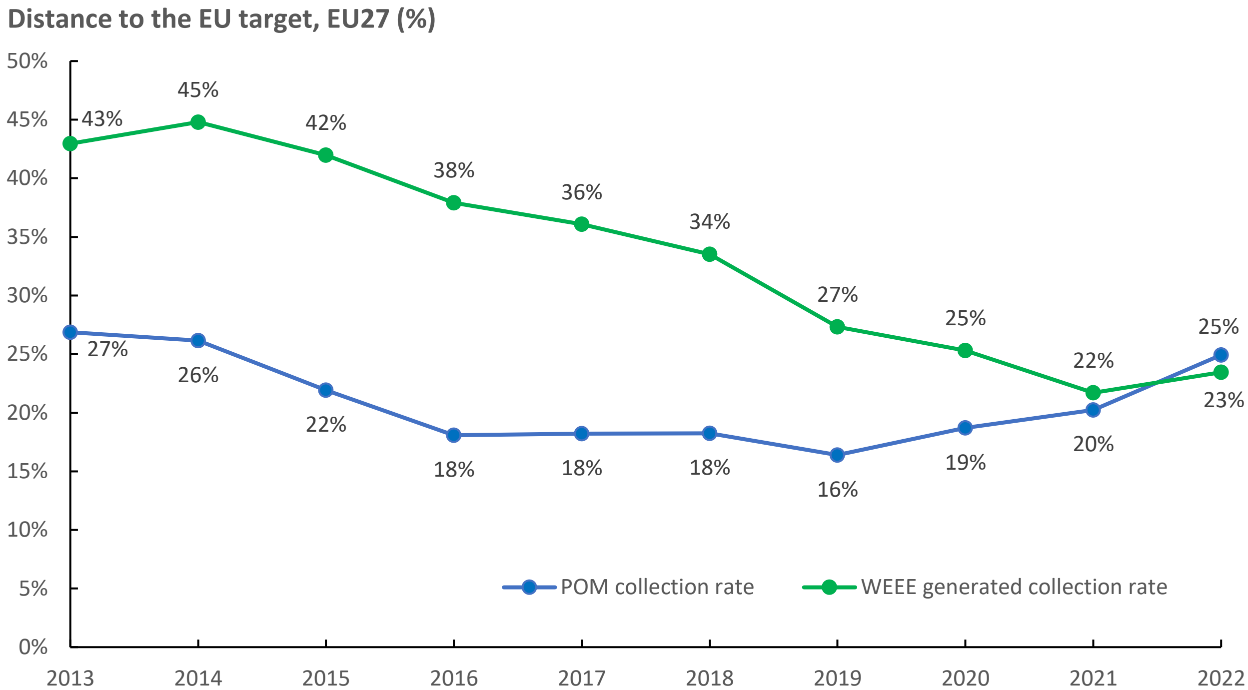

Figure 3.4 Distance to the target for POM and WEEE generated collection rate, EU27 (2013-2022)

Parallel flows[14]

Parallel flows of WEEE refer to the phenomenon of electrical waste 'leaking from' the official collection channels. Those flows represent a major problem in terms of meeting collection targets. Parallel flows include WEEE lost in metal scrap, municipal waste, and (il)legal exports, which are not reported and therefore not accounted for and likely do not undergo proper treatment. A considerable portion of WEEE is mixed with metal scrap and processed in facilities that may not comply with the regulatory requirements under WEEE legislation, leading to potential environmental and data reporting issues. Furthermore, small WEEE items are often discarded in municipal waste bins, resulting in landfilling or incineration instead of proper recycling. Illegal exports of WEEE outside the EU, sometimes misclassified as reusable electronic equipment, further contribute to underreporting and hinder accurate collection rate assessments. Exports of second-hand EEE can be legal, but still reduce the potential of collection in Europe. Addressing these parallel flows through improved monitoring, stricter enforcement, and enhanced cooperation between stakeholders is crucial for strengthening WEEE management and achieving higher collection rates.

The figure below illustrates the parallel flows of WEEE in 2021 that were estimated for Europe by the UNITAR (United Nations Institute for Training and Research) report.[15] They collectively account for 32% of WEEE generated in 2021, as shown in Figure 3.5. This shows that a substantial amount of WEEE is not captured in the formal collection systems, making the 85% WEEE generated target difficult to achieve.

[14] Other studies may refer to these “parallel flows” as "complementary flows" or "leakage streams".

[15] UNITAR and WEEE Forum, Update of WEEE Collection Rates, Targets, Flows, and Hoarding – 2021 (Link)

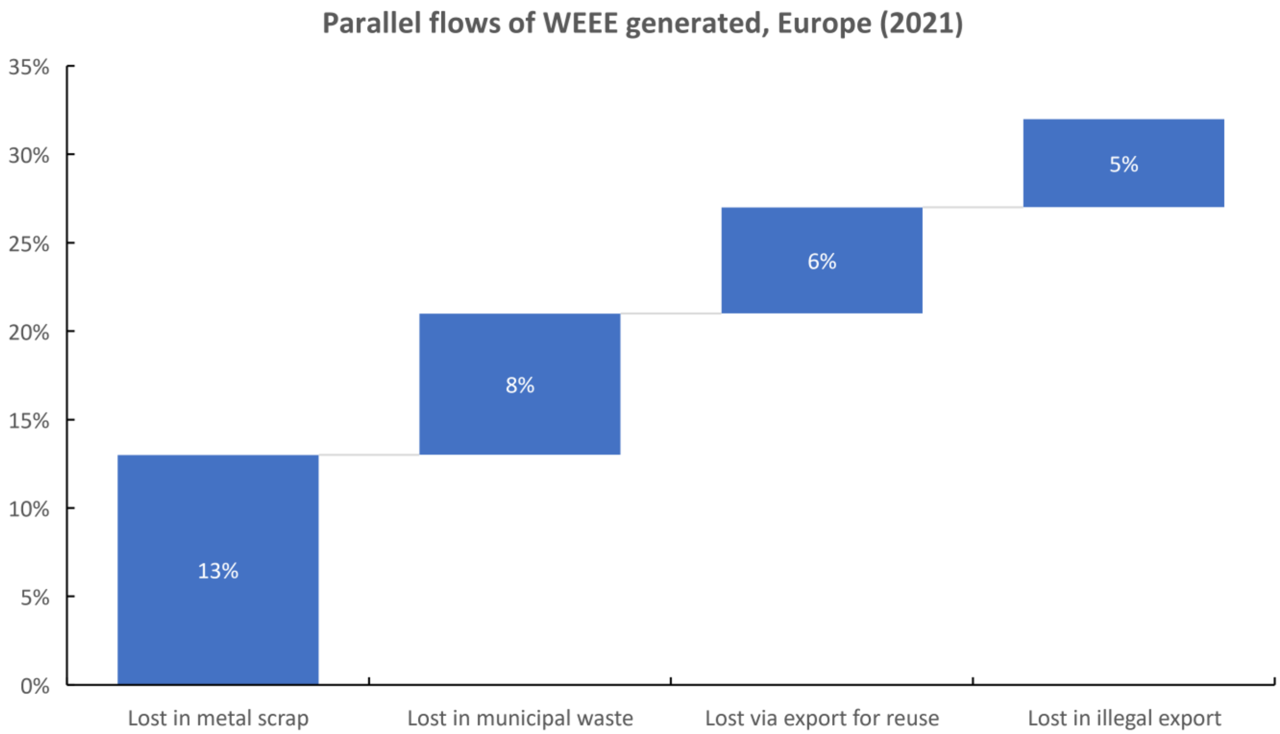

Figure 3.5 WEEE parallel flows mass balance (UNITAR report, 2021)

Lost in metal scrap

Up to 13% of WEEE is lost in metal scrap streams, according to the analysis conducted by UNITAR. This occurs when WEEE is not disposed of in formal collection points but handed over to metal scrap collectors, because of a small payment or due to the ease of door-to-door collection. If this WEEE is subsequently not sorted out, handed over or reported to the formal collection operators, these quantities do not contribute to meeting the collection target. This includes mainly products that are rich in ferro and non-ferro metals that are valuable for recycling. As a result, WEEE is not treated according to standardized practices, which leads to improper dismantling or improper treatment of hazardous substances (e.g. batteries) or the loss of components rich in CRM. Implementing incentives, such as sorting-out fees for metal scrap processors, can encourage the separation of WEEE from other scrap materials, ensuring that more electronic waste collection is registered and that proper processing takes place.

Lost with municipal waste

Another significant parallel flow occurs when WEEE is disposed of with municipal waste. Consumers and businesses may discard small electronic devices, such as unused external hard drives, or small household appliances, in their regular waste bins. This practice leads to WEEE being sent to landfills or incineration facilities, where it is not recycled. Public awareness campaigns and close access to convenient collection points can help reduce the amount of WEEE lost in municipal waste by encouraging consumers to dispose of electronic devices through appropriate channels.

Lost with illegal export

Illegal export of WEEE is a major concern, as it often results in improper treatment and disposal of electronic waste in countries with less stringent environmental regulations. This may include recycling operations where hazardous materials are not managed safely, leading to environmental risks. In addition, illegal export also results in the loss of valuable materials that are embedded in EEE products.

According to the UNITAR study (2020)[16], illegal exports of WEEE often occur when WEEE is embedded in containers that contain used EEE products, which are not illegal to export. These exports are frequently misclassified as second-hand goods or metal scrap, making it difficult to detect and separate the illegal WEEE from legitimate used EEE exports. Strengthening enforcement measures and improving tracking and monitoring systems can help prevent illegal export and ensure that WEEE is processed in compliance with EU regulations. By addressing the issue of illegal WEEE exports, countries can improve the environmentally sound management of WEEE, and move closer to achieving their collection targets.

Export of used EEE

Many used devices are shipped to other regions, often under the premise of reuse, repair, or second-hand markets. While some of these products extend their lifespan, a considerable portion eventually becomes WEEE in the destination countries, where proper collection and treatment may not always be ensured. This export flow can contribute to the displacement of WEEE management responsibilities and hinder accurate tracking of waste quantities, posing challenges for compliance with environmental and regulatory frameworks.

Other potential losses

Several other factors can contribute to the parallel flows of WEEE. Some electronic waste is lost due to incidents such as fires in homes or warehouses, where valuable materials are destroyed before they can be recovered. WEEE may also be mixed with other waste streams, such as plastic, glass, bulky and construction and demolition waste. Additionally, the quantities of WEEE in the other parallel flows may be underestimated, or the amount of WEEE reaching its end-of-life may be overestimated if the assumed average lifetimes are taken too short.

3.2 Diversity within EU27

In the previous section, the analysis was done for the EU27 total. This section zooms in on the collection performance for both the POM and WEEE generated calculation methods for the individual EU Member States. In 2022, only three[17] of them surpassed the POM collection target of 65%, while most other Member States remained far below that target (Figure 3.6). This illustrates that the difficulty to achieve the POM-based targets, as explained for the EU27 total, is also applicable to almost all Member States.

For the WEEE generated collection rate, like the POM method, only three countries exceeded the 85% target, however, more countries are close to the target (Figure 3.7). This shows that, in the near future, the WEEE generated method will become more interesting to use for many EU countries. Nevertheless, the high 85% target is still difficult to achieve for most Member States.

[16] UNITAR and WEEE Forum, In-depth review of the WEEE Collection Rates and Targets in the EU-28, Norway, Switzerland, and Iceland (Link)

[17] More external data validation is required from Eurostat to further improve the accuracy of the submitted values. For example, Bulgaria, which achieves collection rates of above 100% for both calculation methods might not sufficiently incorporate all EEE products that are put on the market. Moreover, the impact of imported second-hand EEE products should also be incorporated.

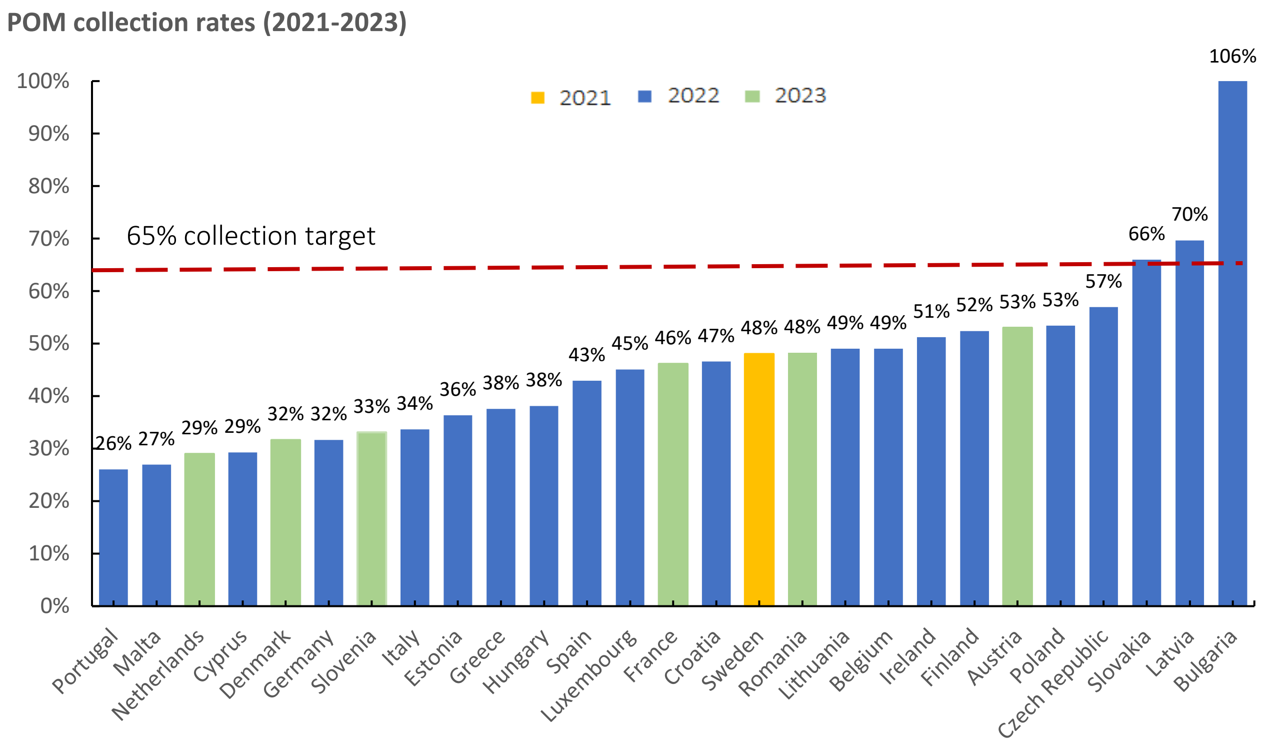

Figure 3.6 POM collection rates, EU27

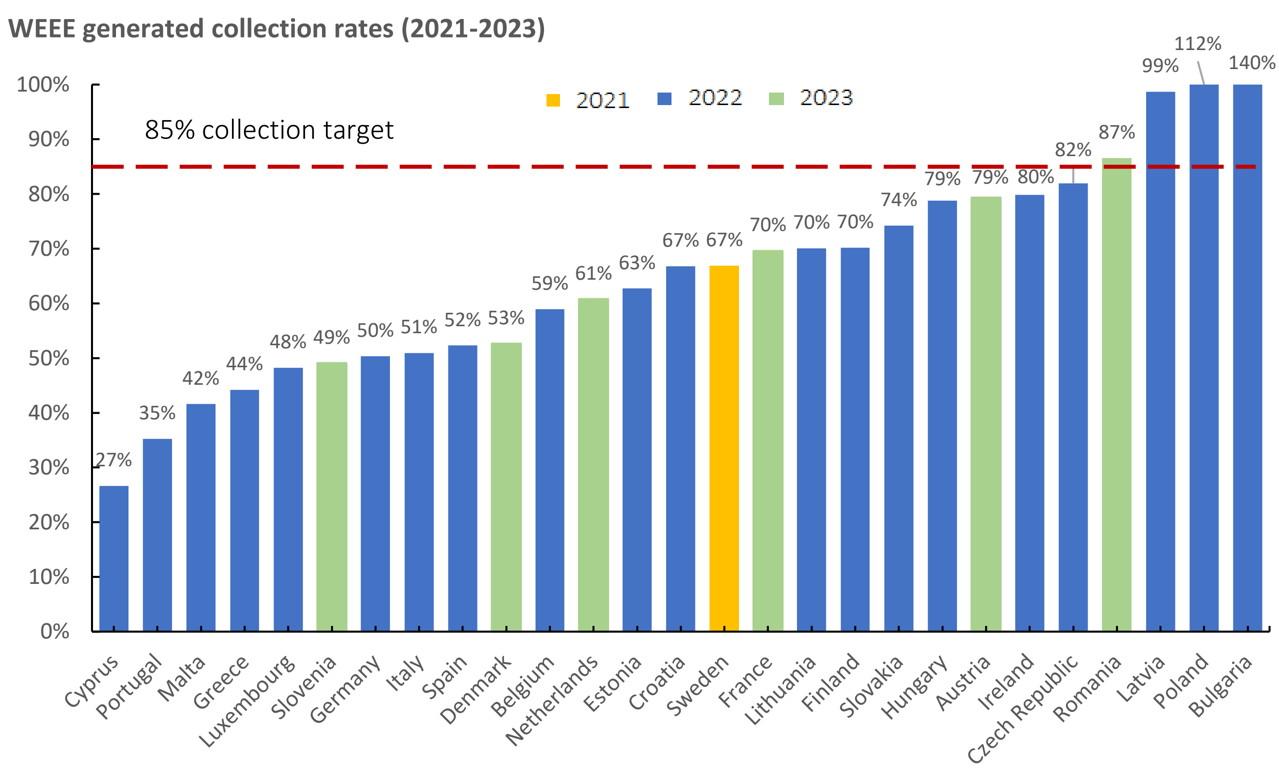

Figure 3.7 WEEE generated collection rates, EU27

3.3 Forecast for 2030

To evaluate the existing collection rate calculation methodologies, not only historic evolutions matter, but also future trends. For this reason, a forecasting model was developed to project how the collection rates could evolve by 2030. The forecasting was first calibrated based on historic trends, and in the next step a sensitivity analysis was performed to evaluate the impact of different assumptions.

Base model outcome

Based on the assumptions made on growth rates, as described in chapter 2, the figure below shows the evolution of POM, WEEE generated and collection quantities up to 2030. The increase in POM quantities follows closely the historic growth rate and then slowly reduces in growth rate near 2030. The increase in the WEEE generated quantity is less pronounced compared to POM due to the long lifetimes of EEE but the growth rate starts increasing near 2030. The collection quantity initially increases strongly based on the growth rate of the previous 2013-2022 period, after which the growth rate starts running parallel with the WEEE generated curve near 2030.

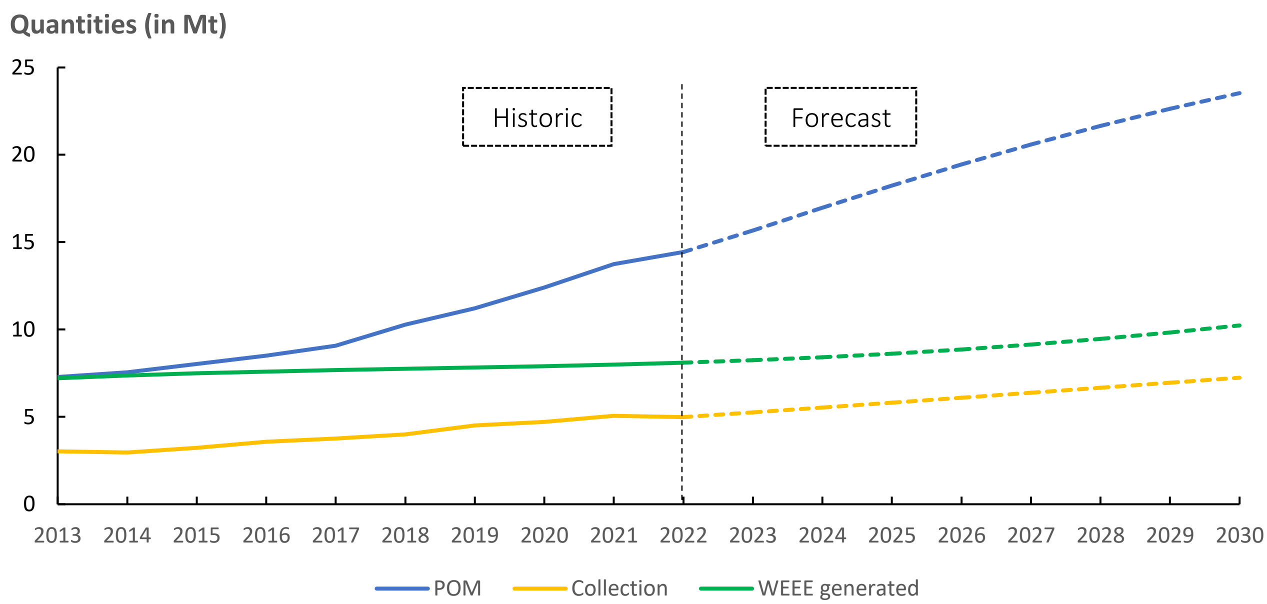

Figure 3.8 Historic and forecasted quantities of POM, Collection and WEEE generated (in Mt), EU27 (2013-2030)

Based on these projected quantities, the future POM and WEEE generated collection rates are calculated up to 2030, as shown in the figure below. The POM collection rate seems to further decline in the coming years because it only considers the average POM quantities of the three preceding years. This is mainly caused due to continuous forecasted growth of the POM quantities in this scenario, which is not directly translated into similarly high WEEE generated quantities based on the long lifetimes of EEE products (14,5 years on average while the method only takes into account the POM of the last three years). In contrast, when using the WEEE generated method the projections forecast, in line with the historic trend, a continuous increase of the collection rate until 2030. This projection builds on the assumption that gradually more WEEE will be collected over the years, resulting in a higher share of WEEE that is formally collected compared to what is generated.

The analysis shows that the WEEE generated method better aligns with the historic reality and the intuition of what will be reality. The 3-year historic period of the POM calculation method, which relates to an average lifetime of EEE of 2 years, results in an underestimation of the collection performance. However, the WEEE generated tool is not commonly used by the EU Member States.

Based on the interviews, the main reasons for not using the tool are that the WEEE generated tool is highly complex to use and concerns about the accuracy of the tool's POM and lifetime data. Moreover, even when the WEEE generated method were used, the gap to the higher 85% EU target for collecting WEEE generated remains large for most Member States, so the incentive to go from reported POM collection rates to WEEE generated collection rates is weak.

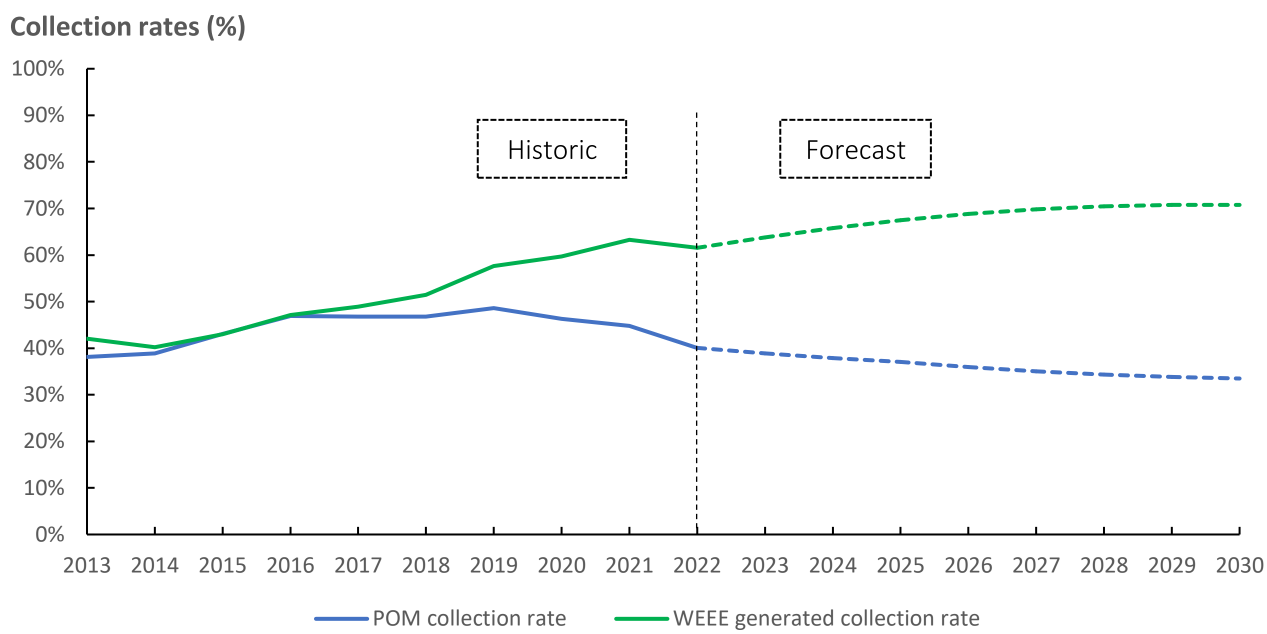

Figure 3.9 Historic and forecasted collection rates, EU27 (2013-2030)

These projections emphasize the importance of adopting more reliable and user-friendly methodologies for calculating WEEE collection rates to ensure that the collection targets are realistic and achievable.

Outcome by EEE category

EEE are clustered in the 7 categories presented in chapter 2. To examine the behaviour of each category separately, the analytical model was extended to the category level. This model also visualises the existing status and forecasts up to 2030 based on the assumptions made in chapter 2 for both collection rate calculation methods, POM (Figure 3.10) and WEEE generated (Figure 3.11). By examining each category separately, the model provides insights into the unique factors influencing the collection rates of different types of EEE, thereby supporting the development of targeted strategies to improve WEEE management across the EU.

For both methods, collection rates increased from 2016 to 2022 for most categories, and are expected to increase further by 2028, especially for the WEEE generated method. The only exception is Cat. 2 (screens, monitors and equipment containing screens) where the collection rate has decreased despite a rise in POM. In 2016, older heavier bulky TVs and monitors were still being replaced at higher rates by more lightweight TVs and monitors, resulting in high collection rates. Recently, still thin but larger TVs are being introduced, which increases the POM quantities again. Since the collection of the older, heavy models has already been largely completed, collection now includes more of the thin and smaller TVs and monitors, leading to a decline in the overall collection rate for this category.

POM method

For the POM method, the forecasted collection rates generally show better results for categories of smaller equipment, specifically categories 2, 3, 5, and 6. On the other hand, categories of larger equipment, such as categories 1, 4a, and 4b, are expected to have less favourable collection rates. The main reason for this is that the larger equipment categories experienced strong growing POM quantities, and generally have longer lifetimes. The categories with small equipment had lower POM quantities growth rates, the growth rate is even negative for category 6 (see chapter 2). The increasing quantities of the larger equipment thus tend to stay in use for extended periods before being discarded, reducing the likelihood of their collection within the short timeframe of the current POM calculation method.

WEEE generated method

In contrast, the WEEE generated method reveals different dynamics. Here, larger equipment such as categories 1, 4a, and 4b are forecast to achieve better collection rates compared to smaller equipment. This trend aligns more closely with intuition and literature, as larger items are typically less likely to be hoarded and are not usually disposed of in municipal waste, making them more likely to be processed through formal collection channels.

A notable success of the WEEE generated method is the improvement in collection rates for category 4b (photovoltaic panels and inverters), which shows reasonable collection rates. This is a significant improvement compared to the POM method, where collection rates for category 4b stay low due to their long lifetimes of >20 years, which are not considered in the collection rate calculation method.

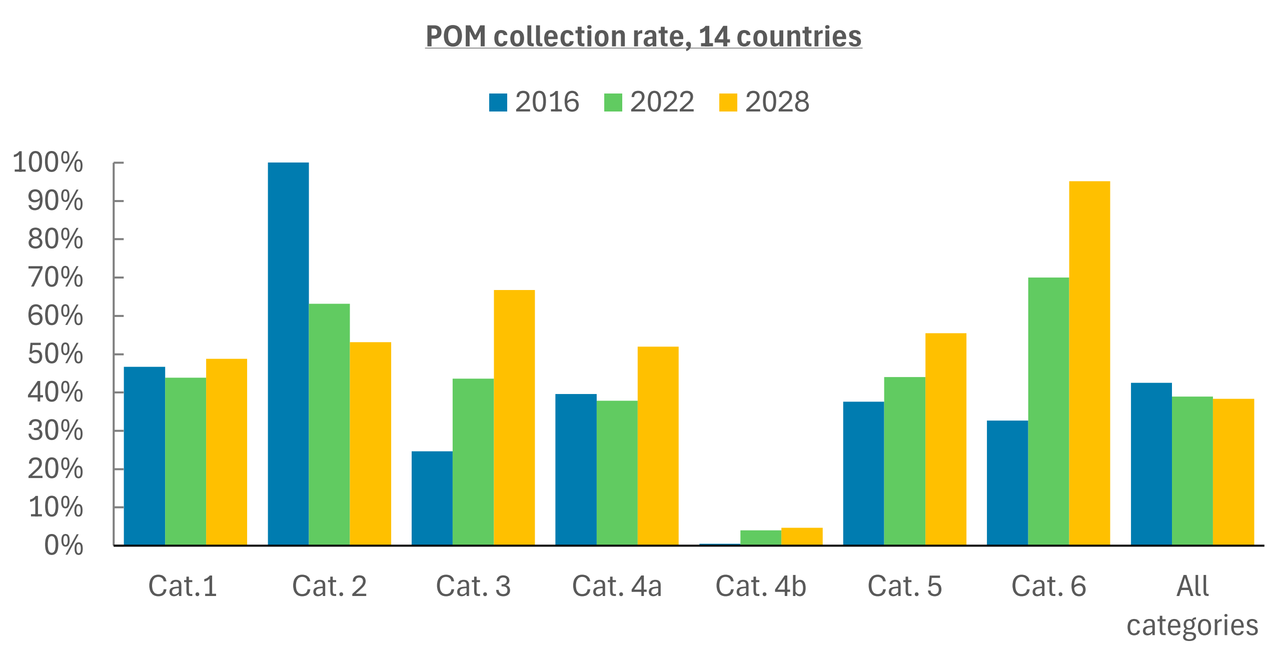

Figure 3.10 POM collection rates per EEE category, 14-countries model (2016-2022-2028)

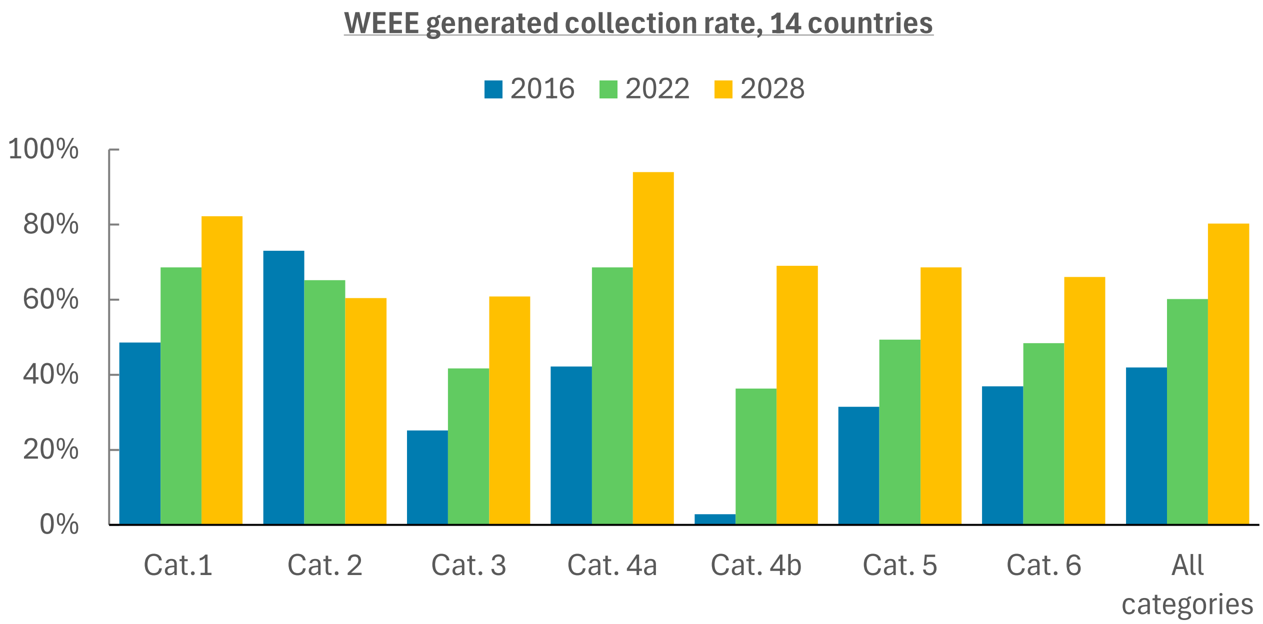

Figure 3.11 WEEE generated collection rates per EEE category, 14-countries model (2016-2022-2028)

3.4 Sensitivity analysis

Next to the base model, a sensitivity analysis has been performed by changing key assumptions of the forecast model, to evaluate the outcome of alternative scenarios. More specifically, a sensitivity analysis has been performed on two key assumptions, POM growth rates and product lifetimes, to assess the impact on the different collection rate calculation methods.

Alternative POM evolution scenarios

The future evolution of POM quantities is uncertain. To tackle this, a sensitivity analysis is performed by including two alternative POM growth scenarios (Figure 3.12). In contrast to the base model, one scenario assumes a peak in POM quantities by 2024 and a soft decline by 2030. This could happen if we are currently achieving market saturation in combination with increased product longevity by shifting significantly towards circular economy practices such as refurbishment and reuse. The other scenario considers a scenario in between, a slower growth POM scenario. These alternative scenarios provide a broader perspective on possible future evolutions and help to assess the sensitivity of the forecast model to changes in POM trends.

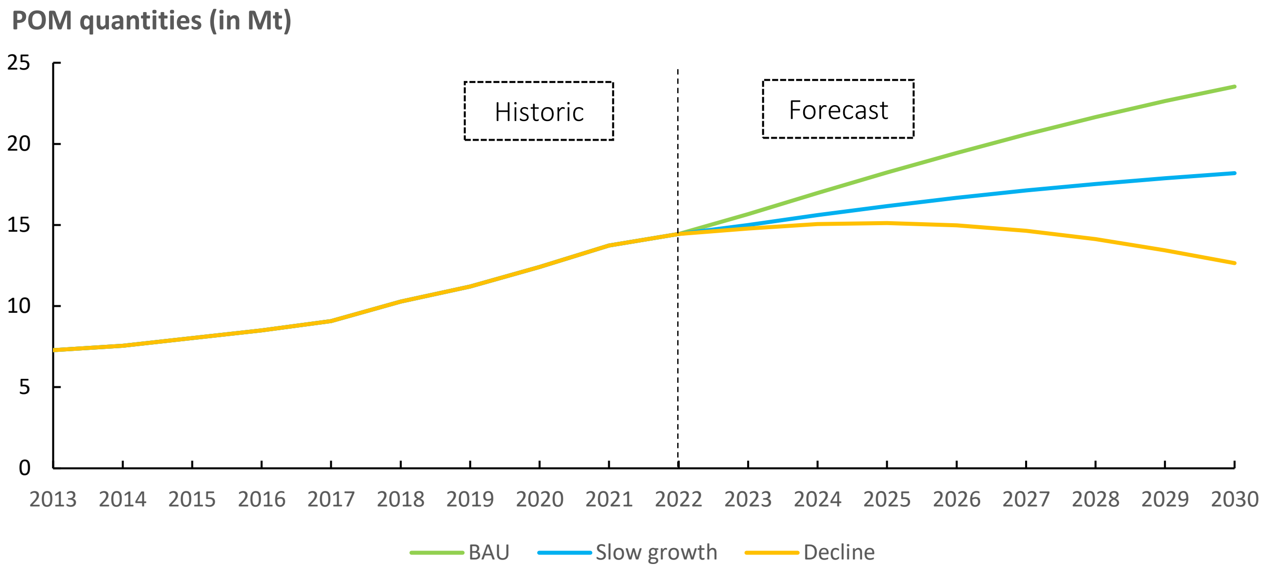

Figure 3.12 Sensitivity analysis of POM growth rate on POM quantities, EU27 (2013-2030)

Based on the different POM quantity scenarios, Figure 3.13 presents the impact on the POM collection rate for each scenario. By 2030, the variation in collection rates reaches approximately 15%, which means that the evolution of POM quantities significantly influences the POM collection rate. In contrast, Figure 3.14 displays the WEEE generated collection rate, calculated using the three alternative POM scenarios. The difference in collection rates remains below 1%, demonstrating that the WEEE generated collection method is largely unaffected by the evolution of the POM quantities.

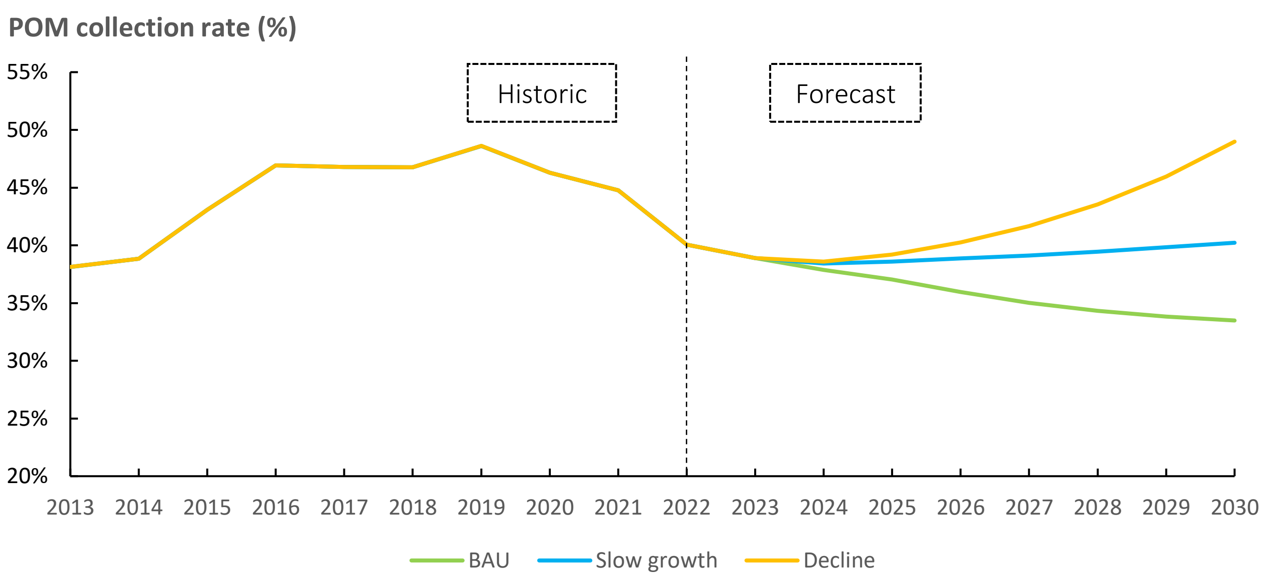

Figure 3.13 Sensitivity analysis of POM growth rate on POM collection rate, EU27 (2013-2030)

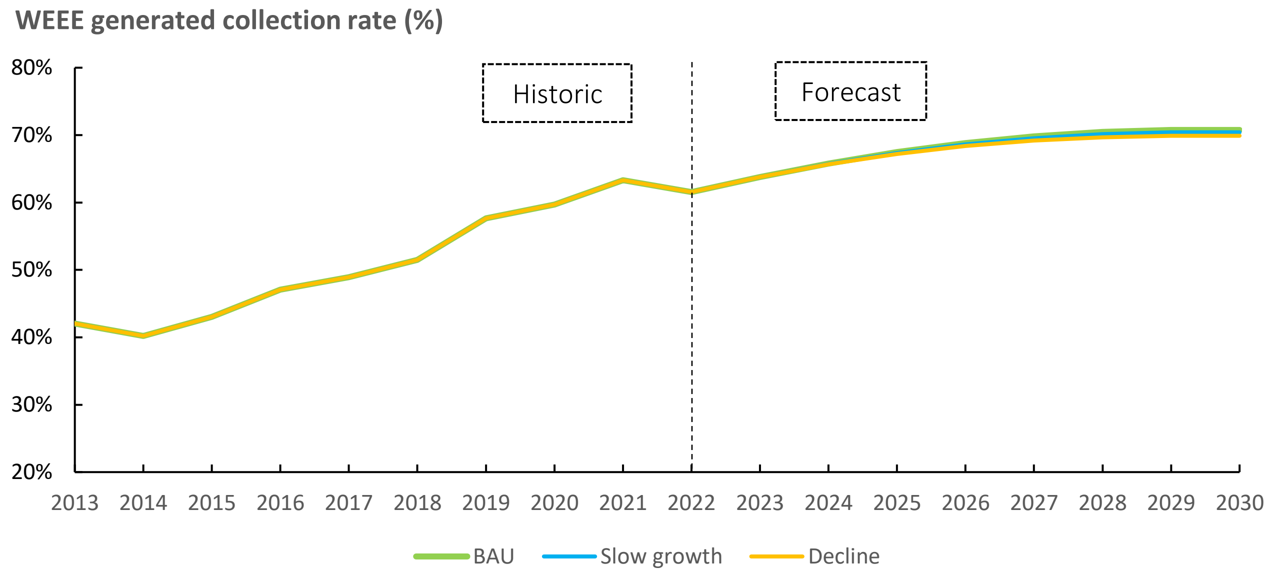

Figure 3.14 Sensitivity analysis of POM growth rate on WEEE generated collection rate, EU27 (2013-2030)

Another analysis presented in Figure 3.15 examines the WEEE generated collection rates that should be achieved for meeting the current POM collection target of 65%. This was done for all three scenarios. This analysis shows that the resulting WEEE generated collection rate that should be achieved becomes unrealistically high. It is already exceeding 100% in 2022 and it is forecast to increase to 137% by 2030 for the BAU scenario.

It is clearly unrealistic to achieve the POM collection target today and it will continue to be unrealistic, mainly due to the fact that this method is not considering the long lifetimes of EEE products.

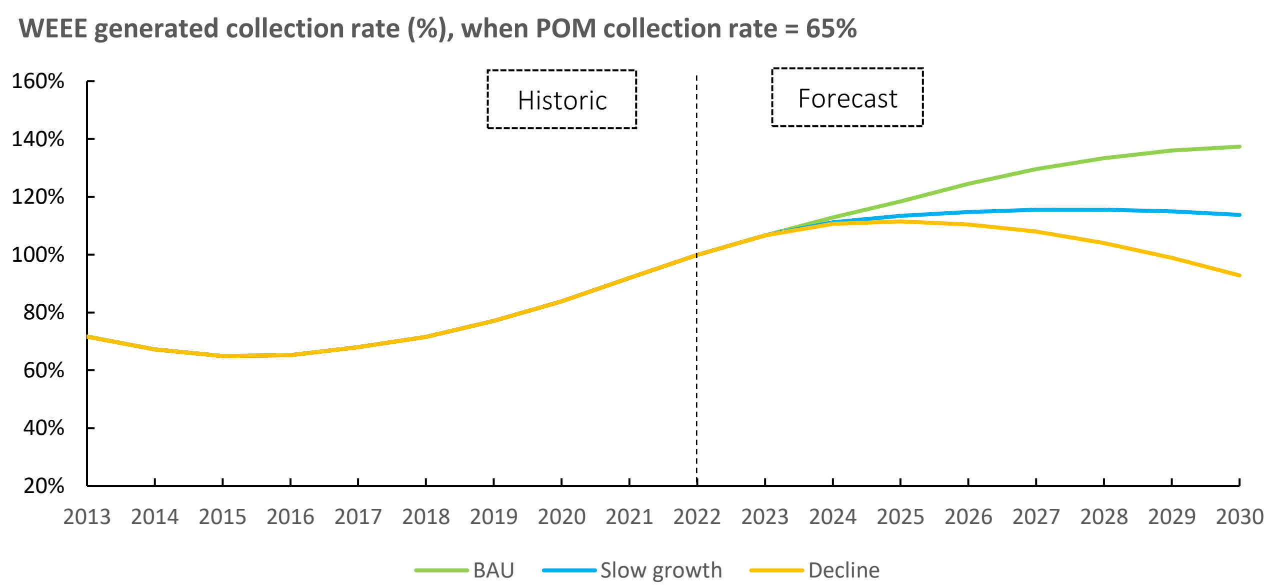

Figure 3.15 Sensitivity analysis of POM growth rate on WEEE generated collection rate that is to be achieved to reach the POM collection target of 65%, EU27 (2013-2030)

EEE product lifetime values variation

The other sensitivity analysis focuses on the impact of variations in product lifetime on the WEEE generated collection rate. At this moment, lifetime studies on EEE products are not yet frequently done in the different EU countries. Therefore, the assumed lifetime values in the WEEE generated tool might not match reality. The WEEE generated tool also considers identical lifetimes for all countries and for all years. In reality, these lifetimes will differ from country to country and also not stay constant in time, e.g. due to more focus on durability and repair of EEE products. For these reasons, it is important to know how robust the WEEE generated method is for calculating the collection rates. To explore this, the impact on the WEEE generated collection rate is analysed when reducing all lifetime values substantially, by 20%, or increasing them by 20%. This sensitivity analysis was performed on the base model keeping all other variables constant.

Figure 3.16 presents the total WEEE generated quantities under the different lifetime scenarios for the EU27. The three lines follow the same trend, with the distance between them remaining relatively constant, averaging less than 1 million tonnes between the two extreme scenarios (+20% and -20% lifetime values). In the scenario in which longer product lifetimes are assumed than what is included in the EU tool, the calculated WEEE generated quantities are lower, as this considers that products remain in use for a longer period before disposal. Conversely, in the -20% lifetime scenario, products are assumed to be discarded much sooner, leading to higher calculated WEEE generated quantities.

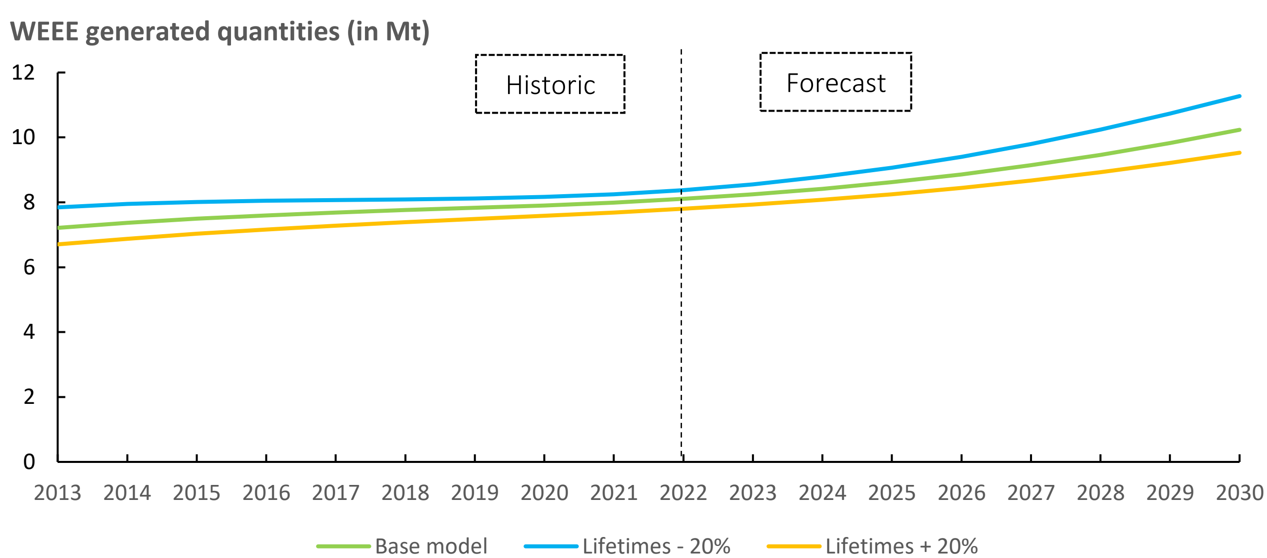

Figure 3.16 Sensitivity analysis of product lifetimes on WEEE generated quantities, EU27 (2013-2030)

Similarly, Figure 3.17 illustrates the calculated WEEE generated collection rates for the different lifetime scenarios. The calculated collection rates are higher in the +20% lifetime scenario since the WEEE generated calculations are now considering that products are disposed of at a lower speed. The difference between the scenarios remains relatively stable in time, with a variation of less than 3% between the base model and the two extreme cases. This indicates that while product lifetime variations influence WEEE generation and collection rates, the overall impact remains limited within the examined scenarios.

In other words, even with incomplete knowledge on product lifetimes, the WEEE generated calculation method yields results that are more robust than the POM calculation method. Nevertheless, investing in more lifetime studies will further increase the accuracy and, therefore, reliability of the WEEE generated collection rate calculation method.

In addition, if lifetime estimations are executed regularly in different locations in the EU, a diverse set of default lifetime values could be provided which can take into account regional differences and product lifetime trends.

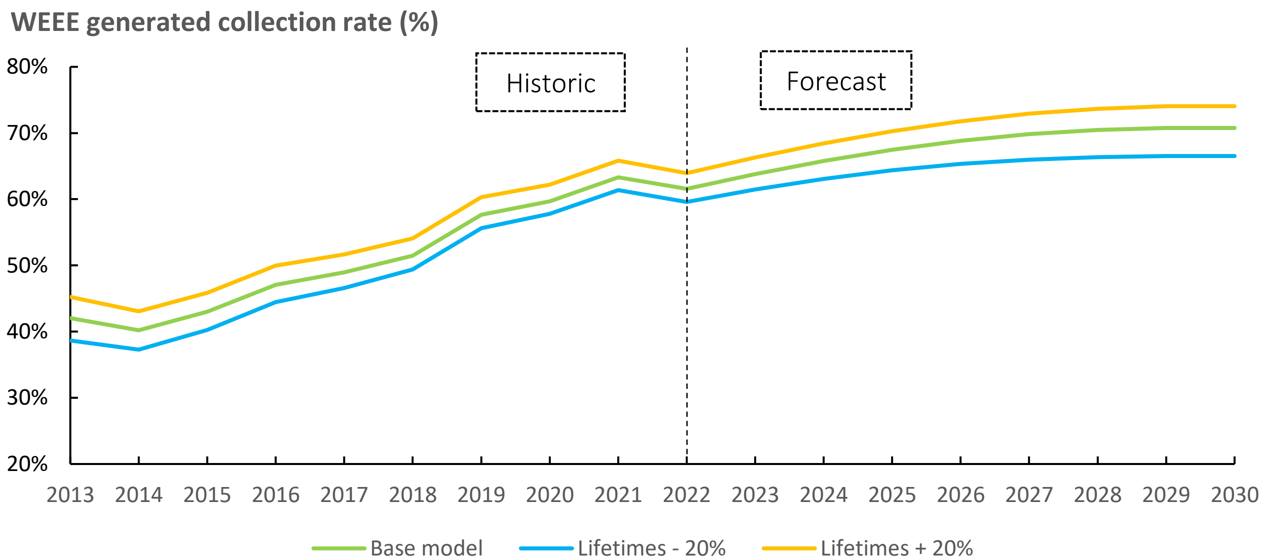

Figure 3.17 Sensitivity analysis of product lifetimes on WEEE generated collection rate, EU27 (2013-2030)

4 The WEEE Forum perspective and priorities

The WEEE Forum represents not-for-profit Producer Responsibility Organizations (PRO), mandated by producers of electrical and electronic equipment, across Europe that for more than twenty years have been responsibly managing the collection, treatment and reporting of WEEE. They operate under the Directive's Extended Producer Responsibility principle, i.e. they take over responsibilities from producers for the end-of-use of electrical and electronic products. The WEEE Forum has outlined its view on the role of the different stakeholders and the success factors for WEEE management in its vision[18] published in 2020. The all-actors principle where the different actors of the value chain collaborate and take up their part of the responsibility to foster circularity, stands central in the WEEE Forum vision.

To identify the elements of the vision that are most critical for this study and capture new insights since its publication, professionals in the WEEE Forum were interviewed, as discussed in Chapter 2. The following key takeaways from the interviews underscore the need for strategic, enforced, and innovative approaches to improve WEEE management across the EU.

Figure 4.1 Key takeaways from the interviews with the members of the WEEE Forum

Adopting new targets according to the SMART principle

One of the key takeaways from the interviews with members of the WEEE Forum is the recommendation that new proposed targets should always be defined according to the SMART principle. This means that the targets should be Specific, Measurable, Achievable, Realistic, and Time-bound. The current POM calculation method was found to be unrealistic because it fails to consider the long lifetime of products, while the WEEE generated method was found to be excessively complex to use.

Retaining strategic materials within the EU

Another focal point that was highlighted during the interviews is the strategic importance of retaining valuable and critical materials from WEEE within the EU boundaries. This involves preventing WEEE or its components from being processed outside the EU or being lost in landfills or other non-compliant disposal methods. Retaining these materials within the EU not only supports the circular economy but also enhances the EU's strategic autonomy and resource security. Therefore, it was highlighted that a revised WEEE legislation should put additional priority in preventing WEEE to be lost in these different parallel flows.

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[18] WEEE Forum, 2020, "An enhanced definition of Extended Producer Responsibility and the role of all actors" (Link)

Countering sub-standard practices

The interviews revealed a significant concern regarding the lack of enforcement to prevent WEEE from entering parallel markets, such as illegal export and non-compliant treatment. Strengthening enforcement measures is crucial to ensuring that WEEE is processed in accordance with EU regulations, thereby preventing environmental harm and ensuring that valuable materials are recovered and recycled properly. According to the data on parallel flows from the UNITAR report (Figure 3.5), it is concluded that the 85% WEEE generation target is only achievable if all parallel streams are effectively collected and registered. This emphasizes the need to address all potential parallel flows to meet the EU's ambitious collection targets.

Solutions for this can be to establish a coordination body composed of all the different actors in the EEE value chain, enhance the role of customs and strengthen enforcement of the law by governments, as outlined in the vision of the WEEE Forum.

The co-operation of all actors that have access to WEEE will be critical in financing solutions to solve the societal challenges, amongst which the design of technologies and infrastructure to recover critical raw materials, more enforcement and better sorting processes. Some PROs choose to incentivize the different actors in the value chain, such as providing a sorting-out fee to metal scrap processors; it encourages metal scrap processors to separate WEEE from other scrap materials, ensuring more electronic waste is properly collected and processed.

Avoiding 'cherry picking' in WEEE management

To avoid 'cherry picking', where only the easiest to collect and process WEEE is collected by certain producers or PROs, it is recommended to have either a single Product Responsibility Organisation (PRO) or a clearing house managing multiple PROs. This approach ensures a more balanced and comprehensive collection and treatment of all types of WEEE, promoting fairness and efficiency in the system.

Consider the impact of emerging technologies on collection rates

Next to photovoltaic panels, also other emerging technologies with long lifetimes, such as air conditioners and heat pumps, negatively influence the collection rates based on the POM method. These technologies often remain in use for extended periods, leading to lower immediate collection quantities and complicating the achievement of collection targets. Therefore, when setting new targets in the revised WEEE Act, it is advised to look beyond PV as the only emerging technology negatively influencing POM collection rates and include the impact of all emerging technologies.

5 Review of alternative collection targets

To prepare the ground for targets that could be integrated in the new WEEE Act and that would address current shortcomings as well as accelerate the transition to a circular economy, a step-wise approach has been followed. First a long list of potential targets and calculation methods was drafted, based on literature, interviews and brainstorming during workshops. The list was reviewed in a workshop within the WEEE Forum in order to prioritize and select the strongest concepts. This section provides an overview of the six prioritized concepts, outlining their respective advantages and disadvantages:

1. adjusted POM collection rate calculation;
2. simplified WEEE generated calculation;
3. tailored collection targets by category;
4. available for collection method;
5. multi-target framework; and
6. service-oriented goals.

5.1 Adjusted POM collection rate calculation

Chapter 3 argues that the current POM calculation method, which is based on the average POM quantities of the three preceding years, does not provide a realistic view on the collection rate. Therefore, this section investigates alternative approaches for POM collection rate calculations that could better reflect reality in the collection rate calculations. One of the key adjustments is extending the historical period used in the POM calculation method. For example, instead of relying on data from just the past three years, the calculation could incorporate a longer timeframe, such as five, ten or even 15 years. The timeframe could even align with the average product lifetime for each category.

Table 5.1 presents several scenarios to assess the potential impact of longer timeframes in the calculation. The scenarios include variations based on five-year and ten-year timeframes, as well as both even and uneven weighting approaches. In the even weighting approach, all years within the chosen timeframe are given equal importance, meaning each year contributes the same weight to the average POM quantities. In contrast, the uneven weighting approach uses a Weibull distribution curve, which assigns greater weight to older years and less weight to the more recent years, in line with EEE products typical lifespan distributions. Indeed, after an initial wave of early failures, durable EEE will typically experience little breakdowns until they come close to their estimated end-of-life and gradually all break down. The percentages in the table below reflect the weight that is given on the POM quantities of each historic year that is considered.

Table 5.1 Adjusted POM collection rate calculation scenarios

	Avg. life	Y-10	Y-9	Y-8	Y-7	Y-6	Y-5	Y-4	Y-3	Y-2	Y-1	Y
POM (current)	2y								1/3	1/3	1/3	
POM (5Y)	3y						20%	20%	20%	20%	20%	
POM (5Y, uneven weight)	3,5y						27%	26%	22%	16%	9%	
POM (10Y)	5,5y	10%	10%	10%	10%	10%	10%	10%	10%	10%	10%	
POM (10Y, uneven weight)	6,6y	14%	14%	14%	13%	12%	10%	9%	7%	5%	2%	
WEEE generated	14,5y	Based on lifetime calculations										
Collection												100%

Table 5.1 highlights that even when the historic timeframe taken into account for the calculation of the POM collection rate, amounts to 10 years (7 years longer than now) and applies an uneven weight (expecting older EEE appliances to have a higher propensity of breaking down), the average life of WEEE barely amounts to up to 6.6 years, or less than half of the average lifetime calculated based on the WEEE generated method. If an equal weight is applied for this same timeframe of 10 years, the average lifetime of WEEE is even less, indeed 5,5 years.

Figure 5.1 shows the calculated POM collection rates across the different scenarios for the historic period from 2018 to 2022 for the whole EU27. The results show notable differences between the scenarios that become more pronounced when moving up to the year 2022. In 2022, the difference between the collection rate calculated using the current POM method on the one hand and the examined POM-method with a 10-year uneven-weighted method on the other, is approximately 17%. Strikingly, the results of the 10-year, uneven weighted POM method and the WEEE generated method are nearly aligned, with only a 5% difference. This figure confirms that a longer POM time horizon generally results in higher calculated collection rates that are intuitively better aligned with reality.

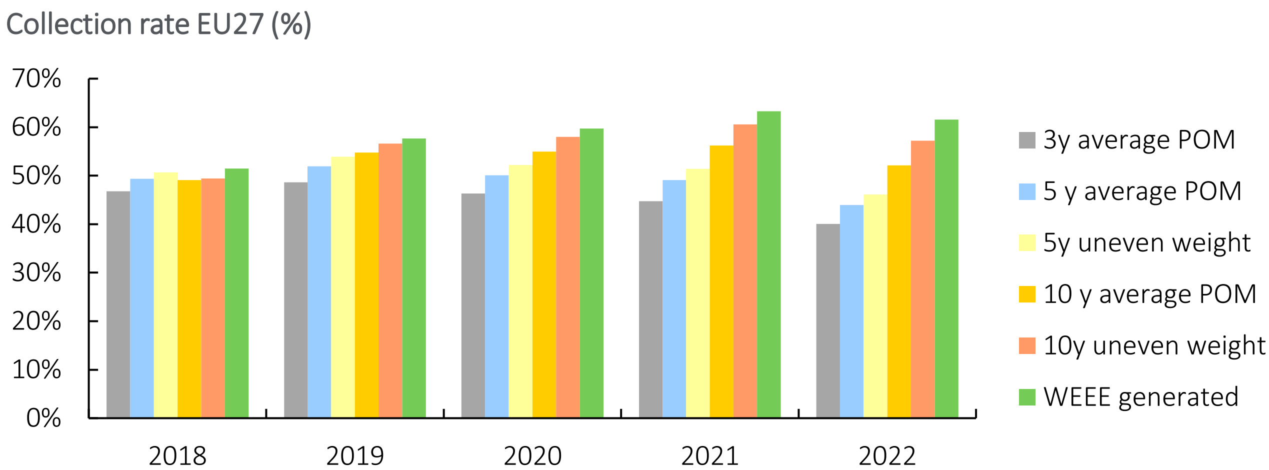

Figure 5.1 Comparison of the calculated collection rates across the different scenarios, EU27 (2018-2022)

The previous considered POM calculation methodologies still consider significantly lower average lifetimes (max. 6.6 years) than what is considered in the WEEE generated calculations (14.5 years). To address this, Table 5.2 examines another set of four scenarios, with timeframes of 10 years and 15 years, by taking either a 3-year or 5-year average around (just before and after) the defined average age.

Figure 5.2 shows that both the calculated POM collection rates based on 10 or 15 year average lifetimes better match the WEEE generated result compared to the current POM method. For the 10 year average lifetime, the collection rates are found to be approximately 3% higher than those calculated with the WEEE generated method in 2022, while for the 15 year average lifetime, they are approximately 5% lower. This is connected to the historic evolution of the POM quantities (see Fig. 2.1), i.e. the POM quantities were higher 15 years before 2022 (2007) than around 2012. The difference in result between taking a 3 or 5 year average around the average lifetime is found to be small (less than 2%).

While increasing the historic timeframe in POM-based methodologies enhances their realism, it is important to note that none of the currently explored methods fully aligns with the WEEE generated method, which considers lifetime values by product and also full lifetime Weibull distribution curves.

Table 5.2 Adjusted POM collection rate calculation scenarios with higher average lifetimes

	Avg. life	**Y-12 /Y-17**	**Y-11 /Y-16**	**Y-10 /Y-15**	**Y-9 /Y-14**	**Y-8 /Y-13**	**…**	**Y-3**	**Y-2**	**Y-1**	**Y**
POM (current)	2y							1/3	1/3	1/3	
POM (10Y, 3y avg.)	10y		1/3	1/3	1/3						
POM (10Y, 5y avg.)	10y	20%	20%	20%	20%	20%					
POM (15Y, 3y avg.)	15y		1/3	1/3	1/3						
POM (15Y, 5y avg.)	15y	20%	20%	20%	20%	20%					
WEEE generated	14,5y					Based on lifetime calculations					
Collection											100%

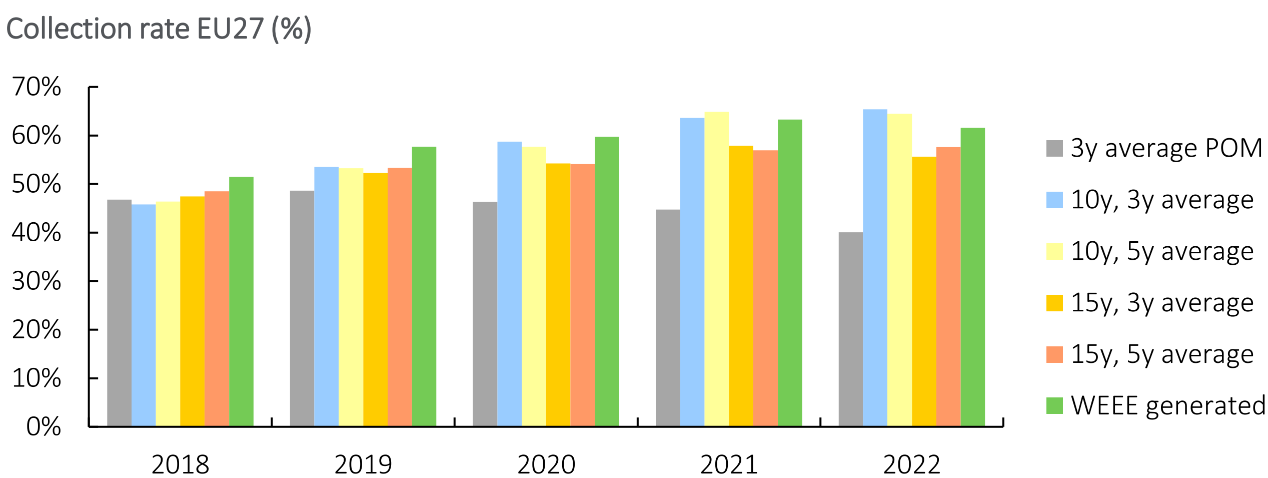

Figure 5.2 Comparison of the calculated collection rates across the different scenarios, EU27 (2018-2022)

Figure 5.3 shows the collection rates from 2013 to 2030, by making use of the base forecasting model for some of the different POM collection rate calculation scenarios introduced above. The 10-year average POM collection rate calculation method closely followed the WEEE generated result until 2022 but is projected to strongly deviate by 2030, following the same trend of the current 3-year average POM method.

On the other hand, the POM collection rate calculation methods that consider 10 and 15 year average lifetimes of EEE products perform better in tracking the WEEE generated result, although they still exhibit different trends over time. The reason for these deviations is that the POM collection rate calculation methods focus on a single point in time (e.g., either 10 or 15 years) rather than accounting for the full lifecycle of all different EEE products.

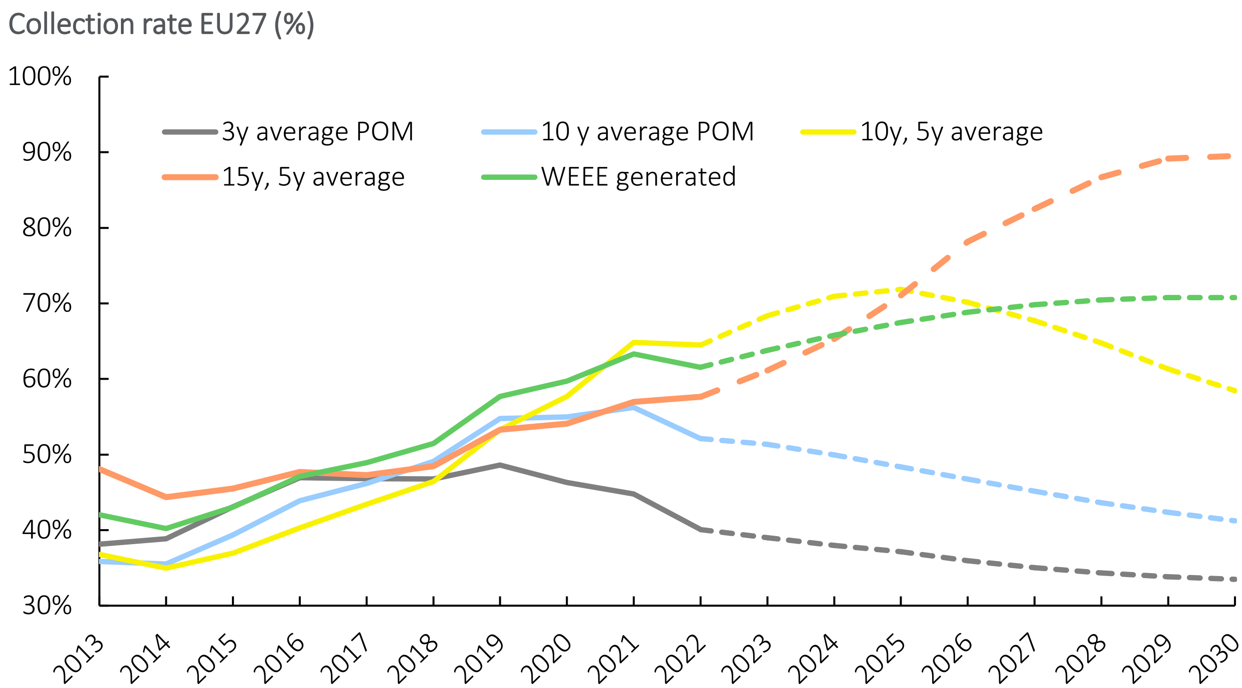

Figure 5.3 Collection rate evolution based on different scenarios of adjusted POM calculation methods, EU27 (2013-2030)

Strengths of the adjusted POM collection rate calculation

Incorporating longer timeframes, such as 10 or 15 years, in the POM collection rate calculation method provides a more intuitive and accurate representation of waste generation trends. Additionally, this adjusted POM method remains a simple calculation process by focusing solely on POM values without requiring detailed lifetime data of each EEE product.

Weaknesses of the adjusted POM collection rate calculation

While extending the historical period enhances the realism of the calculations, the method does not fully account for the specific lifecycle of individual EEE products. The adjusted POM collection rate calculation methods that have been examined focus on a single timeframe for all EEE categories rather than accounting for the full lifecycle of all different EEE products. The forecasting in the base model illustrated that this could result in strong deviations from the WEEE generated calculations.

5.2 Simplified WEEE generated calculation

Currently, the existing Excel tools for calculating WEEE generated are too complex, as evidenced by the low uptake among EU Member States. This highlights the need for a simplified approach that improves usability and adoption across the EU. An integrated tool that automatically calculates WEEE generated figures for each Member State when POM numbers are reported to Eurostat, would remove the need for manual calculations and improve consistency between countries.

Regular updates through EU-wide studies on product lifetimes will help keep the method accurate and relevant. The goal is to develop a practical and standardized solution that is both user-friendly and adaptable for all EU countries. A key requirement for this method is to update the historic POM values so they are aligned with the historic data that is reported to Eurostat. As shown in Figure 5.4, after 2018, the WEEE generated tool POM numbers are strongly deviating from what is reported to Eurostat. It is therefore recommended to integrate the Eurostat reporting in the WEEE generated calculation.

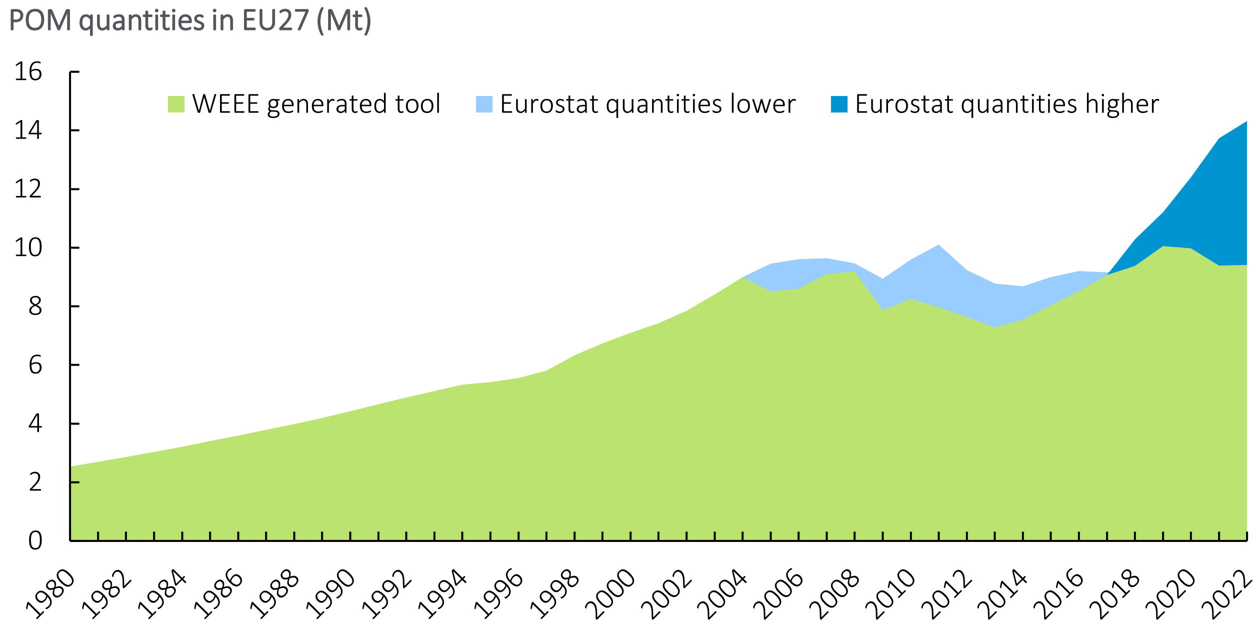

Figure 5.4 Comparison of POM quantities in the WEEE generated tool and Eurostat, EU27 (1980-2022)

Currently, the WEEE generated tool applies lifetime values at the UNU-key level, which includes 54 categories for EEE. The relationship between UNU-key product types and the EU 6+1 EEE categories can be found in Annex 2, Table A.2. However, most Member States do not collect POM data at this level, making direct comparisons with the tool challenging. A practical simplification would be to use an average lifetime per category instead. At this moment all MS are already reporting their data for the 6+1[19] EEE categories. This approach would enable the automatic calculation of WEEE generated quantities when POM data by category are reported to Eurostat. The average lifetime values should be derived by considering the varying lifespans of all products within a category, while also accounting for their respective market shares to ensure a representative estimation.

As illustrated in Figure 5.5, the impact of this simplification on the estimation of WEEE generated remains limited. The WEEE generated quantities calculated for 2020–2022 show only minor variations when applying lifetime values by category rather than by individual product.

This indicates that, while product-specific lifetimes provide a more granular approach, category-level averages still yield sufficiently accurate estimates. Therefore, this method presents a feasible and standardized alternative for improving the consistency and efficiency of WEEE data reporting across the EU.

[19] PV is still included in category 4, but is already separately reported.

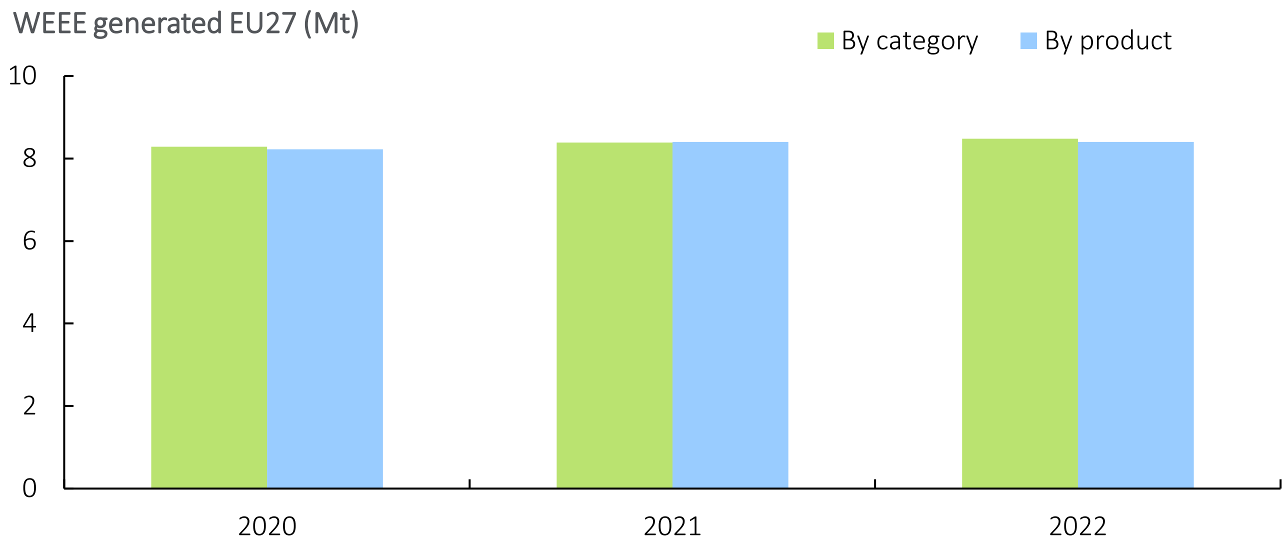

Figure 5.5 Calculated WEEE generated quantities based on lifetimes by category and by product, EU27 (2020-2022)

To enhance accuracy, in a later stage a transition towards product-specific lifetime values is still recommended, if this is supported by harmonized reporting across POM product categories in al Member States. Alternatively, lifetime values could be considered for smaller groups of products with similar lifetimes, rather than applying them to the broader categories. This would allow for a more targeted approach, offering increased precision while maintaining feasibility. However, this approach should still be accompanied by harmonized POM reporting for these smaller product groups across all Member States. While this approach could improve the accuracy of the WEEE generated data, it will also increase the complexity of reporting.

In any case, to keep lifetime estimates relevant, regular screening of EEE product lifetimes and market shares should be performed at EU level. Frequent studies and sampling campaigns should be conducted to determine realistic lifetimes for different product categories, taking into account variations between countries and regions. These studies should also consider factors such as product repair, refurbishment, and reuse, which can significantly extend a product's lifespan.

If a Member State's conditions deviate substantially from the EU default values and this can be (statistically) substantiated, adjustments to lifetime estimates should be permitted. This flexibility allows for more accurate national reporting while maintaining the integrity of the overall EU method.

Strengths of the simplified WEEE generated calculation

By developing an integrated tool that automatically calculates WEEE figures when POM data is reported to Eurostat, this approach eliminates the need for complex manual calculations, improving both efficiency and consistency across EU Member States. This integration can be easily done by using average lifetimes per category, which was illustrated to still provide relatively accurate estimations of the WEEE generated.

Weaknesses of the simplified WEEE generated calculation

This method is highly dependent on the lifecycle parameters that are used in the calculations. Therefore, it is necessary to perform regular updates through EU-wide studies on product lifetimes and product usage to ensure that the system remains relevant and accurate, also reflecting changes that can occur over time. These studies should also investigate if substantial differences in regional product usage and lifetimes exist to evaluate the need for regionalization of some of the lifecycle parameters.

5.3 Tailored collection targets by category

This method proposes setting collection targets based on the specific characteristics of each EEE category. Drawing from the 14-country model, where data on collection per EEE category was available for the period 2013-2022, the results show that collection rates vary significantly depending on the category and the collection calculation method used. To address these variations, this approach suggests setting higher collection targets for categories that are easier to collect and lower collection targets for categories that are more difficult to collect, ensuring a more realistic and achievable system.

As shown in Table 5.3, the collection rate for each EEE category is presented for 2022, along with projections for 2028 based on the base forecasting model. These calculations include the current POM and WEEE generated methods, as well as the new proposed POM method that considers a 5-year average of the POM quantities 10 years in the past, which was introduced in subchapter 5.1. In the table, collection rates highlighted in green or light green indicate high achieved collection rates, while those in orange, light red, and red represent low achieved collection rates.

Table 5.3 Collection rates by 3-year average POM, 5-year average POM based on an average lifetime of 10 years and WEEE generated, 14-country model (2022, 2028)

	POM (3y avg.)		POM (10y, 5y avg.)		WEEE generated		Comments
	2022	2028	2022	2028	2022	2028	
Cat. 1 - Temperature exchange equipment	44%	49%	73%	76%	69%	82%	The TEE market is growing, making it more difficult to achieve POM targets
Cat.2 - Screens, monitors, and equipment with screens	63%	53%	68%	67%	65%	60%	Only category with decreasing collection rates. Could be caused due to decreasing market and lighter products.
Cat. 3 – Lamps	44%	67%	41%	56%	42%	61%	Lamps are more difficult to collect. More disposal in municipal waste.
Cat. 4a - Large equipment (excl. PV)	38%	52%	74%	90%	69%	94%	The large equipment market is growing, making it more difficult to achieve POM targets
Cat. 4b – PV	4%	5%	7%	38%	36%	69%	PV market is new and growing fast, with long product lifetimes.
Cat.5 - Small equipment	44%	55%	59%	70%	49%	69%	Small equipment is more difficult to collect. More disposal in municipal waste.
Cat. 6 - Small IT and telecommunications equipment	70%	95%	41%	54%	48%	66%	High forecasted collection rates due to a shrinking market.

<40 %	<50 %	<60 %	<70 %	<80 %	>80 %

Based on the results presented in the table, for the current POM method, the categories with smaller EEE can achieve slightly higher collection targets, whereas large equipment faces greater challenges. This is mainly linked to the strong POM growth rates of the categories with larger equipment and their long lifetimes, and thus not to better collection. In contrast, for the POM method that considers an average lifetime of 10 years, as well as the WEEE generated method, the opposite trend is observed. Under these approaches, large equipment is forecast to be collected at a higher rate. The collection targets tailored by category should thus be based on the collection rate calculation method that is used.

When the WEEE generated calculation method is used for setting the collection targets, the collection targets for categories with large equipment could be put higher compared to the categories with small equipment. The main reason for this is that there is less tendency for hoarding large equipment or discarding it in other waste bins. This is only valid if the parallel flows to metal scrap processers are reduced, since the larger equipment that are rich in metals are most valuable to them.

Strengths of tailored collection targets by category

Tailoring the collection targets by category offers a flexible and category-specific approach to setting collection targets acknowledging the diverse challenges faced across different EEE categories.

Weaknesses of the tailored collection targets by category

A notable drawback is the increased complexity and less clarity on the overall goal, as it requires defining and tracking a larger number of target values. Moreover, the trends in category collection rates are strongly dependent on the calculation method that is used. Therefore, the tailoring of the collection targets by category should be linked to the collection rate calculation method that is used.

5.4 Available for collection method (AfC)

In article 24a (e) of Directive 2024/884, the Commission already announced that in their impact assessment they will assess the need of using this method for photovoltaic panels by "calculating the collection targets on the basis of waste photovoltaic panels available for collection based on their expected lifetime, rather than on the quantity of products placed on the market". This AfC approach thus extends the WEEE generated calculation method, that is considering the expected lifetime of EEE products, by also incorporating parallel flows, ensuring a more comprehensive and accurate estimate of the available waste streams for collection. The AfC method, presented in this section, draws upon the same principles as the method proposed by the Joint Research Centre (JRC) for batteries[20], adapting it to the context of WEEE management.

According to JRC, these additional parallel flows can be incorporated into the AfC calculation by subtracting them from the quantity of WEEE generated in the denominator, if they are supported by statistically relevant data. The JRC recommends constraining the quantities of parallel flows that can be included with thresholds. By setting thresholds of what can be accounted for, Member States still have an incentive to reduce the quantities of parallel flows for obtaining higher collection rates. Table 5.4 summarizes the main parallel flows of WEEE and suggests threshold values based on the estimated historical losses in EU27 and whether there should be an incentive for reducing the parallel flows.

Based on the suggested thresholds below, if a Member State has performed statistically robust studies on all parallel flows and reaches all thresholds, the AfC quantity will be 13% lower than the WEEE generated quantity. If this MS has a WEEE generated collection rate of 65%, its AfC collection rate will be 75%.

The main parallel flows in scope of WEEE management are metal scrap and municipal waste. It is recommended to include both in the method, but to cap them with thresholds. Especially for metal scrap the threshold should be put lower since WEEE can be sorted out prior to processing. Financial incentives can encourage additional sorting and reporting before treatment of WEEE. For municipal waste or other waste streams this is less evident, hence the proposal for a threshold closer to the quantities lost. Investing in awareness campaigns and the collection network, remains important to guide consumers to proper WEEE disposal habits.

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[20] European Commission, JRC, *Technical specification for a harmonized methodology to calculate appropriate collection rates for waste portable and Light means of Transport batteries*, Publication Office of the European Union, Luxembourg, 2024 (Link)

Export of EEE for reuse within the EU should not be limited and thus it is recommended to not put a threshold on this. Instead of incorporating these quantities as a parallel flow, the export quantities can also be subtracted from the POM quantities, which is already being done by the Netherlands. It is recommended to streamline this procedure to prevent double counting, Member States should not be allowed to count export quantities as a parallel flow, in addition to subtracting them from POM quantities. Illegal export of WEEE is forbidden, hence the recommendation to set the threshold at 0%. Reducing these quantities should be the responsibility of the competent authorities by strengthening, for example, customs procedures.

Giving the possibility to MS to include parallel flows in the calculation of the collection rate, by subtracting these quantities from the amount of WEEE that is generated (in the denominator), will result in an increase of the collection rates. At present, only a few member states have done statistically robust studies to estimate the different parallel flows. Therefore, introducing the possibility of adding these parallel flows should be followed with standardized procedures to perform the sampling studies or setting up registers, and support for MS that do not yet have acquired this expertise.

Table 5.4 Suggested thresholds for parallel flows of WEEE under the AfC method

Parallel flows of WEEE		Threshold (Yes/No)	Estimated loss in EU27 (UNITAR)	Suggested value of threshold	Comments
1	Municipal waste	Yes	8%	5%	Statistically relevant sampling analyses will need to be carried out frequently.
2	Export for reuse	No	6%	No threshold	Obtaining robust data is challenging. Some MS are already subtracting these quantities from their POM quantities
3	Metal scrap	Yes	13%	5%	Statistically relevant sampling analyses will need to be carried out frequently. WEEE should be removed from metal scrap as much as possible.
4	Illegal export	Yes	5%	0%	Illegal export of WEEE is forbidden. Obtaining robust data is challenging.
5	Other waste streams (plastic, glass, etc.)	Yes	Not estimated	2%	Statistically relevant sampling analyses will need to be carried out frequently.
6	Lost in incidents (e.g. fires)	Yes	Not estimated	1%	Statistically relevant sampling analyses will need to be carried out frequently.

Strengths of the AfC method

The advantage of the AfC method is that it offers more realistic and meaningful targets by incorporating parallel flows, providing a fuller picture of waste streams and aligning targets with the actual collection potential.

Weaknesses of the AfC method

On the downside, the AfC method requires extensive data collection to measure parallel flows, which can be a significant challenge for some Member States. Additionally, if not all Member States include parallel flows in their calculation, collection rates cannot be compared anymore equally. Members States with limited resources to measure parallel flows therefore risk achieving lower collection rates by not being able to include all parallel flows.

5.5 Multi-target framework

The multi-target framework introduces a points-based system that evaluates various aspects of WEEE management at the national level. Points are awarded for different services performed and results achieved, extending the focus beyond collection rates to incorporate broader circularity aspects. This approach allows countries and PROs to concentrate their efforts, investments, and innovations on areas most relevant to their specific context or where the cost-effectiveness of measures is optimal. Authorities should avoid placing sole responsibility on PROs, as effective WEEE management requires the collaboration of all actors, including producers, retailers, local authorities, consumers, repairers, remanufacturers, recyclers, customs, and enforcement agencies.

An example of this approach can be seen in Colombia, where the multi-target framework, established through Resolution 851 of 2022[21], includes several key parameters such as collection efficiency, consumer awareness, geographical coverage, research and development, and the reincorporation of recovered materials into new products. This framework provides a comprehensive structure that not only addresses collection but also promotes circularity and sustainability in WEEE management.

A proposition of such a system for Europe is presented in Table 5.5. The five main evaluation topics in this framework are collection, preparation for reuse, parallel flows, CRM recovery, and awareness campaigns. Each topic is further divided into subtopics, each with its own specific goal and a maximum number of points that can be collected. In this example, compliance could be achieved when a minimum of 70 out of 100 points is reached, ensuring that multiple aspects of WEEE management are addressed and circularity is incentivized. However, no points are awarded if data are not provided or not statistically relevant, reinforcing the need for comprehensive reporting. Additionally, points can be awarded gradually rather than being strictly all-or-nothing. This means that if a country does not fully achieve the target, it can still receive partial points based on its progress toward the goal. This approach encourages continuous efforts, as countries remain motivated to improve their performance even if the target initially seems difficult or unrealistic to achieve.

Collection

Based on the assessment of the different collection rate calculation methods in chapter 2, the simplified WEEE generated method is most recommended in this framework to set the collection target. Based on the analysis of the parallel flows (explained in section 3.1), it is proposed to set an ambitious but realistic collection target of 80% compared to the quantity of WEEE that is generated.

In addition to the collection rate achieved, also the collection network infrastructure can yield points in relation to the amount of collection points per inhabitant. Both public and private collection points should be included, as well as mobile collection points. Moreover, it is recommended to include activity criteria for the different collection points, to prevent an incentive for non-active collection points, such as a minimum amount of WEEE that is collected or the frequency that WEEE is send for treatment. The goal is set at 1 collection point per 2000 inhabitants, which is more ambitious than what is reported for France, UK, Spain, Germany and Italy[22], where the maximum was 1 collection point per 4300 inhabitants in Spain. Alternatively, or in addition, the framework could also look at the average distance of consumers to a collection point, or the time it takes for collection points to be emptied.

[21] Multi target framework of Colombia, introduced with Resolution 0851 in 2022 (Link)

[22] ERION, "Extended Producer Responsibility schemes and their strategic role for producers", 2021

Table 5.5 Proposed multi-target framework for WEEE management. In this example compliance could be achieved when a minimum of 70 out of 100 points is reached at a national level.

Topic	Subtopic	Member state goal	Max. points	Points distribution	Comments and alternatives
Collection	WEEE generated collection rate (%)	80%	40	Gradual	Preliminary goal set at 80% as it is an ambitious but realistic target for most Member States.
	Collection network infrastructure (coll. pt. / inh)	1/2000	10	Gradual	Both public and private collection points count (incl. mobile points). Minimum activity criteria can be introduced for the different type of collection points. An alternative target could be the average distance of consumers to a collection point.
Prepared for reuse	Prepared for reuse rate (% vs. collection)	5%	10	Gradual	The target could be made MS dependent, based on average reusability of collected items, e.g. based on the average lifetime of collected WEEE products. Alternative targets are the share of WEEE that is screened on potential for reuse and the separate prepared for reuse collection network.
Parallel flows (min. 1 sampling every 3 years)	WEEE lost in metal scrap	0%	5	Gradual (> 20% = 0 pt, 18-20% = 0.5 pt, etc.)	The sampling campaigns can be made more efficient by also screening other waste streams (e.g. batteries, plastics, textiles) that are relevant for other legislations. It is important to define standardized procedures for quantifying the parallel flows. E.g. for WEEE that is lost in incineration or landfill, all the different input waste streams should be included, so also WEEE in plastic waste, construction and demolition waste, etc.
	WEEE lost in incineration (e.g. municipal waste)	0%	5	Gradual (> 15% = 0 pt, 13.5-15% = 0.5 pt, etc.)	
	WEEE lost in landfill (e.g. municipal waste)	0%	5	Gradual (> 5% = 0 pt, 4.5-5% = 0.5 pt, etc.)	
	WEEE lost in illegal export	0%	5	Gradual (> 5% = 0 pt, 4.5-5% = 0.5 pt, etc.)	
CRM	EPR-related budget spent on mapping CRM flows and increasing CRM recycling (% of total EPR fees)	5%	10	Gradual	In a later stage, when the market has become more mature, also output targets could be adopted. The recovery and recycling targets could also be included in the multi-target framework.
Awareness campaigns	EPR-related budget spent on awareness campaigns (% of EPR total fees)	20%	10	Gradual	Any kind of awareness campaign can be included, e.g. also school or company visits, radio commercials, social media activity, etc. Alternative metrics could focus on impact of campaigns, e.g. awareness about need for action and guidelines for disposal.

Prepared for reuse

The current WEEE directive doesn't set targets on prepared for reuse of WEEE. Some member states (e.g. Spain and France) have already adopted national targets with the ambition to stimulate waste prevention. To foster circularity in WEEE management, it is recommended to also adopt reuse targets in the multi-target framework. Not all WEEE is suitable for prepared for reuse (e.g. old energy intensive fridges should not be reused), and therefore the target is set at 5%.

In some Member States the quality of WEEE might be higher than in others, e.g. Member States with higher replacement rates of EEE, resulting in WEEE with lower average lifetimes. To compensate for this, the target could be made MS dependent, e.g. by considering the average lifetime of EEE of that market. Next to a results-based target, like the reuse rate, also the performed services could be included in the framework, e.g. on the amount of WEEE that is screened on its potential for reuse.

Parallel flows

If the WEEE generated calculation method is preferred over the AfC, information about the amount of WEEE lost in parallel flows may remain scarce. To remediate this lack of knowledge the multi-target framework can incentivize collecting data about parallel flows by awarding points when statistically robust sampling analyses are being performed. All actors should be involved in national sampling campaigns in order to secure access to all waste streams suspected of containing WEEE.

Moreover, there is an opportunity to make the sampling campaigns more efficient by also screening other waste streams that are relevant for other legislations, e.g. batteries, plastics, textiles, etc. Low WEEE quantities in parallel flows will yield higher points in the framework. The ultimate goal is to have no losses in the parallel flows.

CRM

Despite the political focus on CRM, recycling them from collected WEEE remains a challenge. The understanding and capabilities to single out (W)EEE components with high CRM content are weak and the recycling costs are high. Therefore, at this stage and due to the importance of increasing the efforts to recycle CRM, it is chosen to adopt a target on CRM budget spent rather than output targets. Points are yielded based on the share of the EPR fees that are spent on mapping CRM flows or increasing the CRM recycling. In a later stage, when the market has become more mature, also output targets could be adopted.

The existing recycling and recovery targets could also be included in the framework.

Awareness campaigns

As awareness campaigns are already well adopted and will remain relevant for guiding consumers in the correct WEEE disposal habits, a target has been integrated in the proposed preliminary framework. It is proposed to give points based on the amount of the total budget spent. Any kind of awareness campaign can be included, e.g., television commercials, but also school or company visits, radio commercials, social media activity, etc.

Alternative metrics could focus on impact of campaigns, e.g. awareness about need for action and guidelines for disposal.

Strengths of the multi-target framework

One of the important benefits of the multi-target framework is its comprehensive evaluation of WEEE management. Unlike single-target systems that focus mainly on collection rates, this framework assesses multiple aspects of circularity, including prepared for reuse and investing in CRM recovery. Additionally, this method not only considers the final results but also evaluates the services provided, such as the availability and accessibility of collection points, reducing the losses in parallel flows and awareness campaigns.

The flexibility of the multi-target framework is another strength. Countries and PROs can focus on areas that are most relevant to their specific circumstances while still ensuring compliance. This means that different nations, with varying economic, logistical, and regulatory conditions, can implement targeted and innovative measures in a way that aligns with their capabilities and priorities or that is optimal in terms of cost-effectiveness. Unlike rigid EU-wide collection targets, this adaptable system allows them to achieve compliance through different pathways.

Weaknesses of the multi-target framework

Despite its strengths, the multi-target framework does introduce some challenges. It requires increased data collection efforts on various dimensions of circularity which makes implementation slightly more complicated and costly.

Additionally, service-based targets contain the risk that the focus on the effectiveness of certain services is reduced. For example, increasing the number of collection points just to meet targets may not necessarily translate into higher-quality collection and treatment processes. Careful oversight and refinement of the framework will be necessary to ensure that it drives meaningful improvements rather than just numerical compliance.

From a political communication perspective, a multi-target system may be perceived as more complex than a single collection target. Policymakers and the general public often prefer clear, straightforward targets, and communicating the benefits of a more nuanced system may require additional effort. However, this challenge can be mitigated through proper stakeholder engagement and transparent reporting.

While the framework requires strong data collection mechanisms and careful implementation, its advantages outweigh its challenges, making it a favourable approach to modernizing WEEE management regulation.

5.6 Service-oriented goals

The service-oriented goals method is a simpler and more limited version of the multi-target framework, focusing exclusively on services while removing collection targets. In the proposal, it retains the same five main topic areas, i.e. collection, preparation for reuse, parallel flows, CRM recovery, and awareness campaigns, but includes only service-related subtopics with corresponding goals (Table 5.6). In this example, compliance is achieved when a minimum of 60 out of 100 points is reached.

Table 5.6 Proposed service-oriented multi-target system. In this example compliance could be achieved when a minimum of 60 out of 100 points is reached at a national level.

Topic	Subtopic	Member state goal	Max. points	Points distribution
Collection	Collection network infrastructure (coll. pt. / inh)	1/2000	15	Gradual
Prepared for reuse	WEEE volume screened on potential for reuse (%)	25%	15	Gradual
Parallel flows (min. 1 sampling every 3 years)	WEEE lost in metal scrap	0%	10	Gradual (> 20% = 0 pt, 18-20% = 1 pt, etc.)
	WEEE lost in incineration (e.g. municipal waste)	0%	10	Gradual (> 15% = 0 pt, 13.5-15% = 1 pt, etc.)
	WEEE lost in landfill (e.g. municipal waste)	0%	10	Gradual (> 5% = 0 pt, 4.5-5% = 1 pt, etc.)
	WEEE lost in illegal export	0%	10	Gradual (> 5% = 0 pt, 4.5-5% = 1 pt, etc.)
CRM	Budget spent on mapping CRM flows and increasing CRM recycling (% of total spending)	5%	15	Gradual
Awareness campaigns	Budget spent on awareness campaigns (% of total spending)	20%	15	Gradual

Strengths of the service-oriented goals method

Advantages of service-oriented goals are an increased focus on service quality and the reduced need for data collection and reporting on collection rates. This allows countries and PROs to direct their attention completely towards improving their services such as increasing their collection network, investing in prepared for reuse and organizing awareness campaigns, which in turn could result in better collection and enhanced circularity.

Weaknesses of the service-oriented goals method

Having only service-oriented goals, without collection or other results-based targets, makes the assessment of the actual impact of WEEE management efforts more difficult, potentially leading to reduced accountability in achieving high recycling rates.

Additionally, this method may be perceived negatively by policymakers and stakeholders, as collection remains one of the most critical challenges in WEEE management. Indeed, higher collection is the key for more recycling and reuse. Omitting targets on collection rate may therefore weaken the regulatory credibility in the eyes of decision-makers.

6 Recommendations for a new WEEE Act

6.1 Proposed set of targets that foster circularity in WEEE management

Based on the review of the six new methods, the combination of a multi-target framework and the simplified WEEE generated calculation is most recommended. This set of targets could provide a balanced and effective approach for a new WEEE Act, ensuring a more accurate, flexible, and comprehensive method for collection targets. The SWOT analysis below highlights the strengths, weaknesses, opportunities, and threats of this combined approach.

Table 6.1: The SWOT highlights the benefits of combining a multi-target framework with a simplified WEEE generated calculation target

Strengths	Weaknesses
• Comprehensive evaluation of both collection results and offered services • Focus on prepared for reuse, CRM recovery and reducing parallel flows • Flexibility in strategy for each Member State to reaching the overall ambition • More accurate WEEE end-of-life estimation instead of POM methods	• Increased data collection efforts and administrative burden • Requires product lifetime studies on the EU-wide region and frequent studies to track parallel flows
Opportunities	**Threats**
• Aligns with EU circular economy and CRM aspirations • Promotes enhanced stakeholder engagement (local authorities, PROs, recyclers, retailers, etc.)	• Enhanced auditing/inspection requirements to prevent misreporting on the different targets of the framework

By integrating these two methods, a new WEEE Act can enable:

✓ Member States to meet realistic collection targets: The simplified WEEE generated approach ensures a more realistic estimate of WEEE quantities, making target-setting more data-driven, accurate and transparent.

✓ Flexibility for different Member States: The multi-target framework allows countries to tailor efforts based on their unique challenges and priorities or in terms of their cost-effectiveness and marginal cost.

✓ Encouragement of circular economy practices: By extending the focus beyond collection, the framework ensures a holistic approach that promotes long-term circular economy practices including enhanced collection, prepared for reuse, CRM recovery, or awareness.

✓ Continuous improvement: Frequent EU studies on lifetimes help refine the WEEE generated estimates, while the multi-target system incentivizes ongoing investment in WEEE management services.

6.2 Other recommendations

Increase enforcement to prevent WEEE entering the parallel market

To address the growing concern of illegal export and non-compliant treatment of WEEE, the new WEEE Act should emphasize the need for stricter enforcement mechanisms. Illegal export is a major issue where WEEE is exported as part of used EEE or mixed with other waste streams. These exports often bypass regulations and go to countries with low environmental standards, contributing to both environmental damage and loss of valuable materials.

A key recommendation is to enhance the role of customs authorities in preventing illegal export. Customs should be equipped with better capacity in terms of tools, financial resources and trained personnel, to identify suspicious shipments. There should be clear documentation and traceability requirements to verify the intended destination of used EEE and ensure it is appropriately processed in compliance with EU standards. Additionally, the illegal export of mixed WEEE needs to be specifically targeted, with the introduction of stricter controls and penalties for non-compliance.

Furthermore, WEEE that is mixed in metal scrap should be carefully screened and removed before processing to ensure that hazardous materials are not improperly treated. This could be achieved by enforcing that all such WEEE be processed by CENELEC-certified recyclers who adhere to strict environmental and safety standards.

Strengthen the 'all-actors' vision in the new WEEE Act

The new WEEE Act should adopt a more comprehensive, all-actors approach. This approach ensures that all actors that govern or have access to WEEE, i.e. producers, retailers, local authorities, consumers, repairers, remanufacturers, recyclers, customs and enforcement agencies, sit around the table and are accountable for the successful management of WEEE. By distributing responsibility across the entire value chain, from the point of sale to the final processing step of end-of-use products, the Act will encourage more active participation and reduce the burden on any single group. Clear and consistent definitions of the roles and responsibilities of all actors are essential in the new WEEE Act, and enforcement mechanisms should be strengthened to ensure compliance with these requirements. It is essential that the targets set for Member States under the WEEE Act are not limited to producers or PROs alone as they only control part of the WEEE management chain. By collaborative action among stakeholders, achieving ambitious targets becomes feasible.

One of the solutions for this can be to establish a coordination body composed of the main actors in the EEE value chain. This coordination body could even have access to a shared fund that receives a fixed fraction of the EPR fees and that creates additional incentives for all actors to contribute to achieving the targets.

The current requirements for retailers to take back WEEE must also be better enforced and expended to ensure that all retailers, including e-commerce platforms, comply with take-back obligations and guarantee correct data reporting and WEEE recycling. This means retailers should actively inform customers about their take-back obligations and the means through which WEEE can be returned for proper recycling. Additionally, a new WEEE Act could promote reverse logistics to take back small WEEE by logistics service providers on behalf of local retail and online marketplaces, which would expand a door-to-door collection system. Second hand platforms should also document cross-border sales for estimating the export for reuse quantities. Enforcement mechanisms could include mandatory audits of retailers and periodic checks on their take-back systems. There should also be stronger penalties for non-compliance, including fines or the possibility of suspension of operating licenses.

Local authorities and enforcement agencies play a critical role in ensuring that WEEE does not end up in parallel schemes. The new WEEE Act should ensure that local authorities actively participate in monitoring illegal disposal sites, preventing improper treatment, and ensuring that WEEE is managed in compliance with the EU's WEEE framework.

Create and enforce a national data register to collect data from all actors

Currently most data on (W)EEE management is collected by producers or PROs, however, they cannot capture the whole value chain or all WEEE arising in the market due to the existence of a parallel market. Other actors in the value chain, such as second-hand platforms, retailers and recyclers, should be required to register all (W)EEE data in a register. This includes data on export/import of EEE for reuse, export of WEEE for recycling abroad and recycling of WEEE not originating from a producer or PRO.

Moreover, this register could also keep track of all the subsequent processing steps that happen after WEEE is send to recyclers (e.g. for determining CRM that are recovered from WEEE).

Perform thorough external data quality control

Over the past years, the reported collection rates in Eurostat of a few EU countries were significantly above the EU average (see Bulgaria). Since the collection rates are an important parameter of the legislation, sufficient data quality control should be performed for each of the Member States. This includes assessing whether all the POM quantities are captured in the data reporting (by also addressing free riders), and no double counting is happening in the collection quantities. In addition, the impact of export and import quantities of used EEE should also be accounted for. These quantities can be added to the POM quantities or WEEE generated quantities, but not both.

7 Conclusions

This report provides a comprehensive evaluation of the current methods for calculating WEEE collection rates. Based on these insights, the study explores alternative methods which can support the European Commission in setting realistic, achievable targets that foster the circular economy.

The EU collection rates were found to be underestimated based on the POM calculation method due to only considering a 3-year historic period, which relates to an average lifetime of EEE of 2 years. This is a significant difference with the average lifetime of EEE products that is estimated to be 14.5 years based on the WEEE generated calculation. This implies that **the current POM collection target of 65% is unachievable for most Member States**, because of the growth in EEE POM quantities over time. The growing POM quantities, linked to emerging technologies such as PV panels, air conditioners and heat pump that have long lifetimes, cannot be collected in the 3-year historic period. It was estimated that to reach the 65% POM collection target for the whole EU27, more than 100% of the WEEE that is generated should have been collected in 2022.

The WEEE generated method provides a more accurate estimate of the quantities of WEEE that can be collected, making it a better tool for setting collection targets. However, the existing Excel tool was found to be too complicated for practical use and is not fully aligned with the Eurostat reported data. This study recommends using a simplified WEEE generated calculation method with average lifetimes per category that is fully synchronized with the POM data reporting to Eurostat. In this way, the WEEE generated quantities can be automatically calculated for all Member States and directly captured in the Eurostat database. Additionally, it is recommended to perform frequent EU-wide lifetime and market share studies on the different EEE products to make the calculation more robust and tailored to regional conditions.

The study also sets forward a multi-target framework that goes beyond a collection target. The proposed multi-target framework offers a more holistic approach on WEEE management, also targeting efforts done for prepared for reuse, CRM recovery, awareness campaigns, actively reducing parallel flows and increasing the collection network and infrastructure. If a multi-target framework is selected in the next WEEE legislation, future work should further deep dive in the different metrics that will be included in the framework and set-up standardized procedures to monitor them.

The combination of the multi-target framework and a simplified WEEE collection rate calculation is preferred because it sets realistic and achievable targets, while maximally supporting the EU's circular economy goals.

The study also underscores the need for enhanced enforcement mechanisms that are essential to address the different kind of parallel flows of WEEE. These parallel flows reduce the quantities of WEEE that end up in the formal collection systems and are thus not processed in compliance with the EU standards.

Annex

Annex 1: WEEE recovery and recycling/reuse targets

Recovery and recycling/reuse targets as defined by the WEEE Directive (2012/19/EU) [23] per EEE category (see Table below).

Table A.1 Recovery and recycling/reuse targets of WEEE Directive (2012/19/EU)

		Recovery target	Recycling & reuse target
EU1	Temperature exchange equipment	≥85%	≥80%
EU2	Screens, monitors, and others	≥80%	≥70%
EU3	Lamps	≥80%	≥80%
EU4	Large equipment	≥85%	≥80%
EU5	Small equipment	≥75%	≥55%
EU6	Small IT and telecom	≥75%	≥55%

[23] WEEE Directive (2012/19/EU) - European Union regulations on the collection, recycling, and disposal of WEEE

Annex 2: Lifetime distribution per EU EEE category

The table below lists up the UNU keys (54 product types) for the 6+1 EEE categories and provides key data on product level that is used in the model, including EU27 category market share, shape parameter (k), scale parameter (λ), and average lifetime.

Table A.2 Shape, scale and average lifetimes of the lifetime distribution of UNU keys

EU EEE category	UNU Key (54 product types)	Name	EU27 product market share in category (2020)	Shape (k)	Scale (λ)	Avg. lifetimes
1	0108	Fridges (incl. combi-fridges)	51%	2.2	16.71	14.80
	0109	Freezers	11%	1.28	18.55	17.19
	0111	Air Conditioners (household installed and portable)	22%	2	20.6	18.26
	0112	Other Cooling equipment (e.g. dehumidifiers, heat pump dryers)	7%	2.36	13.36	11.84
	0113	Professional Cooling equipment (e.g. large air conditioners, cooling displays)	8%	1.6	15.36	13.77
	1002	Cooled Dispensers (e.g. for vending, cold drinks)	0%	2	15	13.29
2	0303	Laptops (incl. tablets)	10%	1.94	8.76	7.77
	0308	Cathode Ray Tube Monitors	0%	1.4	15.94	14.53
	0309	Flat Display Panel Monitors (LCD, LED)	36%	2.3	12.18	10.79
	0407	Cathode Ray Tube TVs	0%	2.49	12.08	10.72
	0408	Flat Display Panel TVs (LCD, LED, Plasma)	53%	1.88	10.95	9.72
3	0501	Small lighting equipment (excl. LED & incandescent)	20%	1.42	8.72	7.93
	0502	Compact Fluorescent Lamps (incl. retrofit & non-retrofit)	2%	1.6	7.11	6.37
	0503	Straight Tube Fluorescent Lamps	11%	1.75	8.7	7.75
	0504	Special Lamps (e.g. professional mercury, high & low pressure sodium)	4%	1.6	7.3	6.54
	0505	LED Lamps (incl. retrofit LED lamps)	63%	1.36	12.915	11.83

4	0001	Central Heating (household installed)	4%	2	14.21	12.59
	0101	Professional Heating & Ventilation (excl. cooling equipment)	1%	1.92	16.07	14.26
	0102	Dishwashers	13%	1.79	17.13	15.24
	0103	Kitchen equipment (e.g. large furnaces, ovens, cooking equipment)	11%	2	19.35	17.15
	0104	Washing Machines (incl. combined dryers)	32%	1.85	13.32	11.83
	0105	Dryers (wash dryers, centrifuges)	6%	2.58	18.08	16.06
	0106	Household Heating & Ventilation (e.g. hoods, ventilators, space heaters)	14%	2	13.47	11.94
	0307	Professional IT equipment (e.g. servers, routers, data storage, copiers)	7%	1.46	7.78	7.05
	0602	Professional Tools (e.g. for welding, soldering, milling)	5%	2.5	15.5	13.75
	0703	Leisure equipment (e.g. sports equipment, electric bikes, juke boxes)	0%	2.4	11.56	10.25
	0802	Professional Medical equipment (e.g. hospital, dentist, diagnostics)	1%	2.41	13.52	11.99
	0902	Professional Monitoring & Control equipment (e.g. laboratory, control panels)	5%	1.92	11.56	10.25
	1001	Non- cooled Dispensers (e.g. for vending, hot drinks, tickets, money)	0%	2	10.06	8.92
4b	0002	Photovoltaic Panels (incl. inverters)	100%	2.5	25	15.94
5	0114	Microwaves (incl. combined, excl. grills)	16%	2.07	17.99	7.47
	0201	Other small household equipment (e.g. small ventilators, irons, clocks, adapters)	1%	1.22	7.97	9.76

	0202	Equipment for food preparation (e.g. toaster, grills, food processing, frying pans)	14%	2.02	11.02	7.19
	0203	Small household equipment for hot water preparation (e.g. coffee, tea, water cookers)	1%	1.18	7.61	9.92
	0204	Vacuum Cleaners (excl. professional)	0%	1.22	10.59	7.61
	0205	Personal Care equipment (e.g. toothbrushes, hair dryers, razors)	4%	1.2	8.09	9.12
	0401	Small Consumer Electronics (e.g. headphones, remote controls)	15%	1.3	9.87	9.04
	0402	Portable Audio & Video (e.g. MP3, e-readers, car navigation)	22%	1.5	10.01	8.86
	0403	Music Instruments, Radio, Hi-Fi (incl. audio sets)	31%	2.3	10	7.95
	0404	Video (e.g. Video recorders, DVD, Blue Ray, set-top boxes) and projectors	24%	1.14	8.33	12.00
	0405	Speakers	2%	1.13	12.54	6.36
	0406	Cameras (e.g. camcorders, photo & digital still cameras)	6%	1.19	6.75	14.70
	0506	Household Luminaires (incl. household incandescent fittings & household LED luminaires)	16%	2.34	16.59	18.17
	0507	Professional Luminaires (offices, public space, industry)	1%	2	20.5	13.33
	0601	Household Tools (e.g. drills, saws, high pressure cleaners, lawn mowers)	14%	1.77	14.98	4.14
	0701	Toys (e.g. car racing sets, electric trains, music toys, biking computers, drones)	1%	1.43	4.56	11.93
	0801	Household Medical equipment (e.g. thermometers, blood pressure meters)	0%	1.99	13.46	5.30
	0901	Household Monitoring & Control equipment (alarm, heat, smoke, excl. screens)	4%	1.55	5.89	5.68

6	0301	Small IT equipment (e.g. routers, mice, keyboards, external drives & accessories)	15%	1.3	6.15	9.19
	0302	Desktop PCs (excl. monitors, accessories)	22%	1.8	10.33	8.26
	0304	Printers (e.g. scanners, multi functionals, faxes)	31%	1.88	9.31	7.09
	0305	Telecommunication equipment (e.g. (cordless) phones, answering machines)	24%	1.32	7.7	5.07
	0306	Mobile Phones (incl. smartphones, pagers)	2%	1.52	5.62	4.56
	0702	Game Consoles	6%	1.14	4.78	22.18

The information in the table above is used in the model to calculate the average lifetimes for each EU category based on the average shape and scale parameters of the Weibull lifetime distributions. The shape and scale parameters for each EU category are computed as the weighted average of the corresponding parameters of the product types within that category. The average lifetime for each EU category is then calculated using the formula: λ*EXP(GAMMALN(1+1/k)).

Table A.3 Shape, scale and average lifetime of the lifetime distribution of EU categories

EU EEE category	Avg. shape parameter	Avg. scale parameter	Avg. lifetimes
1	2.01	17.43	15.45
2	2.04	11.17	9.89
3	1.43	11.27	10.24
4a	1.94	14.47	12.83
4b	2.5	25.00	22.18
5	1.69	12.43	11.09
6	1.59	8.36	7.50

The results of the Weibull distribution, based on the average lifetimes, for each EU EEE category are presented in the figure below for a 50-year period.

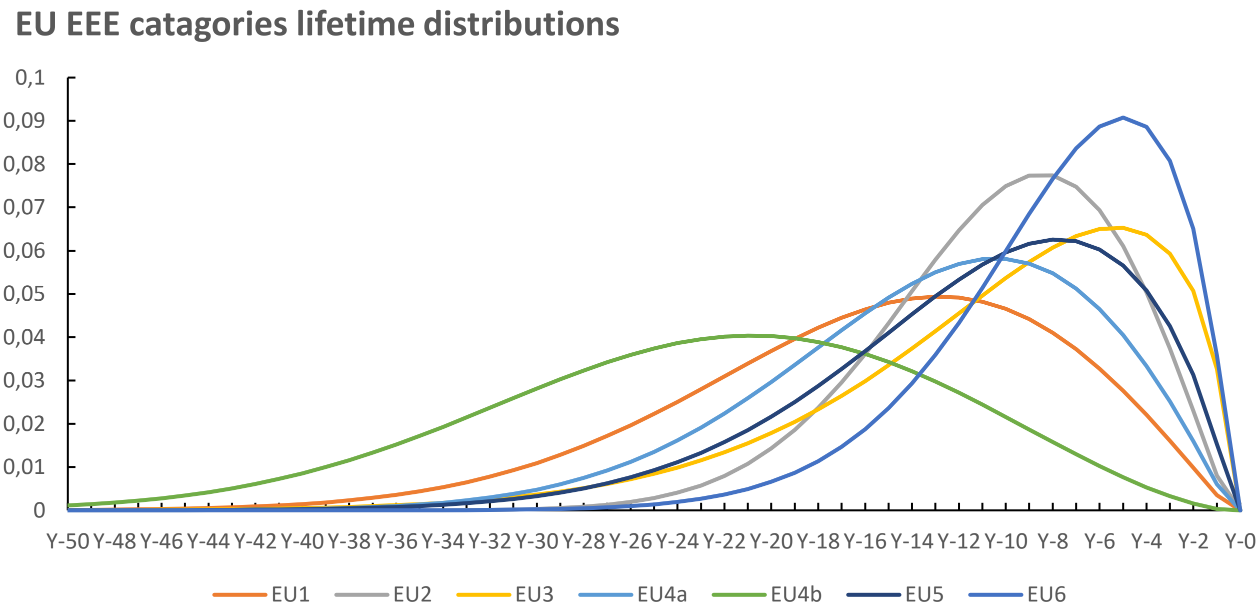

Figure A.1 Weibull distribution of each EU category over a 50-year period

The WEEE generated quantities are calculated in the model by multiplying the POM quantities at the EEE category level by the relevant probability for disposal for every year, as depicted in the lifetime distribution.

Since the historical POM data only goes back to 1980, it was chosen to calculate the WEEE generated quantities for each year based on POM quantities that go back 30 years in time. The remaining probability of EEE products that are disposed of after 30 years (see Table A.6) was multiplied with the average of the last available POM quantities that were still available.

The figures below illustrate how the model is calculating the WEEE generated quantities for 2022. The POM quantities from Figure A.2, covering the years 1992 to 2022, are multiplied by the corresponding percentages of lifetime distribution from Figure A.3 for each respective year (Y-0 to Y-30, where Y-0 is 2022 and Y-30 is 1992). For the remaining 12 years of available POM quantities (1980–1991), an average POM quantity is calculated and multiplied by the sum of the remaining percentages in the lifetime distribution (>Y–30).

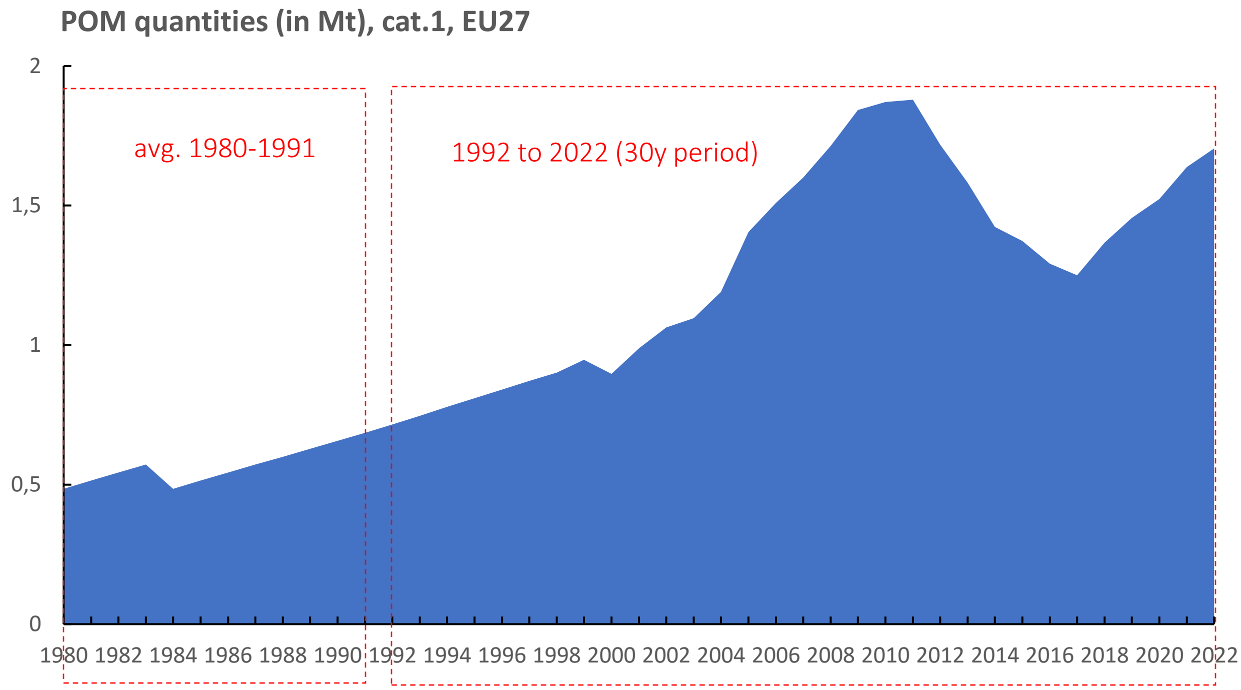

Figure A.2 POM quantities (in Mt) for EU category 1, EU 27 (1980 – 2022)

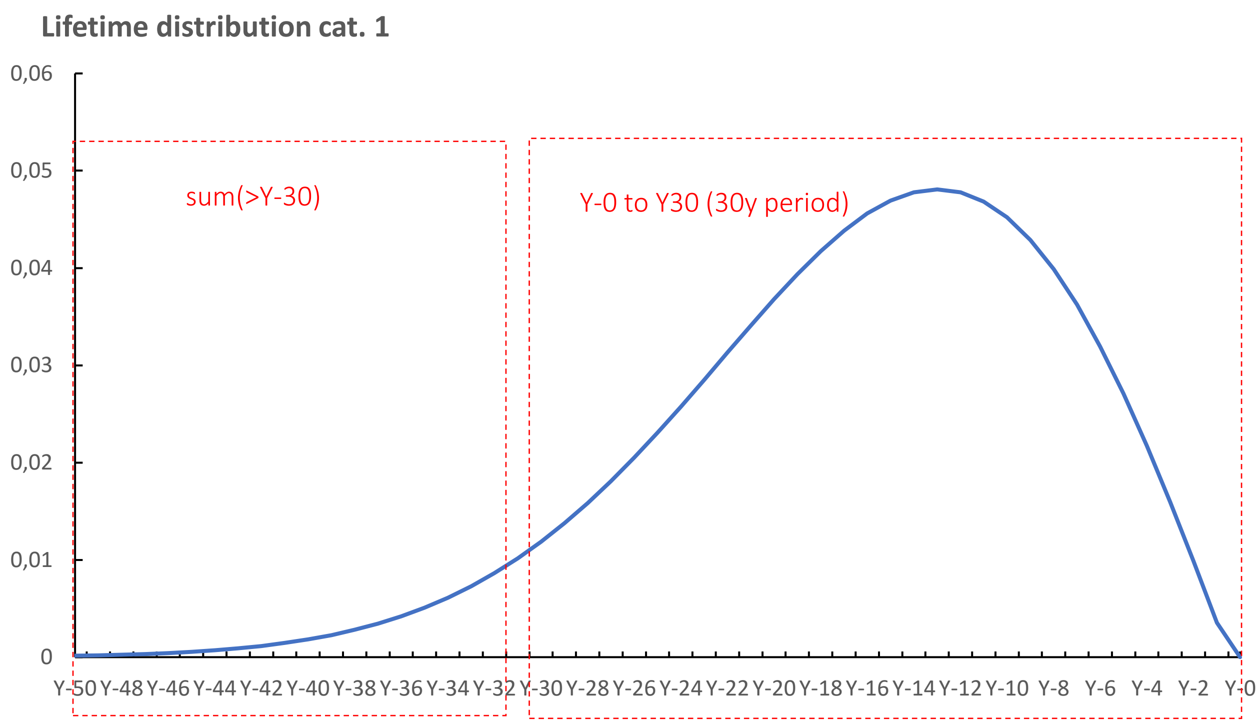

Figure A.3 Lifetime distribution of EU category 1 over a 50-year period

Table A.4 POM quantities in tons at category level from 1980 to 2022

Year	Cat. 1	Cat. 2	Cat. 3	Cat. 4a	Cat. 4b	Cat. 5	Cat. 6
1980	485,302	206,233	32,053	942,386	0	780,546	86,496
1981	514,540	225,588	34,009	1,004,248	0	824,912	97,578
1982	543,202	244,697	35,924	1,064,913	0	868,294	108,579
1983	571,648	263,746	37,826	1,125,315	0	911,149	130,468
1984	599,809	282,697	39,707	1,185,085	0	960,599	147,658
1985	628,229	301,768	41,607	1,245,376	0	1,022,036	166,616
1986	657,000	320,976	43,534	1,306,365	0	1,084,368	185,736
1987	685,738	340,217	45,462	1,367,423	0	1,146,800	204,905
1988	715,370	359,874	48,594	1,430,038	0	1,211,192	224,396
1989	745,961	380,040	51,806	1,494,477	0	1,277,986	242,698
1990	778,209	400,994	55,161	1,581,173	0	1,349,246	262,593
1991	809,969	421,939	58,495	1,667,283	142	1,419,310	281,601
1992	840,849	442,581	61,775	1,751,990	1,649	1,487,426	300,372
1993	871,685	463,275	65,057	1,836,613	1,061	1,555,421	318,794
1994	901,744	484,565	68,283	1,914,356	639	1,620,246	338,164
1995	946,833	439,809	71,673	1,964,339	1,230	1,638,018	350,012
1996	896,740	514,666	73,200	2,028,987	1,806	1,695,670	342,480
1997	988,782	558,868	75,246	2,017,529	2,238	1,790,540	377,532
1998	1,063,242	624,141	81,502	2,161,369	2,074	1,930,873	464,546
1999	1,096,114	693,182	77,819	2,261,152	2,590	2,070,121	531,533
2000	1,190,497	718,002	84,845	2,357,874	5,948	2,183,274	552,055
2001	1,405,090	724,047	88,768	2,489,802	10,333	2,151,426	556,700
2002	1,509,206	781,874	96,373	2,587,040	8,642	2,322,112	546,261
2003	1,600,096	879,025	100,821	2,671,861	23,885	2,571,237	560,866
2004	1,713,712	932,242	109,100	2,802,483	70,369	2,752,756	609,837
2005	1,842,266	965,321	116,940	2,986,156	94,982	2,823,924	628,330
2006	1,871,456	921,557	122,514	3,148,700	101,528	2,785,939	656,399
2007	1,879,198	786,498	132,387	3,188,642	116,857	2,854,984	676,883
2008	1,718,173	576,980	131,895	3,119,310	506,884	2,754,671	652,169
2009	1,582,042	626,549	122,248	3,058,950	304,536	2,626,033	613,193

2010	1,423,851	735,986	120,008	2,656,457	683,925	2,077,922	878,043
2011	1,373,502	635,637	112,342	2,563,384	1,390,125	1,989,707	837,254
2012	1,290,949	520,994	104,289	2,529,169	817,101	1,975,058	772,251
2013	1,249,946	473,251	130,887	2,637,590	456,282	1,828,433	745,027
2014	1,366,874	489,510	101,140	2,681,573	242,797	1,968,817	793,628
2015	1,455,172	432,525	99,220	2,813,058	197,763	2,082,935	757,266
2016	1,523,037	457,563	107,786	2,985,437	251,693	2,178,537	780,556
2017	1,637,508	468,081	100,760	3,085,948	388,568	2,512,365	754,893
2018	1,704,450	495,814	146,882	3,481,767	522,182	2,691,204	635,126
2019	1,998,029	571,374	114,077	4,728,027	889,169	2,442,575	472,991
2020	2,257,209	663,356	101,769	5,002,108	1,416,963	2,430,841	531,816
2021	2,460,874	672,491	99,450	5,583,904	1,631,159	2,821,605	466,113
2022	2,316,793	623,327	92,683	5,224,938	2,916,577	2,731,002	437,781

Table A.5 Weibull distribution probabilities per EU category over a 50-year period

	EU1	EU2	EU3	EU4a	EU4b	EU5	EU6
Y-50	0.000141	4.62E-10	1.6E-05	7.42E-06	0.001109	1.3E-05	1.97E-08
Y-49	0.000187	1.09E-09	2.12E-05	1.11E-05	0.001415	1.81E-05	3.36E-08
Y-48	0.000248	2.5E-09	2.79E-05	1.66E-05	0.00179	2.52E-05	5.7E-08
Y-47	0.000325	5.66E-09	3.67E-05	2.45E-05	0.002244	3.48E-05	9.6E-08
Y-46	0.000424	1.26E-08	4.82E-05	3.59E-05	0.002789	4.79E-05	1.6E-07
Y-45	0.00055	2.73E-08	6.3E-05	5.22E-05	0.003435	6.54E-05	2.66E-07
Y-44	0.000709	5.83E-08	8.2E-05	7.51E-05	0.004194	8.89E-05	4.39E-07
Y-43	0.000906	1.22E-07	0.000107	0.000107	0.005077	0.00012	7.19E-07
Y-42	0.001151	2.51E-07	0.000138	0.000151	0.006093	0.000162	1.17E-06
Y-41	0.001453	5.06E-07	0.000178	0.000212	0.007249	0.000216	1.88E-06
Y-40	0.001821	1E-06	0.000229	0.000295	0.008551	0.000287	3.02E-06
Y-39	0.002266	1.94E-06	0.000294	0.000406	0.010002	0.00038	4.79E-06
Y-38	0.002802	3.69E-06	0.000375	0.000554	0.0116	0.000499	7.56E-06
Y-37	0.00344	6.88E-06	0.000477	0.000749	0.013341	0.000652	1.18E-05
Y-36	0.004193	1.26E-05	0.000606	0.001004	0.015215	0.000846	1.84E-05
Y-35	0.005077	2.26E-05	0.000765	0.001333	0.017209	0.001092	2.83E-05

Y-34	0.006103	3.98E-05	0.000963	0.001753	0.019303	0.0014	4.32E-05
Y-33	0.007285	6.87E-05	0.001208	0.002286	0.021473	0.001785	6.54E-05
Y-32	0.008634	0.000116	0.001509	0.002952	0.023691	0.002261	9.83E-05
Y-31	0.010159	0.000193	0.001878	0.003777	0.025923	0.002845	0.000146
Y-30	0.011866	0.000315	0.002327	0.004786	0.028133	0.003557	0.000216
Y-29	0.013759	0.000503	0.002871	0.006008	0.030281	0.004418	0.000317
Y-28	0.015835	0.000788	0.003528	0.00747	0.032325	0.00545	0.000459
Y-27	0.018088	0.00121	0.004316	0.009197	0.034223	0.006677	0.00066
Y-26	0.020505	0.001822	0.005256	0.011212	0.035932	0.008124	0.000941
Y-25	0.023065	0.002691	0.006371	0.013533	0.037413	0.009814	0.001328
Y-24	0.02574	0.003896	0.007686	0.01617	0.038628	0.011769	0.001855
Y-23	0.028497	0.005528	0.009226	0.019123	0.039544	0.014008	0.002567
Y-22	0.031291	0.007688	0.011018	0.022381	0.040133	0.016544	0.003515
Y-21	0.034073	0.010477	0.013089	0.025917	0.040373	0.019387	0.004764
Y-20	0.036785	0.013989	0.015463	0.029686	0.040252	0.022534	0.006386
Y-19	0.039363	0.018296	0.018162	0.033627	0.039763	0.025971	0.008467
Y-18	0.041738	0.023434	0.021205	0.037658	0.038906	0.029673	0.011096
Y-17	0.04384	0.029384	0.024601	0.041679	0.037694	0.033596	0.014369
Y-16	0.045595	0.036057	0.028351	0.04557	0.036142	0.037678	0.018378
Y-15	0.046931	0.04328	0.032443	0.049197	0.034278	0.041838	0.023203
Y-14	0.04778	0.050789	0.036847	0.052411	0.032132	0.045972	0.028896
Y-13	0.048079	0.058227	0.041512	0.05506	0.029743	0.049952	0.035474
Y-12	0.047776	0.065158	0.046361	0.056988	0.027155	0.05363	0.042887
Y-11	0.046826	0.071089	0.051285	0.058046	0.024415	0.056836	0.051009
Y-10	0.045202	0.075507	0.056137	0.058099	0.021572	0.059381	0.059605
Y-9	0.04289	0.077918	0.060726	0.057033	0.018678	0.061061	0.068311
Y-8	0.039892	0.077901	0.064807	0.054763	0.015787	0.061661	0.076614
Y-7	0.036228	0.075157	0.068073	0.051242	0.012952	0.060961	0.083832
Y-6	0.031939	0.069545	0.070141	0.04646	0.010227	0.058737	0.089108
Y-5	0.027079	0.061123	0.070524	0.040451	0.007664	0.054763	0.091395
Y-4	0.02172	0.050156	0.068583	0.033293	0.005322	0.048804	0.089445
Y-3	0.015948	0.037118	0.063398	0.025098	0.003262	0.040569	0.081724

Y-2	0.009858	0.022683	0.05333	0.015992	0.001562	0.029568	0.066026
Y-1	0.003546	0.007796	0.032951	0.006023	0.000361	0.014134	0.036469
Y-0	0	0	0	0	0	0	0

Table A.6 Sum of Weibull distribution probabilities: Year 0 to year 30 and after year 30

	Y-0 to Y-30	>Y-30
EU1	94%	6%
EU2	100%	0%
EU3	99%	1%
EU4a	98%	2%
EU4b	79%	21%
EU5	99%	1%
EU6	100%	0%

Table A.7 WEEE generated quantities in tons at category level calculated by multiplying POM quantities and lifetime distributions (2013-2030)

	Cat. 1	Cat. 2	Cat. 3	Cat. 4a	Cat. 4b	Cat. 5	Cat. 6
2013	1,150,407	732,496	101,768	2,376,625	17,202	2,203,443	630,704
2014	1,189,895	733,664	104,296	2,435,410	25,365	2,226,449	653,232
2015	1,225,655	728,154	105,952	2,487,134	35,254	2,238,785	674,065
2016	1,258,183	716,637	106,860	2,532,815	46,569	2,244,462	691,902
2017	1,287,883	700,078	107,573	2,574,207	59,095	2,246,261	707,458
2018	1,315,329	679,994	107,887	2,612,823	72,724	2,249,888	720,062
2019	1,341,095	657,955	109,413	2,651,629	87,449	2,258,853	725,538
2020	1,366,450	635,938	110,591	2,699,847	103,403	2,269,045	719,304
2021	1,393,178	616,226	111,015	2,763,821	121,008	2,278,851	706,679
2022	1,422,729	600,325	110,925	2,846,862	140,855	2,294,140	688,413
2023	1,455,093	588,361	110,301	2,947,457	163,832	2,314,225	665,410
2024	1,490,215	580,178	109,362	3,064,300	191,532	2,338,629	639,236
2025	1,528,758	575,766	108,259	3,199,025	225,555	2,367,979	611,249
2026	1,571,100	574,902	107,080	3,352,354	267,600	2,402,379	582,618
2027	1,618,169	577,154	105,885	3,523,927	319,456	2,441,359	554,323

2028	1,668,958	582,001	104,717	3,712,703	382,899	2,484,184	527,144
2029	1,723,488	588,846	103,595	3,915,968	459,582	2,529,876	501,686
2030	1,781,706	597,079	102,552	4,130,822	550,876	2,577,398	478,403

Deloitte.