In-depth review of the WEEE Collection Rates and Targets

in the EU-28, Norway, Switzerland, and Iceland

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Acronyms and Country Acronyms

Acronyms	
B2B	Business-to-Business
B2C	Business-to-Consumer
CWIT	Countering WEEE Illegal Trade project
EC	European Commission
EEE	Electrical and Electronic Equipment
EEE POM	Electrical and Electronic Equipment Placed On the Market
EU	European Union
ICT	Information and Communications Technology

Acronyms	
inh	Inhabitant
kt	Kiloton, or 1,000,000 kg
POM	Placed On the Market
PRO	Producers Responsibility Organisation
ProSUM	Prospecting Secondary raw materials in the Urban mine and Mining wastes – Project
PV	Photovoltaic panels
t	(metric) Ton, or 1,000 kg
WEEE	Waste Electrical and Electronic Equipment

Acronyms and Country Acronyms

Country Acronyms	
BGR	Bulgaria
CZE	Czech Republic
HUN	Hungary
POL	Poland
ROU	Romania
SVK	Slovakia
DNK	Denmark
EST	Estonia
FIN	Finland
GBR	United Kingdom of Great Britain and Northern Ireland
IRL	Ireland
ISL	Iceland
LTU	Lithuania
LVA	Latvia
NOR	Norway

Country Acronyms	
SWE	Sweden
ESP	Spain
GRC	Greece
HRV	Croatia
ITA	Italy
MLT	Malta
PRT	Portugal
SVN	Slovenia
AUT	Austria
BEL	Belgium
CHE	Switzerland
DEU	Germany
FRA	France
LUX	Luxembourg
NLD	The Netherlands

Executive Summary

The minimum collection rates for Waste Electrical and Electronic Equipment (WEEE) are set out in the WEEE Directive (2012/19/EU) in the European Union. Beginning in 2019, the most stringent collection target of WEEE was enacted in most EU Member States. Article 7 of the WEEE Directive states that the minimum collection rate to be achieved annually by a Member State shall be either 65% of the average weight of electrical and electronic equipment (EEE) placed on the market (POM) in the three preceding years or 85% of WEEE Generated on the territory of a Member State.

The WEEE Forum members have identified difficulties in reaching the targets in almost all Member States and have contracted UNITAR to undertake this study, which addresses:

- an analysis and in-depth review of the current situation in each country,
- an analysis of factors that influence the WEEE collection in order to picture the actual WEEE management across Europe,
- draw options for future improvement,
- an in-depth review of the methodologies for target-setting, as provided by the WEEE Directive.

In this study, the methodology for measuring the collection targets, WEEE flows, and the impact of national implementation of the WEEE legislation uses a combination of an internationally recognised framework for WEEE statistics. This methodology was developed by the SCYCLE team which is co-hosted by the United Nations University and the United Nations Institute for Training and Research. Data and information from official statistics, literature, studies, and surveys with WEEE Forum members and official representatives of the Working Group on Waste Statistics have been harmonized and integrated. The quantitative analysis in this study has been performed using the most recent available data, usually from 2017 or 2018, and it is assumed that the data largely resembles WEEE management in 2019, when new collection targets are officially enforced.

Key findings

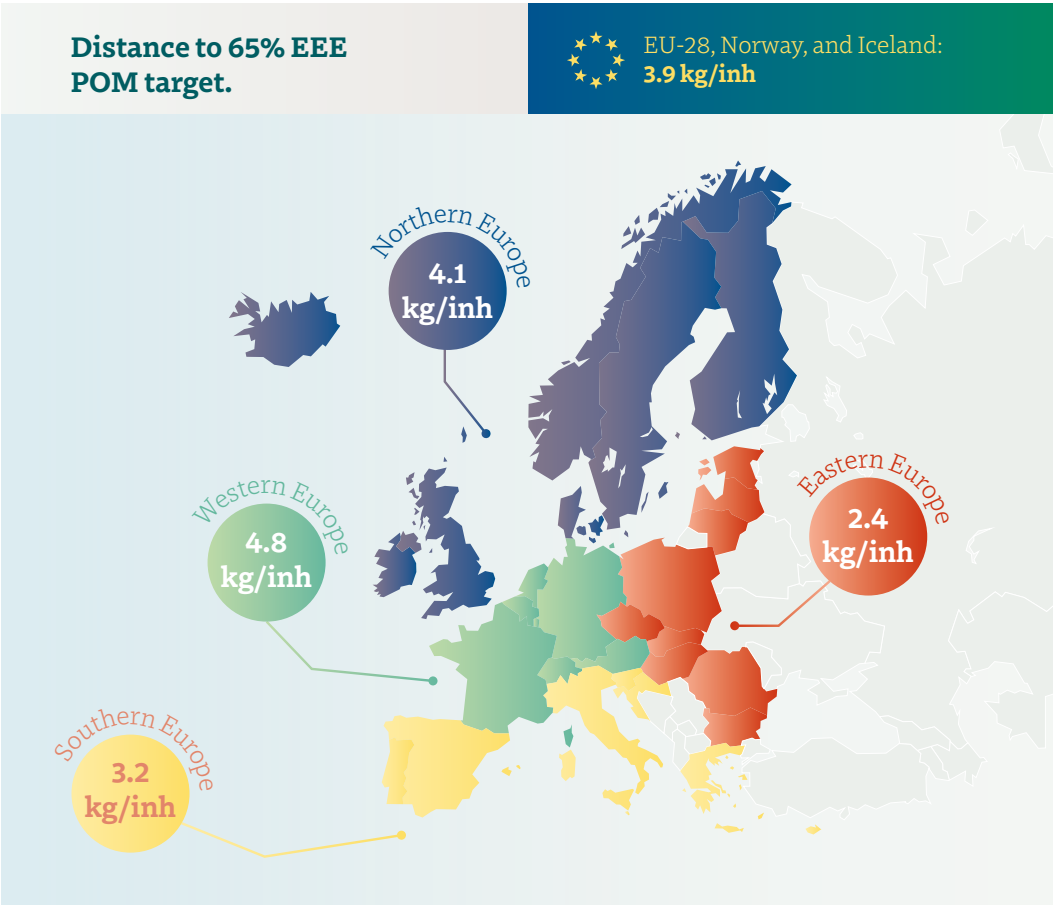
Distance to target

In 2018, 65% of EEE POM for the EU-28, Switzerland, Norway, and Iceland was 13.5 kg/inh and 85% of WEEE Generated was 15.9 kg/inh. This study shows that EEE POM and WEEE Generated targets are not equivalent and that the WEEE Generated target methodology leads, on average, to a higher collection target. Based on 2018 reported data, the distance to reach the collection target is 6.4 kg/inh when calculated with 85% of WEEE Generated and 3.9 kg/inh when calculated using 65% of EEE POM. Despite the fact that the WEEE collected increased from 7.3 kg/inh in 2010 to 9.5 kg/inh in 2018, the annual increments are not sufficient for meeting the 2019 collection targets when they are officially enforced in the EU. Based on the WEEE collection reported in 2018, 26 Member States will not reach either of the minimum collection rates in 2019. Only three countries – Bulgaria, Croatia, and Switzerland – would have reached the collection target of 65% EEE POM[2]. These countries seem to diverge from the overall trend and the underlying analysis of factors that affect the WEEE collection rate.

Table

Distance to the collection target in 2018

2018		EU-28, Norway, and Iceland	Northern Europe	Western Europe	Southern Europe	Eastern Europe
WEEE Collection		9.5	13.5	11.3	6.3	6.2
Collection target (kg/inh)	85% WEEE Generated	15.9	19.2	17.2	15.1	10.2
	65% of average EEE POM three preceding years	13.5	17.6	16.1	9.5	8.6
Distance to collection target (kg/inh)	85% WEEE Generated	6.4	5.7	6.0	8.8	4.0
	65% of average EEE POM three preceding years	3.9	4.1	4.8	3.2	2.4



[2] Aside from the official explanations from governments, there were no additional public reports or underlying information available to better understand the increased collection in Croatia and Bulgaria.

Factors that influence WEEE Collection

The in-depth analysis shows that a single factor in isolation does not explain why a country does not reach the target, but that the collection rate is affected by a combination of interlinked factors. The impact of these factors has been quantified where possible and grouped into three main groups.

1. Other WEEE flows outside of the formal WEEE system
2. How the WEEE legislation has been implemented at a national level
3. Behavioural and economic factors

1. Other WEEE flows outside of the formal WEEE system

This study reveals that the factors that had the biggest impact on the collection rate are other WEEE flows that are not being reported via official channels. The following estimations have been made for 2018:

- Approximately 2.1 kg/inh of WEEE is in metal scrap and not declared as WEEE, and despite being recycled, this WEEE may be treated at sites that do not comply with the WEEE Directive requirements and which may not meet the Waste Framework Directive requirements.
- Around 1.4 kg/inh of WEEE is discarded in waste bins and subsequently landfilled or incinerated.
- Illegal exports of WEEE outside the EU account for 0.5-1.4 kg/inh.
- Currently, 0.5 kg/inh of used-EEE exports are documented. The amount exported for reuse is potentially between 1 and 2 kg/inh, but these amounts are not widely registered or reported in the countries surveyed.
- The other WEEE flows and undocumented used-EEE exports account for approximately 6-7 kg/inh of WEEE, when corrected for potential double-counting.

2. How the WEEE legislation has been implemented at the national level

The second group of factors relate to the different national models used to implement the WEEE Directive.

- The use of substantiated estimates for reporting WEEE collected has been infrequent across Member States. To date, only 0.6 kg/inh of collected WEEE is reported from substantiated estimates, compared with a total WEEE collection of 9.5 kg/inh.
- The use of financial incentives to collect more WEEE leads to the higher collection rates observed in Switzerland. In Switzerland, Producer Responsibility Organisations (PROs) financially incentivize the collectors of WEEE. However, it should be noted that these incentives are high, relative to EU costs, and might not be applicable in other economies.
- The study has revealed that countries that use an 'all actors' approach, clearing houses, and/or some form of mandatory handover of WEEE tend to have higher collection rates than countries that have not implemented such mechanisms. The countries which have implemented either the 'all actors' approach, clearing house, or mandatory handover can collect up to 1.4 kg/inh more WEEE than countries with none of these measures.

3. Behavioural and economic factors

The third group of factors covers behavioural and economic business cycle aspects.

- Hoarding and second-hand use can affect WEEE collection; 4 to 5 kg/inh of WEEE is hoarded prior to being discarded, and reusable EEE can be resold, given away, or reused.
- In normal operation, the inflow and outflow of hoarded WEEE is constant, so the impact of hoarding and reuse on the WEEE is typically minor. The amount of hoarded WEEE can only increase collection rates significantly once every few years if a campaign for moving hoarded WEEE from households into collection channels is undertaken.
- The economy and business cycles also have an impact on WEEE collection. Generally, there is more WEEE collection when EEE POM increases. The reverse trend is also true. On average, if EEE POM declines in a year by 1 kg/inh, WEEE collection declines by 0.49 kg/inh for the period of 2010 to 2018.

Methodology for calculating the collection target

The final element that affects the collection target is of an operational nature and is related to practical application of the calculation methodology. In practice, Member States have the most experience using the 65% of EEE POM target, largely because it is more straightforward and uses readily available data. However, there are some shortcomings in the EEE POM calculation methodology that may be relevant for countries.

The most relevant shortcoming of the EEE POM target methodology is that the EEE POM is, conceptually, not directly related to the amount of WEEE that can be collected in a country. A product purchase will not necessarily result in a product discard. Moreover, the assessment performed showed that POM methodology is very sensitive for fluctuations in consumption of EEE and even more sensitive to fluctuations in PV panels that are placed on the market. The PV panels add, on average, an additional 0.6 kg/inh to the EEE POM target, but the amount can be higher for individual countries. The collection rates of PV panels are very low, as they are not yet arising as waste, due to their long lifespans of more than 15 years. Thus, PV panels and the sensitivity for changes in consumption (EEE POM) in the calculation do not reflect what happens in practice with the collection of WEEE.

The advantage of the WEEE Generated-based target is that, with representative national data, it should more accurately reflect the amount of WEEE arising that can thus be collected. However, the uncertainties for WEEE Generated may be significant if product lifespans are not accurate or realistic for the country or if POM data is not accurate enough. In this report, maximum uncertainties have been quantified, but more detailed research on a country basis is essential for calculating the real impact.

- In an extreme scenario, the maximum uncertainties due to lifespans lead to a spread between -2.0 and +2.0 kg/inh of the WEEE Generated. This is between -11% and 11% of the total WEEE Generated. This maximum uncertainty is not likely to occur in all years for most countries, but there are indications that lifespans may be different in Eastern European countries.
- The average maximum uncertainty due to the EEE POM is 0.3 kg/inh, or 2% of WEEE Generated, but some regional variations have been found.
  - In Western European countries, the WEEE Generated might be up to + 2.0 kg/inh higher if EEE POM from national registers are taken.
  - In Southern European and Eastern European countries, WEEE Generated might be up to 2.5 kg/inh and 1.7 kg/inh lower, respectively, if EEE POM from national registers are taken.
  - Additional research is needed to understand these differences at a national level.
- The WEEE Generated needs to be adjusted downward in times of economic recession. The analysis revealed that this was not necessary in 2018, as there was no recession that year.

Member States might need to explore novel calculation methodologies for the collection targets. In the case of the EEE POM methodology, setting a separate target for PV panels is recommended. In some situations, it may be desirable to construct targets using a hybrid approach of both methodologies, where for some product categories, e.g. PV panels, e-bikes and air-conditioners, it may better represent reality to use WEEE Generated, while for other product categories, in which the EEE POM is not volatile, such as stable replacement markets without economic recessions, the EEE POM methodology is acceptable.

It can be concluded from the study that the WEEE Generated methodology provides a better measure of the amounts of WEEE that actually arise. Nonetheless, shortcomings remain. In times of recession, the WEEE Generated might have to be adjusted downward, and a novel methodology for accomplishing the adjustment is suggested herein. The second barrier is that country-specific data on product lifespans for Eastern Europe is unavailable, so the data must be taken from other countries.

WEEE flows and multi-stakeholder approach

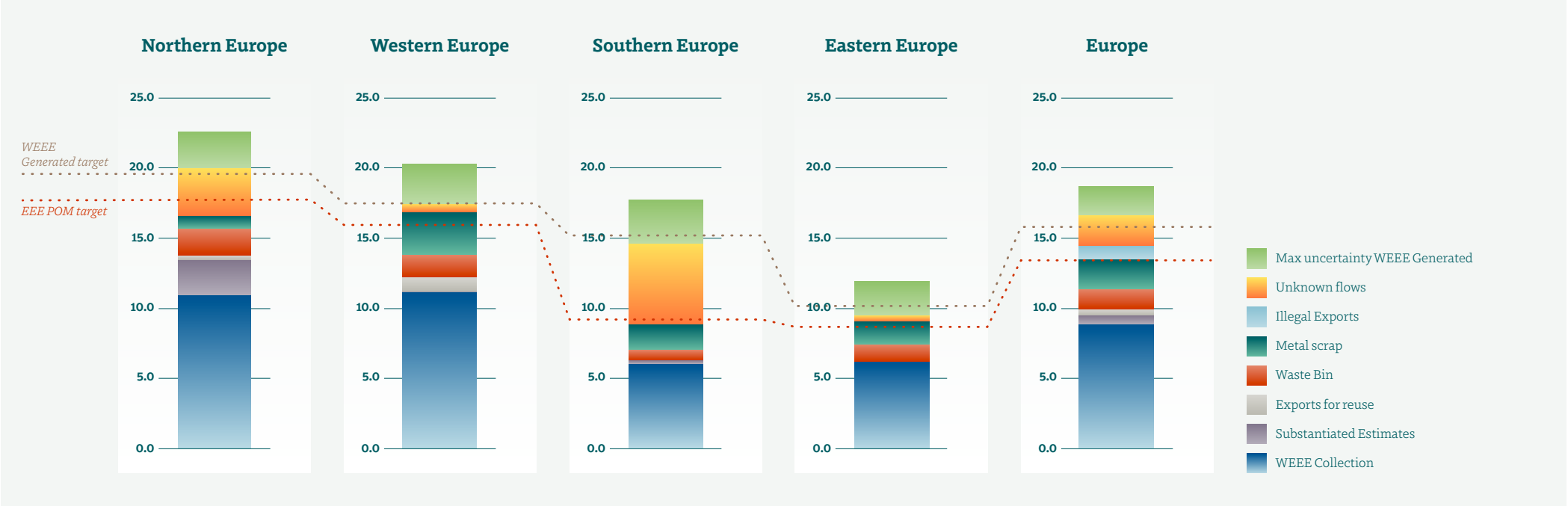
The overview for all WEEE flows, shown below, shows that the countries would need to significantly reduce the other WEEE flows to reach the collection target. As an example, Northern Europe would have a collection rate of 65% compared to EEE POM, Southern Europe would be 63%, Western Europe 67%, and Eastern Europe 70% only if they managed to considerably reduce (by 75%) WEEE flows to waste bins, WEEE in metal scraps, and illegal exports, all while concurrently improving monitoring and reporting of B2B WEEE.

This improvement would only be possible with at least the cooperation of a wide range of stakeholders and actors but, more effectively, with mandated roles for relevant actors within the country. At the Member State level, we recommend that the mass balance approach is undertaken for EEE and WEEE flows to help inform evidence-based policy-making. Undertaking the mass balance approach to monitor the WEEE flows and WEEE Generated regularly will indicate the potential to collect, monitor, and report more WEEE, as well as allow for designation of responsibility to those actors handling the WEEE that is generated. The effectiveness of the WEEE collection and cost efficiency of the interventions can then also be evaluated. This would enable practical, cost-effective solutions tailor-made for the national situation that reduce unwanted WEEE flows.

Key factors in obtaining more reliable data on unreported WEEE flows include access to data, intelligence, and cooperation between all stakeholders, which leads to the four main recommendations for this study:

1. Monitor all WEEE flows at national and EU level
2. Design interventions to reduce unwanted WEEE flows and steer them into the compliant WEEE management regime.
3. Facilitate cooperation between the various stakeholders in the country through a coordination body.
4. Improve target calculation methodology when targets are unrealistic.

Overview of
the WEEE flows that could be quantified for 2018 (in kg/inh)



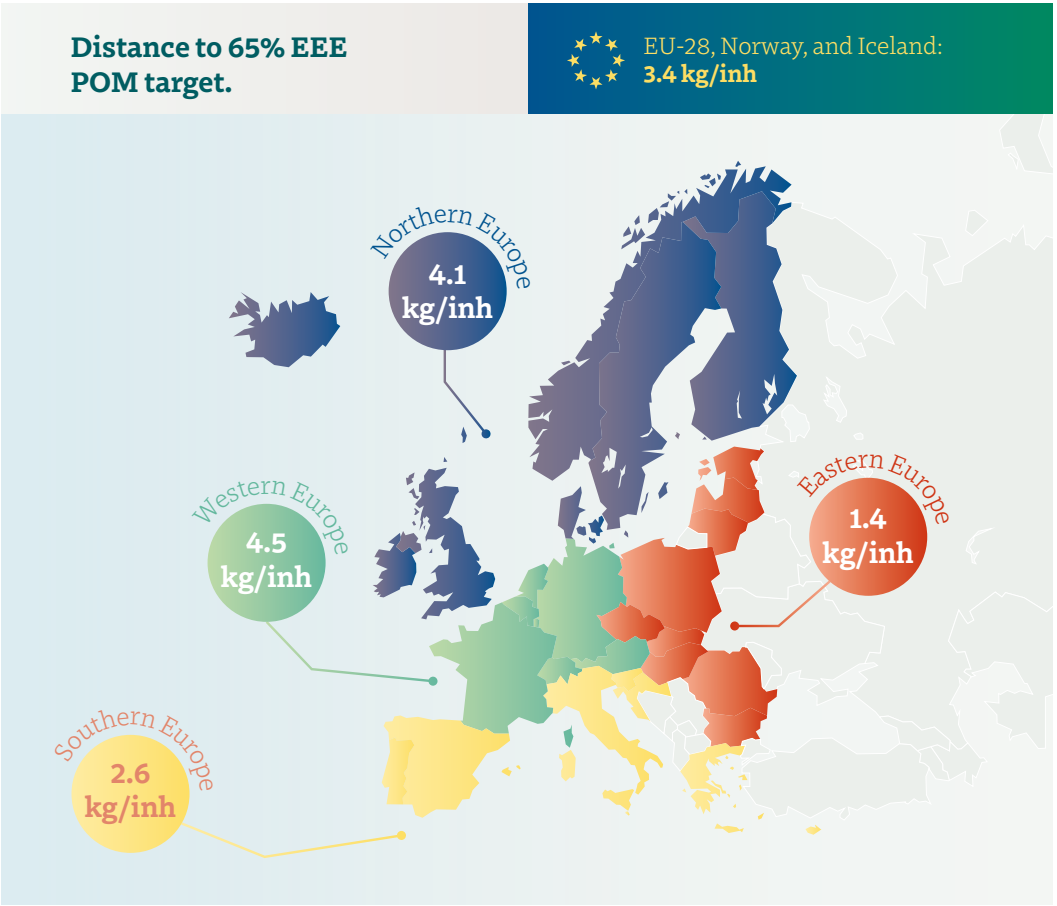
Addendum

The publication of this report was delayed by six months due to the COVID-19 pandemic. In the meantime, more recent data has become available from Eurostat and through the WEEE Forum Key Figures platform. Therefore, the authors and the project team decided to update two main figures and one table by means of this addendum. The data has been extracted from Eurostat and the WEEE Forum Key Figures data as of 10 October 2020, and were subjected to the same validation procedure described in the report. The figures in the addendum replace Figure 7, 8 and Table 1 of the report.

Updated Table 1

Distance to the collection target in most recent available year

MOST RECENT YEAR AVAILABLE		EU-28, Norway, and Iceland	Northern Europe	Western Europe	Southern Europe	Eastern Europe
WEEE Collection		9.6	12.7	11.5	6.6	6.7
Collection target (kg/inh)	85% WEEE Generated	15.7	19.4	17.1	15.1	9.9
	65% of average EEE POM three preceding years	13.0	16.8	16.1	9.2	8.1
Distance to collection target (kg/inh)	85% WEEE Generated	6.1	6.6	5.5	8.5	3.2
	65% of average EEE POM three preceding years	3.4	4.1	4.5	2.6	1.4

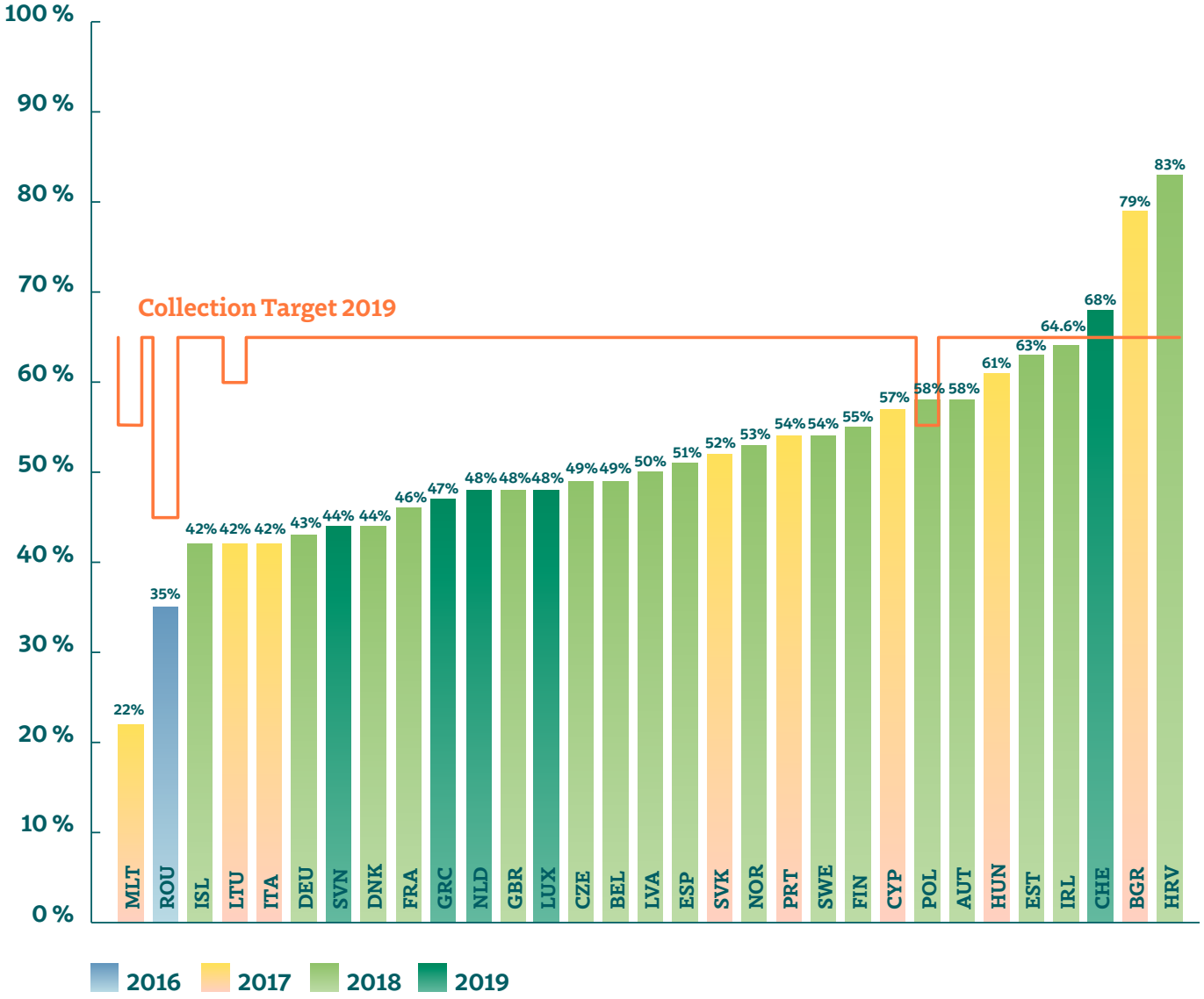


The average WEEE collection in the EU-28, Switzerland, Norway and Iceland was 9.6 kg/inh, and distance to the WEEE collection target was 3.4 kg/inh for the EEE POM target and 6.1 kg/inh for the WEEE Generated target. Thus, the gap became respectively, 0.5 and 0.3 kg/inh smaller when comparing to Table 1 in the report.

When comparing the changes per country, the collected rates of 14 countries have increased when rounding to percentages, 9 stayed the same, and 8 countries decreased. Still the same three countries would have reached the 65% EEE POM target, namely Croatia, Bulgaria and Switzerland (updated Figure 7), when comparing it to Figure 7 in the report. Croatia would have also reached the 85% WEEE Generated target (updated Figure 8), but did not before.

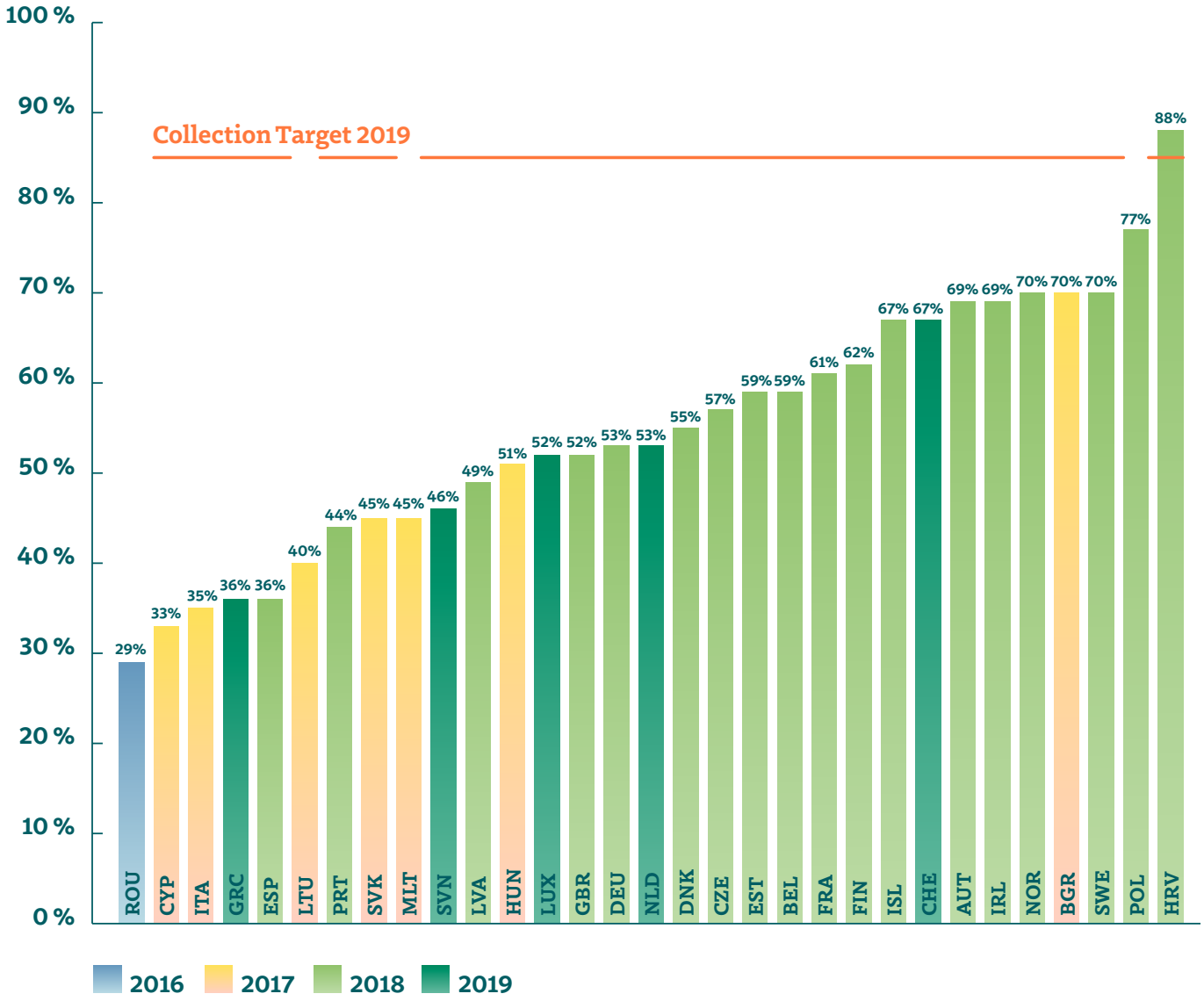
Updated Figure 7

Overview of collection rate compared to EEE POM of three preceding years for Member States of the EU-28, Switzerland, Iceland, and Norway



Updated Figure 8

Overview of collection rate compared to WEEE Generated for Member States of the EU-28, Switzerland, Iceland, and Norway



When there are examples of countries that reach the targets, they seem to contradict both the overall trend reported and the underlying factors observed across the rest of the EU and described in the main report. Besides the official government data, there are no additional public reports or underlying information available for better understanding the increased collection, but such exceptions are worthy of further investigation. Thus, the underlying trend and underlying factors of the inability of Member States to meet the 2019 targets described in the report remain valid.

Chapter 1.
Introduction

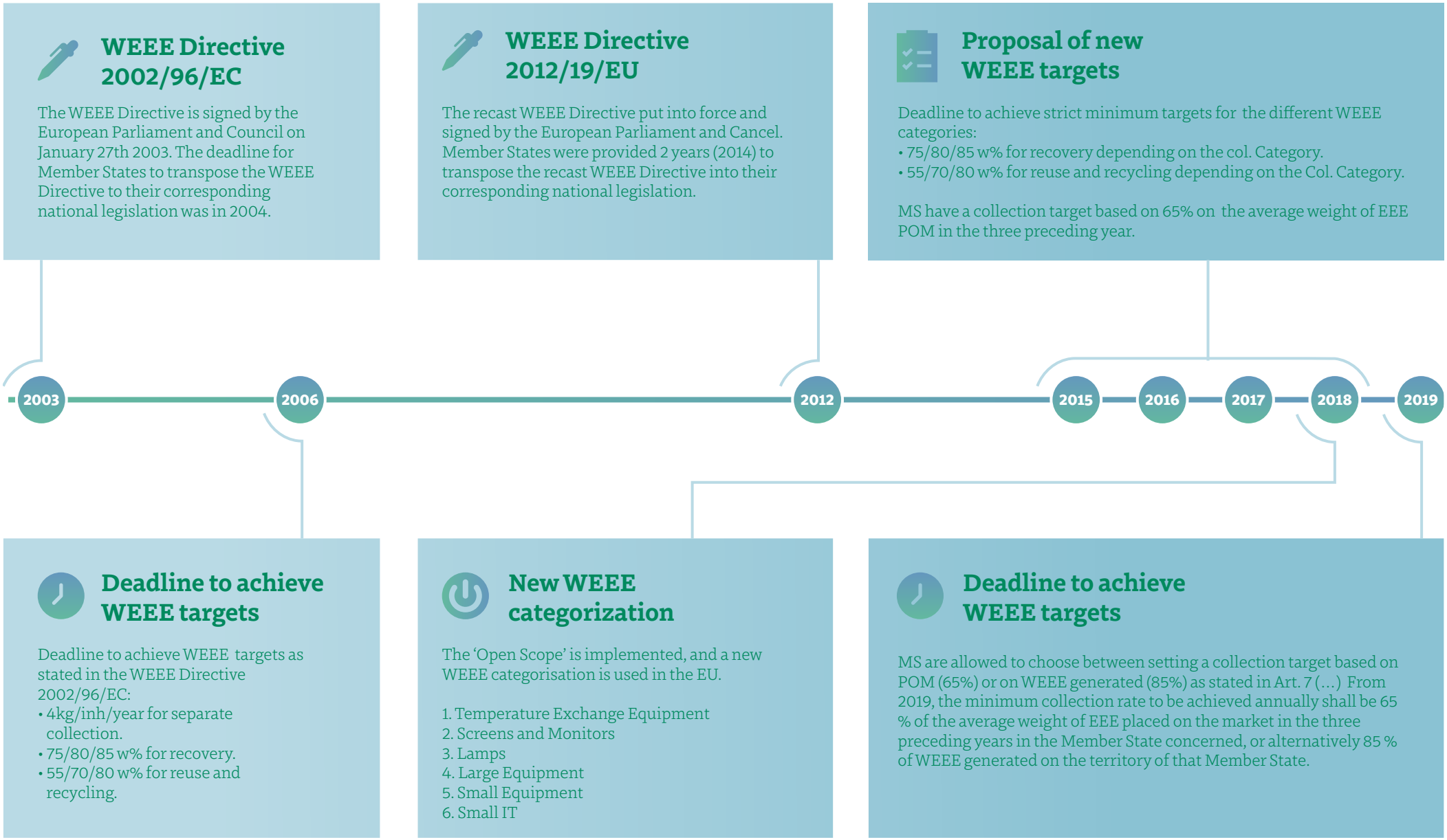
The term WEEE, also referred to as 'e-waste', is an abbreviation of waste electrical and electronic equipment. A key component of the definition is the word 'waste' and what it logically implies – that the item has no further use and is disposed of by the owner in its current condition. WEEE includes nearly any household or business item containing circuitry or electrical components with either power or battery supply. In response to the ever-growing volume of discarded electrical and electronic appliances [1]–[3], the European Parliament put into effect the Waste Electrical and Electronic Equipment (WEEE) Directive in February 2003 [4]. The purposes of the WEEE Directive 2002/96/EC were to prevent and reduce the amount of WEEE; to improve the reuse, recycling, and recovery of WEEE; and to ensure discarded appliances are treated using environmentally sound processes.

The recast of the WEEE Directive 2012/19/EU was enacted on 13 August 2012 [4] [5]. The purpose of the Directive and the recast is to contribute to sustainable production and consumption by, as a first priority, the prevention of WEEE, as well as by the reuse, recycling, and other forms of recovery of such wastes so as to reduce the disposal of waste and to contribute to the efficient use of resources and the retrieval of valuable secondary raw materials. The Directive also seeks to improve the environmental performance of all operators involved in the life cycle of electronic and electrical equipment (EEE), e.g. producers, distributors, and consumers, especially those operators directly involved in the collection and treatment of WEEE. Specifically, different national applications of the 'producer responsibility' principle may lead to substantial disparities in the financial burden on economic operators. Having different national policies on the management of WEEE hampers the effectiveness of recycling policies.

Another central element in the WEEE Directive is that Member States have to collect and environmentally process a minimum amount of WEEE per year. In the WEEE Directive 2002/96/EC, the collection target for WEEE was to collect 4 kg/inh per year from private households [4]. The recast of the WEEE Directive 2012/19/EU introduced gradually increasing collection targets to countries applicable from 2016 and 2019 [4][5]. The EU required that the collection target be equivalent to 45% of all EEE (household, businesses, and public sector) placed on the market (POM), taken as an average of the previous three years, between 2016 and 2018. Beginning in 2019, the minimum collection target to be achieved annually shall be either 65% of the average weight of EEE POM in the three preceding years in the Member State concerned or 85% of WEEE Generated in the territory of that Member State.

Figure 1

Timeline of implementation of the European WEEE Directive 2002/96/EC based on the European Commission and WEEE Directive 2012/19/EU



From 2019 forward, the most stringent collection target was enacted in most EU Member States, and the WEEE Forum members have identified extreme difficulties in reaching the targets in nearly all Member States. The quantitative analysis in this study will be performed based on the most recent available data, mostly from 2017 or 2018, and it is assumed that the data largely resembles WEEE management in 2019, when the collection targets were officially enforced. In light of this, the WEEE Forum commissioned UNITAR to undertake this study, which includes:

- Analysis and review of the current situation in each country;
- In-depth review of the methodologies for target-setting as provided by the WEEE Directive;
- Collation and analysis of the factors that influence the collection rates being achieved, in order to picture the actual WEEE management scenarios across Europe and draw options for future improvement.

Specifically, this study aims to:

- Gather the most up-to-date WEEE data, information, and intelligence at the country level.
- Evaluate the feasibility of achieving the collection set in accordance with the WEEE Directive in each Member State and calculate the distance to target.
- Improve the understanding of the underlying challenges in meeting the collection target in 2019 and beyond.
- Identify common cross-cutting issues that prevent achievement of the collection targets.
- Improve understanding of the pros and cons of the EEE POM methodology and the WEEE Generated methodology against which the collection target is identified.
- Understand the benefits and drawbacks of specific collection targets.
- Recommend measures and concepts in order to improve collection performance in Europe and open the door to different possibilities for setting targets than those currently implemented.

The report is structured as follows:

- **Chapter 2** provides an overview of the methodologies and data sources that were used in the study.
- **Chapter 3** provides an overview of the current WEEE collection rates and the distance to target for the countries in the EU-28, Switzerland, Iceland, and Norway.[3]
- **Chapter 4** describes and quantifies the factors affecting collection rates across the countries. This includes an analysis of:
  - other WEEE flows (i.e. WEEE in waste bins, WEEE of mixed metal scraps, illegal WEEE exports)
  - exports of used-EEE for reuse
  - the impact of the economy and business cycles on WEEE
  - the effects of behavioural aspects, such as hoarding and reuse, on WEEE
  - business to business (B2B) WEEE collection
  - the impact of the national implementation of the WEEE Directive, such as the use of the 'all actors' approach, mandatory handover, the use of substantiated estimates, use of clearing houses, enforcement, and the WEEE target-setting in the countries.
- **Chapter 5** reviews the methodology for calculating the EEE POM and WEEE Generated collection targets.
- **Chapter 6** offers recommendations on how to increase the amount of WEEE collected and new options for target-setting.
- **Chapter 7** provides the country profiles for selected countries. The country profiles give an overview of the country's WEEE management, key statistics, and a description of the implementation of the WEEE legislation.

Figure 2
Structure of the report

[3] The United Kingdom was a member of the EU until 2019, and in 2020, the Directive targets are still enacted until such time as new UK legislation supersedes them.

Chapter 2. Methodology

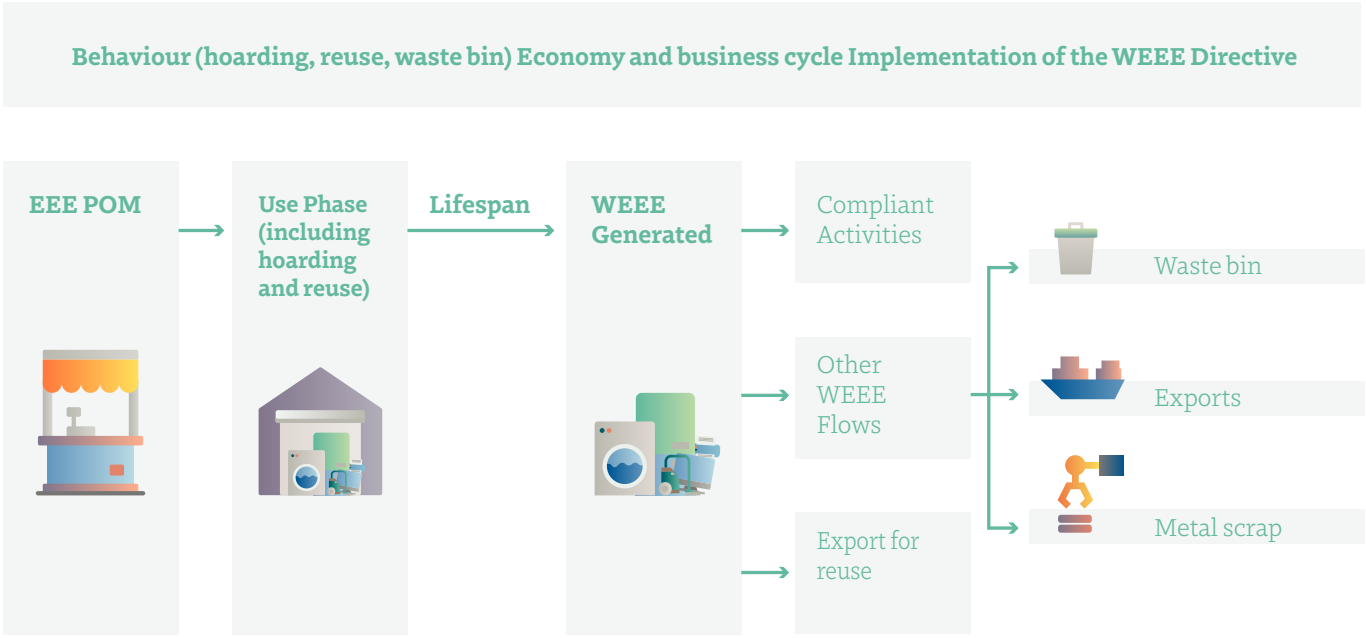
The methodology used in this study, the WEEE flows methodology, reviews and assesses the impact that various WEEE implementation strategies within countries have had on WEEE collection. The WEEE flows methodology is based on a mass balance approach and follows the same principles as the internationally harmonised framework for measuring e-waste statistics – which has been developed by the Partnership for Measuring ICT for Development and which has been a joint effort by the United Nations University, Eurostat, and other UN agencies [6][7]. It uses published data of EEE POM and WEEE collected, a literature review, and information obtained from surveys of WEEE Forum members and official representatives of the Working Group on Waste Statistics at Eurostat.

2.1. Measurement framework of WEEE statistics

The WEEE Flows framework is shown in Figure 3 and is based on calculating a country's total mass balance of EEE and WEEE. The framework describes the stocks and flows of EEE and WEEE. The mathematical model is constructed in such a way that the mass balances of stocks and WEEE flows are consistent with each other and allow for cross-country comparison.

Figure 3

Measurement framework for WEEE Flows



The measurement framework follows the actual life cycle of a unit of EEE and considers all factors that affect each of the life stages, as shown in Figure 3. First, the method accounts for the quantities of EEE Placed on Market (POM). When the equipment has been placed on the market, it stays in households, businesses, or the public sector. This stage is the use phase, and it includes the items that are in hibernation or hoarded. After a certain 'lifespan', which varies from product to product, the good is disposed of and becomes waste. The lifespan includes both second-hand reuse and the hoarding time of the equipment.

The moment the equipment is disposed of, it becomes WEEE Generated, and it is domestically generated WEEE prior to its collection. After that, the WEEE flows are described and quantified for 'compliant recycling' activities, other WEEE flows (including WEEE ending up in waste bins, illegal exports for WEEE, and WEEE mixed with metal scrap), and used-EEE that are exported.

The calculations of EEE POM and WEEE Generated are performed on the basis of the UNU-KEYS, which is a product categorization that comprises 54 products. This categorization can directly be grouped into the 6 or 10 Categories of the WEEE Directives 2002/96/EC and 2012/19/EU. The UNU-KEYS are constructed such that product groups share comparable average weights, material compositions, end-of-life characteristics, and lifespan distributions. The UNU-KEYS classification is an ideal link between the EU categories and the existing classifications. Compliant and other WEEE flows, including exports for reuse, were characterised with categories 6 and 10 in the WEEE Directive. The UNU-KEYS are used by the European Union to perform EEE POM and WEEE Generated calculations, as laid down in the implementing regulation 2017/699/EC, the so-called 'common methodology'. The descriptions of the UNU-KEYS categories and the corresponding tables are listed in ANNEX I: Correlation Tables.

The relation between the EEE POM, WEEE Generated, and the WEEE Flows is further analysed for behavioural aspects, such as hoarding and reuse, economy and business cycles, and the characteristics in the implementation of the WEEE directive in a country (the top box in Figure 3). The latter includes the 'all actors' approach, mandatory handover, substantiated estimates, clearing houses, and the WEEE target-setting in a country.

2.2 Definitions and concepts

For better comprehension of this report, description of the terminology used is provided:

Electrical and electronic equipment (EEE) means any household or business item with circuitry or electrical components with power or battery supply [8]. In the EU, it is defined as all electrical and electronic equipment that falls under the scope of the WEEE Directive, with some specific exemptions such as filament bulbs and large-scale fixed installations, etc.

The terms 'e-waste' or 'electronic waste' are an abbreviation of 'waste electrical and electronic equipment' (WEEE). The word 'waste' means that the item has been discarded by the owner. The definition of e-waste that has been agreed on by the StEP Initiative is as follows: 'E-Waste is a term used to cover items of all types of EEE and its parts that have been discarded by the owner as waste without the intention of re-use' [8].

In the EU's WEEE legislation, **WEEE Generated** refers to the total weight of WEEE resulting from EEE, within the scope of Directive 2012/19/EU, that had been placed on the market of that Member State, prior any collection activity such as collection, preparation for reuse, treatment, or recovery, including recycling and export [5][9]. The mathematical descriptions of WEEE Generated are explained in ANNEX 2.

The **compliant collection** activities are performed under the requirement of national WEEE legislation, in which WEEE is collected by designated organisations. This is further referred to in this report as **WEEE Collection** or **WEEE collected**. Collection mostly happens via retailers, municipal collection points, and/or pick-up services provided by the municipality. The final destination for the WEEE is a compliant treatment facility, which recovers the valuable recyclable materials and reusable components and treats other materials in an environmentally sound way. The data on compliant recycling includes exports but excludes imports. Thus, in practice, the WEEE can finally be treated in a facility in the same country, but can also be exported.

Given the complexity of WEEE flows, and on the basis of Article 16(4) in the recast of the WEEE Directive, Member States may opt to use **substantiated estimates** of WEEE collected through all routes to demonstrate (or to help them demonstrate)

the achievement of the collection targets outlined in Article 7(1). Substantiated estimates must be supported by independent scientific methodologies and based, as much as possible, on real market data. The data on substantiated estimates are part of the official Member States' reporting for the WEEE Directive and are therefore included in the compliant collection data.

Open scope means that EEE products are a priori considered to be in scope unless specific exclusions are applied.

The **minimum collection rate** is defined in article 7 of the WEEE Directive. It can be calculated using two methodologies. The minimum collection rate to be achieved annually by a Member State shall be either 65% of the average weight of EEE POM in the three preceding years or 85% of WEEE Generated on the Member State's territory. The collection target is the minimum collection rate established as the Member State's target, which is currently equal to minimum collection rate in all cases. In this report, only the term 'collection target' is used, as opposed to minimum collection rate.

The **collection rate** equates to the actual quantities collected by a Member State divided by either the average weight of EEE POM in the three preceding years or the WEEE Generated. The collection rate is an indication of the progress made toward achieving the collection target.

The **'other WEEE Flows'** include collection, dismantling, and recycling that takes place outside the compliant take-back systems. These flows could be:

- **WEEE mixed with metal scrap,** which is then recycled together with the metal scrap, or WEEE mixed with metal scrap that is exported. This WEEE management ranges from illegal and rudimentary scrapyards and metal merchants to more sophisticated, large-scale, permissible end-of-life vehicle shredders. The WEEE is not separately registered, and not all shredders are licensed to process WEEE.
- **WEEE** that is **illegally exported**, which is WEEE that is wrongly classified as reusable EEE and exported for reuse purposes, though formally WEEE. But such waste can also be comprised of direct, illegal exports of WEEE.
- WEEE that is discarded together with municipal mixed residual waste (i.e. in normal **waste bins**). In this case, consumers (i.e. private households, enterprises, and public authorities) directly dispose of WEEE in normal waste bins with other types of household waste. Consequently, the discarded WEEE is then treated with regular household and business/office mixed-waste. This WEEE is most likely incinerated or landfilled.

Second-hand products can be exported to other countries. Such products have entered the national market, but cannot be collected in the country and will not become WEEE Generated. These import and export flows also need to be documented to create the national mass balance of WEEE. These flows are referred to as **exports for reuse**.

The **lifespan** of a product is the period of time from when the product has been placed on the market until it becomes WEEE. This includes the passing on of equipment from one owner to another **(reuse)** of the items, the time in hibernation of the equipment prior the actual discard moment, and the hibernation/**hoarding** time of equipment. This report uses the terms lifespan consistently, and could be the same as residence time or lifetime. However, these words may have other definitions and could be interpreted differently by producers, researchers, waste managers, policymakers, and the general public.

Some countries use the legal instrument of **mandatory handover**, where retailers or waste collectors must hand over the collected WEEE to compliant recyclers or to formal take-back systems. Mandatory handover can occur with or without financial compensation.

The **'all actors' approach** is a policy model which includes all natural and legal persons that have legal responsibilities in WEEE management, are handling WEEE (collection, logistics, preparation for reuse, refurbishment, treatment of WEEE), monitor WEEE, legislate and enforce WEEE legislation. All actors are obligated to abide by the WEEE Directive (such as on compliance, monitoring, and reporting) [5], [9]-[11] and work towards the common goal of responsible WEEE operations and transparent monitoring. The exact implementation varies between Member States.

A **clearing house** is an entity responsible for the allocation of responsibility between all producers. It can also coordinate the financial clearing between the producers and the collectors and recyclers of WEEE. The management and arrangements of the clearing house depend on the country and could range from public to private initiatives. Sometimes, clearing houses exist for assigning individual shares of collection to compliance schemes and recyclers.

2.3 Data sources

The WEEE Directive requires Member States to collect information, including substantiated estimates, on an annual basis – based on the quantities and categories of EEE placed on their markets, collected through all routes, prepared for re-use, recycled and recovered within the Member State, and on separately collected WEEE exported, by weight. The data has been downloaded from both the Eurostat WEEE Directive Reporting for EEE POM and the WEEE collection in April 2020, and it includes data up to 2017. The time period has been extended to 2018 with the data from the WEEE Forum Key Figures from the WEEE Forum if data was available and if the 2017 data from the WEEE Forum Key Figures was consistent with Eurostat data for the 2017 data point. The consistency was checked by comparing the totals of the WEEE collected in the WEEE Forum Key Figures and the total of WEEE collected from Eurostat in the last year when both data were available. It was regarded as consistent if it deviated by less than 5%. The 2018 data point was also adjusted for the deviation. Furthermore, whether the 2017 or 2018 data points were unusual years was also verified.

The EEE POM from the apparent consumption methodology was used for the WEEE Generated calculations. Both EEE POM and the WEEE Generated were obtained from internal datasets from the SCYCLE team via the Global E-waste Monitor [1]. Apparent consumption has been calculated by adding together the domestic production and imports and subtracting the exports. For the EEE POM collection target calculations, the official WEEE Directive data reported to Eurostat has been used.

The analysis of collection targets was carried out on most recent available data, mostly from 2017 or 2018, and it is assumed that the data largely resembles the WEEE collection in 2019, when collection targets were officially enforced.

The time series of EEE POM from PV panels has been made using Eurostat's renewable energy statistics. The yearly changes of the installed capacity of PV has been converted into kg by using the same conversion factors in the common methodology study [12].

The WEEE flows data have been primarily obtained from 'Prospecting Secondary raw materials in the Urban mine and Mining wastes' (ProSUM Project) and supplemented with more recent data from recent country studies in France [13], United Kingdom [14] and [15], Belgium [16], the Netherlands [17], and Romania [18]. The data of WEEE collection and the WEEE flows were calculated to 2018 in some instances by retaining the percentage compared to WEEE Generated.

The different WEEE Directive implementation and reporting practices have been obtained via questionnaires with fifteen WEEE Forum Members and through consultations with Eurostat and the Member States. These questionnaires and consultations focused on the use of substantiated estimates, the 'all actors' approach, clearing houses, visible fees, mandatory handover, target implementation, and enforcement. Additional information on the WEEE flows has been obtained from questionnaires with the WEEE Forum Members and through consultations with Eurostat and the Member States.

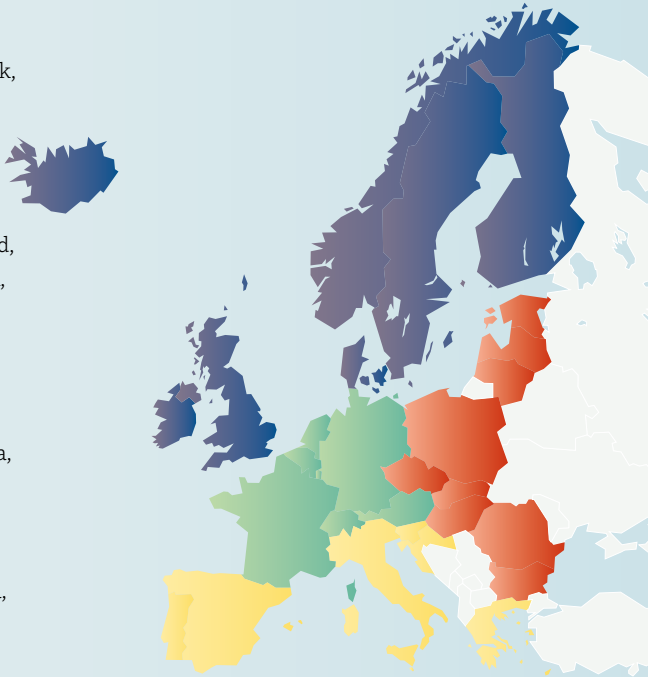
The countries were allocated into four groups, based on geography and WEEE management characteristics, as included in the below map.

Northern Europe:
Ireland, Finland, Sweden, Denmark, United Kingdom, Norway, and Iceland.

Eastern Europe:
Bulgaria, Czechia, Hungary, Poland, Romania, Slovakia, Estonia, Latvia, and Lithuania.

Western Europe:
Belgium, Germany, France, Luxembourg, Netherlands, Austria, and Switzerland.

Southern Europe:
Spain, Croatia, Italy, Cyprus, Malta, Portugal, Greece and Slovenia.



Chapter 3.
Distance to target analysis

3.1 EEE POM, WEEE Collection, and WEEE Generated

The changes to EEE POM between 2010 and 2018 are shown in Figure 4. The following observations are made:

- For all regions, the EEE POM declined in the first half of the decade and increased in the second half of the decade. Total EEE POM in Europe was 22.1 kg/inh in 2010, which decreased to 19.1 kg/inh in 2013. From there, it increased to 23.9 kg/ inh in 2018.
- The impact of the financial crisis on the EEE POM was the largest for Southern Europe, which caused the EEE POM to decrease from 21.9 kg/inh in 2011 to 13.6 kg/inh in 2014.
- In 2018, EEE POM was highest in Western Europe with 30.4 kg/inh, followed closely by Northern Europe with 28.2 kg/inh.
- The EEE POM excl. PV panels in Western Europe and Northern Europe are close to each other, i.e. 28.3 kg/inh and 27.7 kg/inh, respectively.
- The EEE POM is lowest in Eastern Europe, but it shows a steady growth in recent years and reached 15.7 kg/inh in 2018.

Figure 4
EEE POM from 2010 to 2018

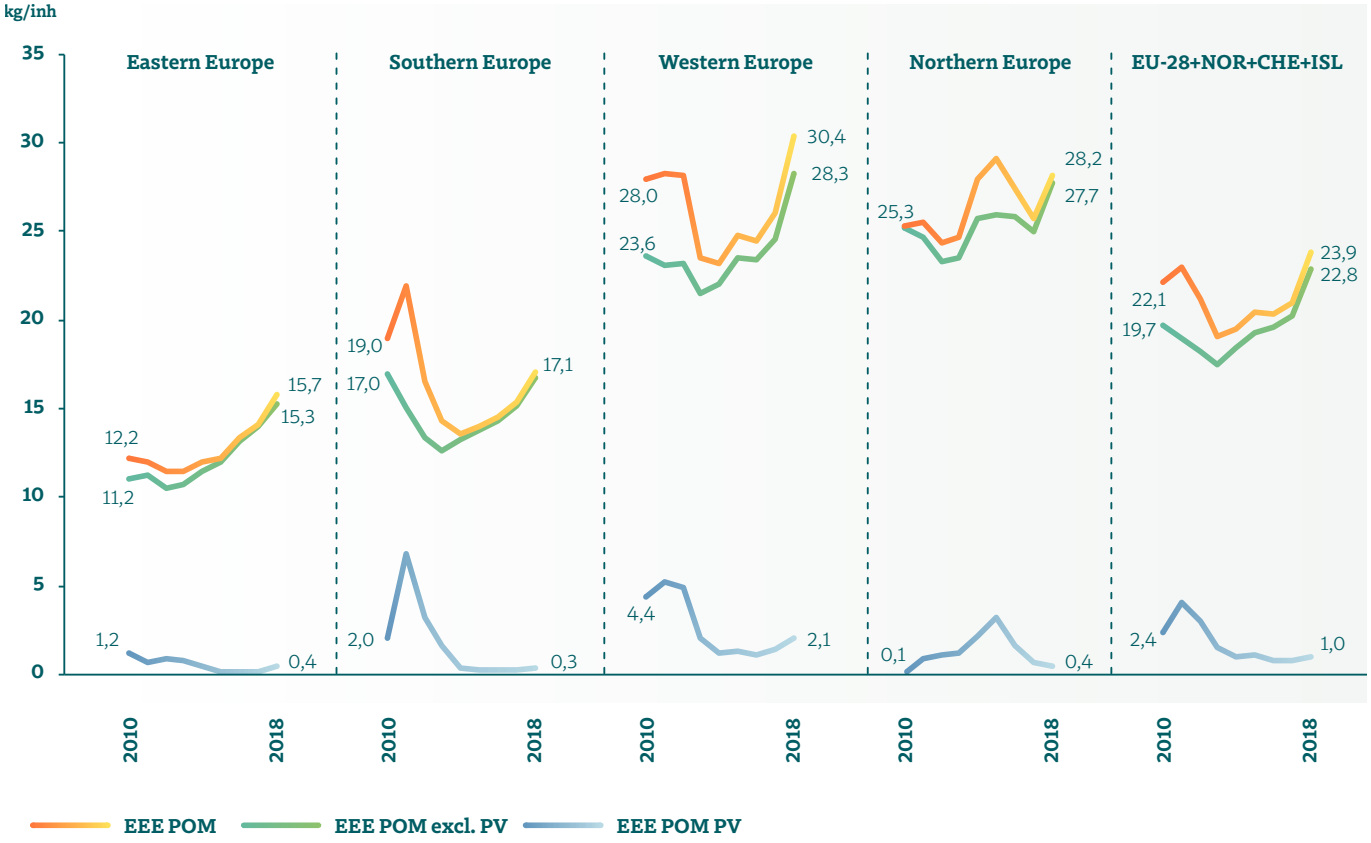


Figure 5

WEEE Generated, WEEE collection, and EEE POM excl. PV panels from 2010 to 2018

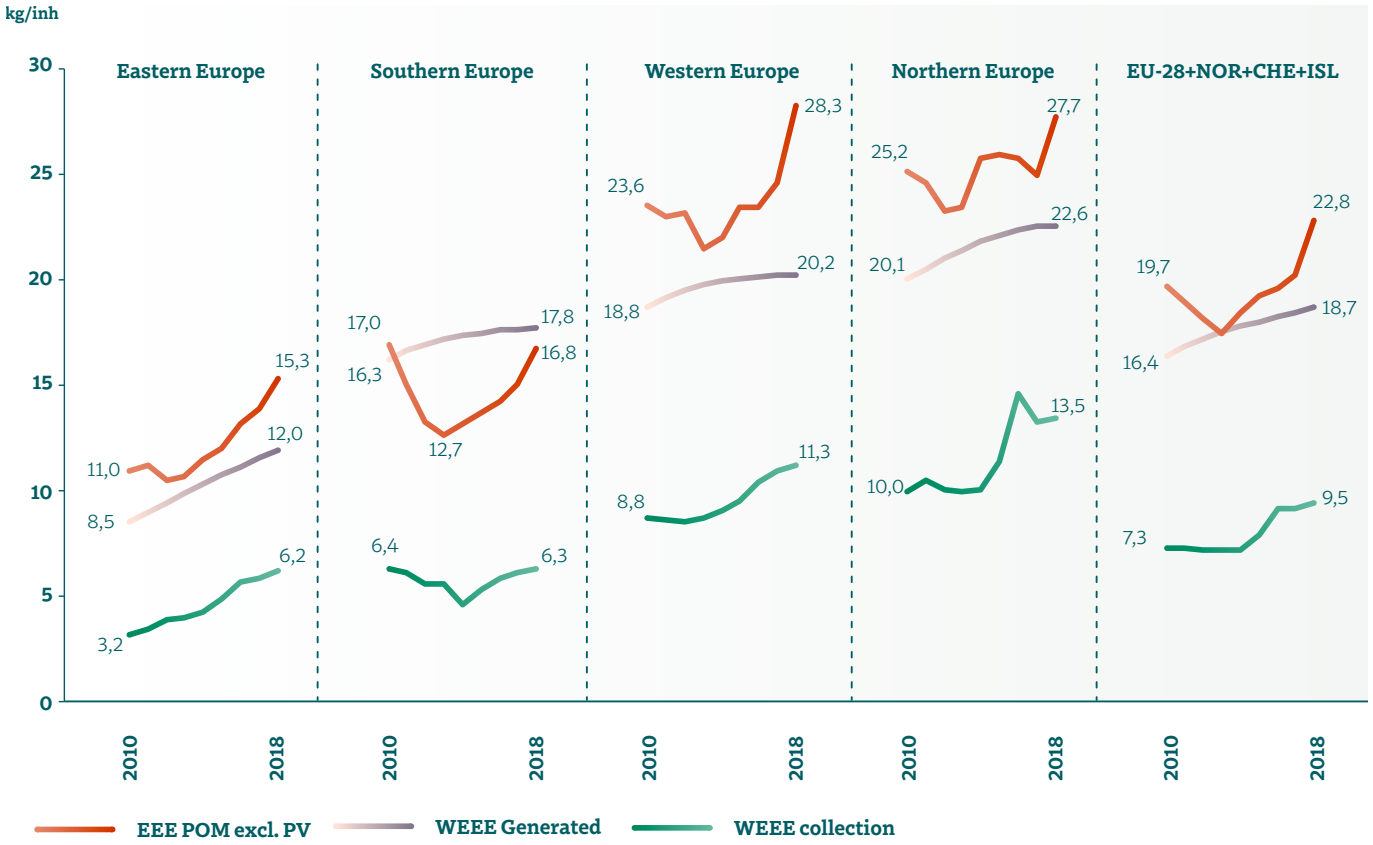


Figure 5 shows the WEEE Generated, EEE POM excl. PV Panels, and the WEEE Collection from 2010 to 2018. The following observations are made:

- From 2010 to 2018, the amount of collected WEEE has increased from 7.3 kg/inh in 2010 to 9.5 kg/inh in 2018. The WEEE collection was stable through 2014 and showed growth in the second half of the decade, reaching 9.5 kg/inh in 2018.
- The collection of WEEE was highest in Northern Europe and was as much as 13.5 kg/inh in 2018.
- Eastern Europe has shown remarkable progress, as it has nearly doubled the amount of WEEE collection over the time period, reaching 6.2 kg/inh in 2018.
- The WEEE Generated shows a stable growth in all regions in Europe from 2010 to 2018. On average, it grew from 16.4 kg/inh in 2010 to 18.7 kg/inh in 2018.
- The WEEE Generated is highest in Northern Europe (22.6 kg/inh). The region with the lowest WEEE Generated is Eastern Europe with 12.0 kg/inh in 2018.

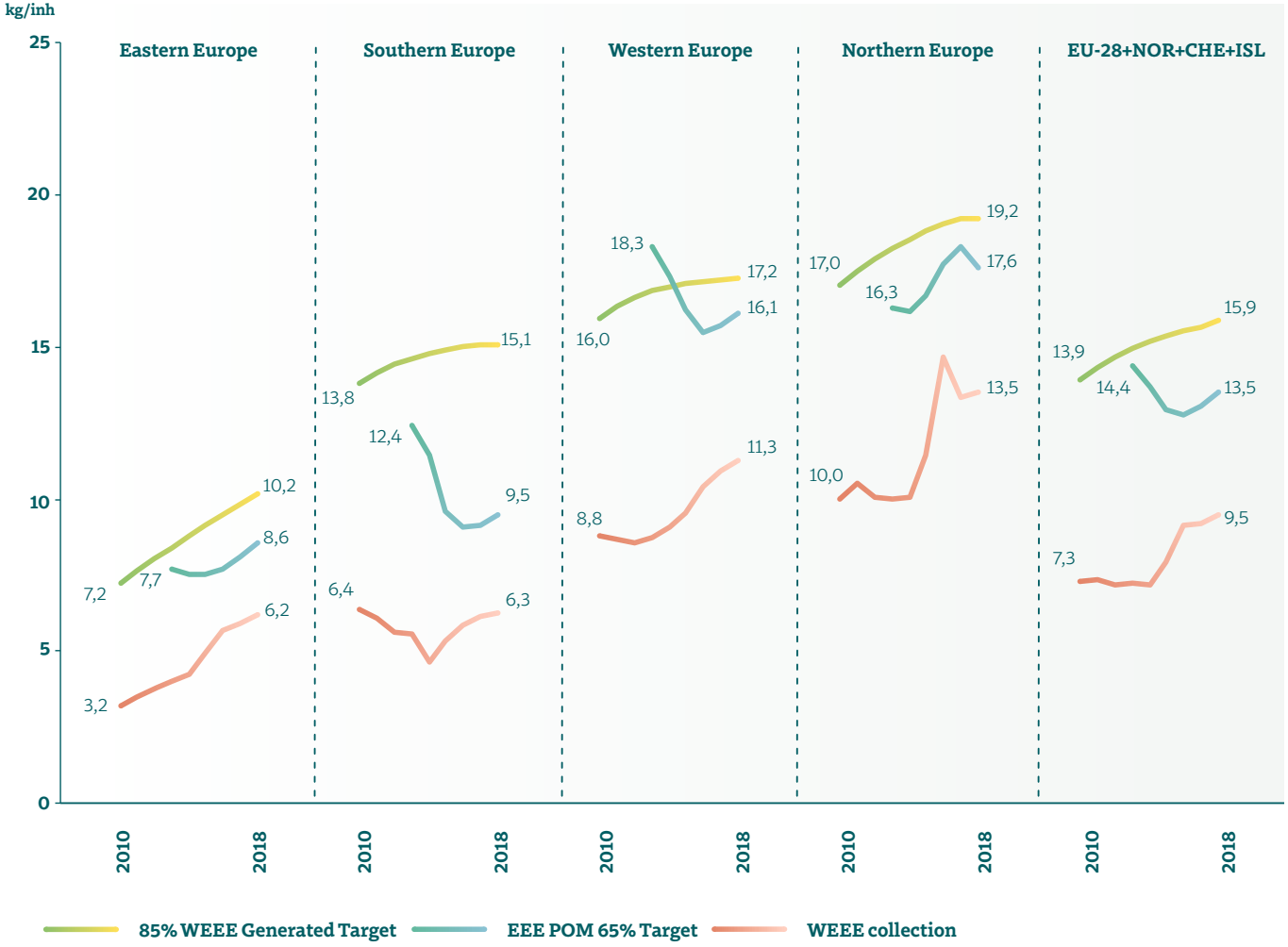
3.2 Collection targets

The target for WEEE collection to be achieved annually by a Member State starting in 2019 shall be either 65% of the average weight of EEE POM in the three preceding years or 85% of WEEE Generated on the territory of a Member State (set by the Directive).[4] The Member State is able to choose between the POM or the WEEE Generated target. The POM and WEEE Generated targets are shown against WEEE collected as regional averages in Figure 6. The collection target calculated with the 65% EEE POM methodology (on average: 13.5 kg/inh) is lower than the collection target calculated with the 85% WEEE Generated methodology (on average: 15.9 kg/inh). Thus, it can be concluded that the targets as set by the methodologies given in the WEEE Directive for WEEE Generated and EEE POM are not equivalent. In Southern Europe, the total EEE POM is lower than the WEEE Generated. This differential leads to a lower EEE POM target. For the other regions, the EEE POM is higher than the WEEE Generated, but the difference is not significant, meaning that the EEE POM-based collection target is lower than WEEE Generated-based collection target.

Figure 6 also shows that the EEE POM target is more dynamic over time than the WEEE Generated target, which is based on a distribution model and consequently generates smooth trends. Practically, targets based on WEEE Generated will be always smoother than EEE POM-based targets. EEE POM-based targets can vary year-to-year as much as 1.9 kg/inh (in extreme cases), but annual fluctuations of the target of 0.5 to 1.0 kg/inh are certainly common. The WEEE Generated based targets, by contrast, are more stable and show year-to-year growth rates of 0.2 on average, varying from 0.1 to 0.4 kg/inh per year in Western Europe and Eastern Europe, respectively. Figure 6 shows that collection of

Figure 6

85% WEEE Generated target, 65% EEE POM target, and WEEE collection



WEEE is far below the 65% EEE POM target. The analysis of the collection targets was performed according to the most recent available data, usually from either 2017 or 2018. It is assumed that the data largely resembles the WEEE collection in 2019, as the annual changes in WEEE collection are significantly lower than the distance to the target. Though 2019 collection data became available for some PROs during the writing of this report, at the moment when the calculations were performed for this study, it seemed impossible to reach the collection targets set by the WEEE Directive for 2019.

[4] For 2019, some countries have a derogation and must collect a lower percentage than 65% of EEE POM, such as Lithuania (60%), Malta (55%), Poland (55%), and Romania (45%). Those countries have to raise the collection target to 65% from 2021 on.

The distance to the 65% EEE POM target is, on average, 3.9 kg/inh (see Table 1). For the 85% WEEE Generated target, it is 6.4 kg/inh.

Table 1
Distance to the collection target in 2018

2018		EU-28, Norway, and Iceland	Northern Europe	Western Europe	Southern Europe	Eastern Europe
WEEE Collection		9.5	13.5	11.3	6.3	6.2
Collection target (kg/inh)	85% WEEE Generated	15.9	19.2	17.2	15.1	10.2
	65% of average EEE POM three preceding years	13.5	17.6	16.1	9.5	8.6
Distance to collection target (kg/inh)	85% WEEE Generated	6.4	5.7	6.0	8.8	4.0
	65% of average EEE POM three preceding years	3.9	4.1	4.8	3.2	2.4

Distance to 65% EEE POM target.

EU-28, Norway, and Iceland: **3.9 kg/inh**

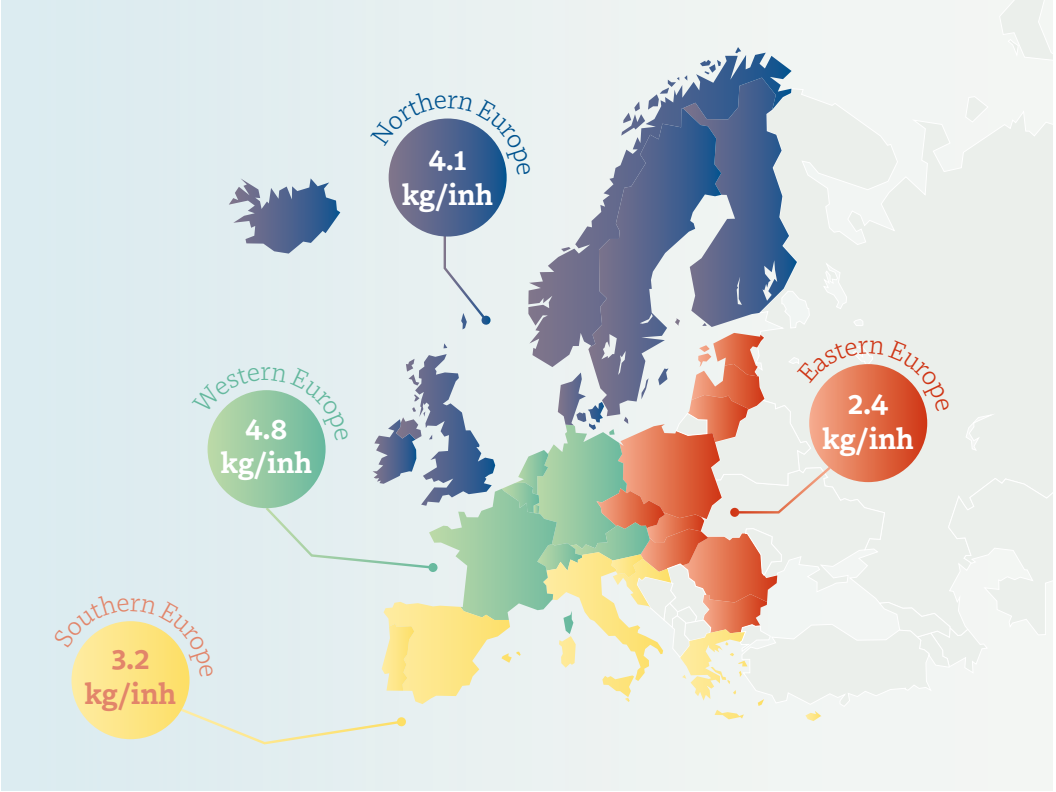


Figure 7 shows the target achieved per country relative to the target achieved by using the EEE POM calculation methodology. The detailed data per country is provided in ANNEX 3. There are three countries that reach the EEE POM collection target of 65%: Switzerland at a 68% collection rate, Bulgaria at 79%, and Croatia at 82%. Below them, a large group of countries follow, from Hungary at a 61% collection rate to Slovenia at 40%. The three countries with the lowest collection rates are Romania, Cyprus, and Malta.

Figure 7

Overview of collection rate compared to EEE POM of three preceding years for Member States of the EU-28, Switzerland, Iceland, and Norway

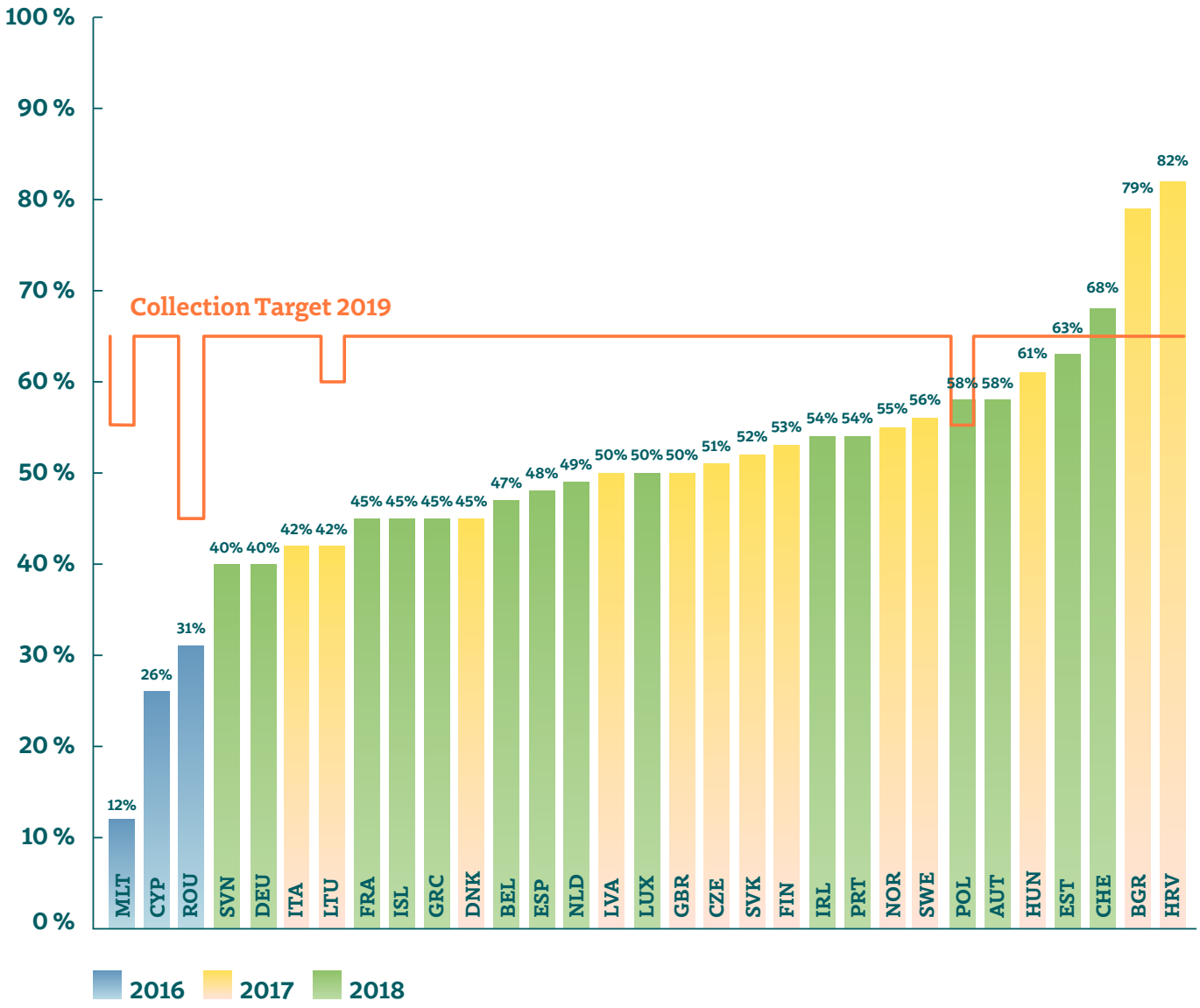
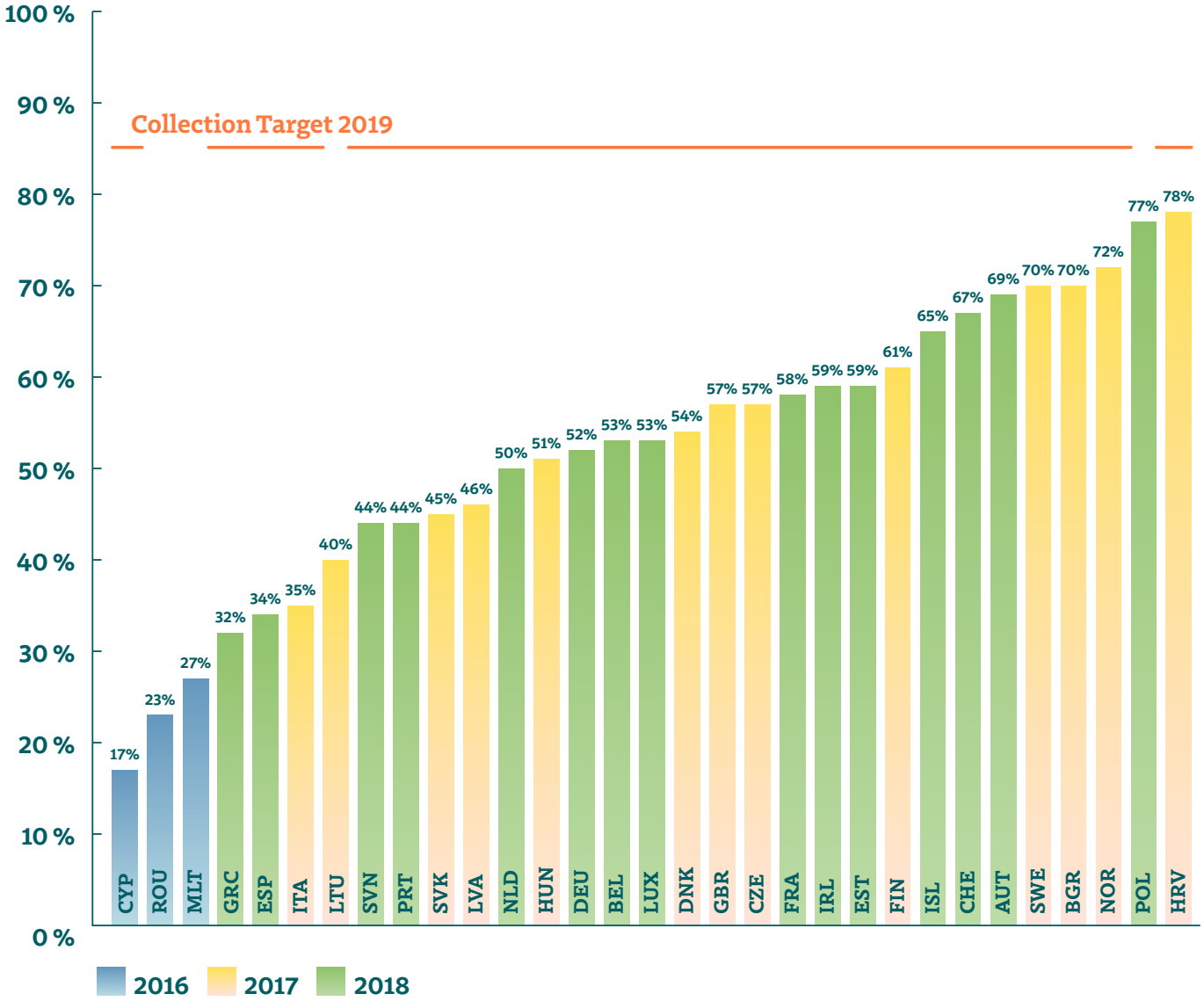


Figure 8 shows the collection rate against the WEEE Generated target. None of the countries can reach the WEEE Generated target of 85%. The countries with the three highest collection rates are Croatia with 78%, Poland with 77%, and Norway with 72%. The data is provided in ANNEX 3.

Nota bene, we have observed an underlying trend regarding the inability of Member States to meet the 2019 targets, which is corroborated by the WEEE Forum members in those countries. When there are examples of countries that reach the targets, they seem to contradict both the overall trend reported and the underlying factors observed across the rest of the EU. Besides the official government data, there are no additional public reports or underlying information available for better understanding the increased collection, but such exceptions are worthy of further investigation.

Figure 8

Overview of collection rate compared to WEEE Generated for Member States of the EU-28, Switzerland, Iceland, and Norway



Chapter 4.
Analysis of factors affecting WEEE collection

This chapter discusses, and quantifies where possible, the factors that influence the collection rate, including the other WEEE flows, various implementation models of WEEE legislation, analysis of behaviour and economic factors, and a final synthesis of factors affecting WEEE collection.

4.1 Other WEEE flows

Across the globe and in the European Union, a large share of the WEEE flows are undocumented, and the most important flows in terms of physical quantities are WEEE mixed in metal scrap, WEEE in waste bins, WEEE exports, and exports of used-EEE [1], [19]. Those flows are quantified on the following pages.

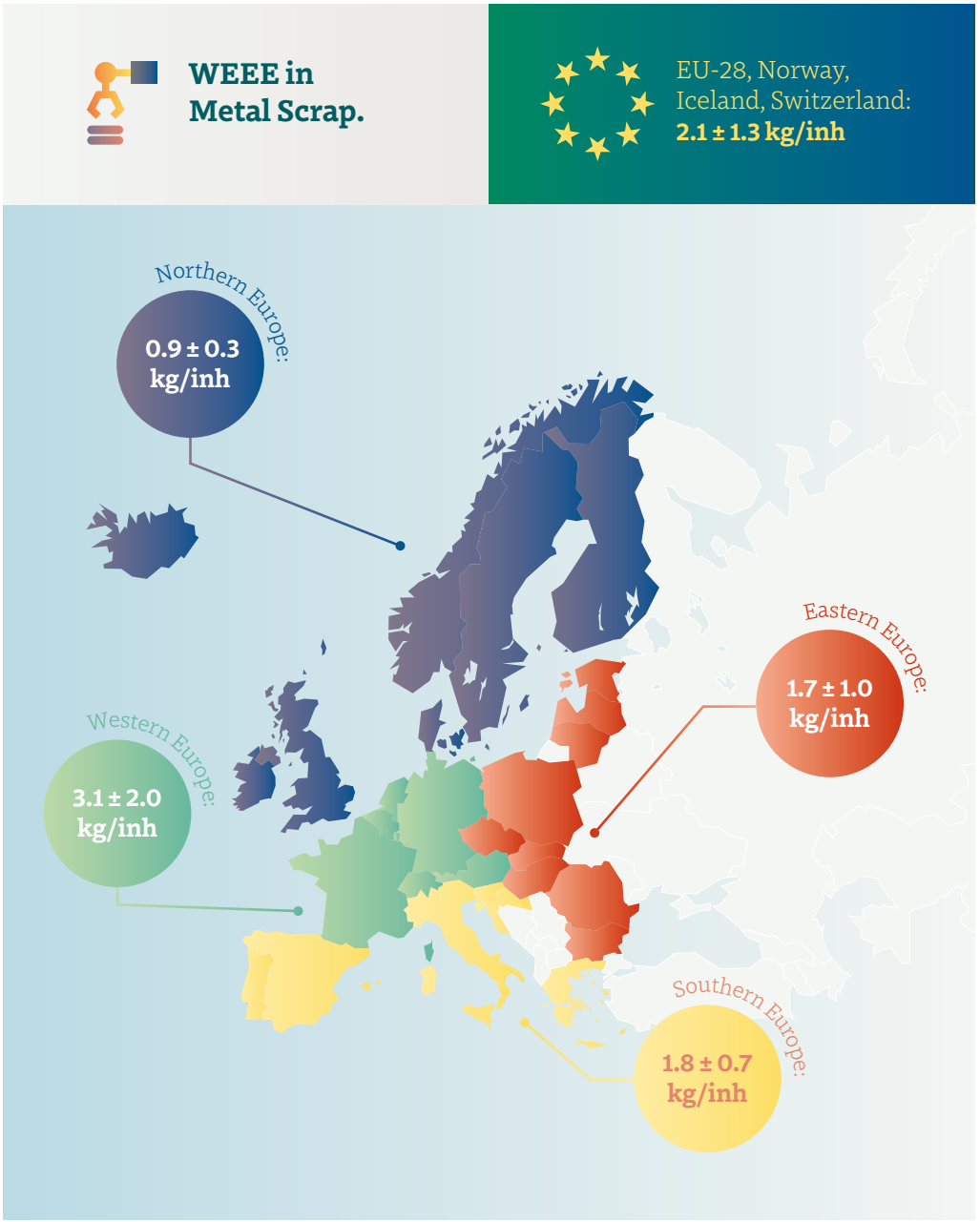
4.1.1 WEEE mixed in metal scrap

WEEE is often collected and mixed in with metal scrap. In such cases, it is recorded in waste statistics as metal scrap, instead of WEEE. There are a variety of operations dealing with scraps, from illegal and rudimentary scrapyards and metal merchants, on the one hand, to more sophisticated, large-scale permitted end-of-life vehicle shredders on the other. The types of WEEE found in metal scraps are mostly large and metal-rich WEEE, such as large equipment and temperature exchange equipment, but other categories can be mixed with metal scrap too. Some WEEE mixed in metal scrap can be also exported to other countries for processing. Consequently, there are varying extents to which WEEE is recycled, including legally, non-compliantly, and illegally. Some PROs have indicated that the collection of WEEE by metal scrap dealers depends on the metal scrap prices. If prices go up, more is to be collected by metal scrap dealers. Collecting data on the amount of WEEE in scrap metal is problematic, since legal and illegal actors have no mandatory role to report.

A small number of studies have recently quantified this flow. They indicate that from 2.8 kg/inh of WEEE in Belgium – of which 2.1 kg/ing is mixed with metal scrap and 0.8 kg/inh is exported [16] – to as much as much as 5.8 kg/inh of WEEE in the Netherlands can be found in mixed metal scrap, recycled in the Netherlands, or exported [17]. Slightly older research from the Horizon 2020-funded 'Prospecting Secondary raw materials in the Urban mine and Mining wastes' (ProSUM) project indicates that the range in European countries is from 0 kg/inh in Switzerland to 4.2 kg/inh in Denmark [19]. The ProSUM project could not assess the WEEE mixed in metal scrap for Finland, Iceland, Sweden, and Norway. For the other EU countries, very few empirical studies were available. A conservative estimate has been used in the ProSUM project for estimating the amount of WEEE in metal scrap in missing countries where no data was available. The WEEE in metal scrap is summarized below. The average is accompanied with a standard deviation that is calculated from the countries' individual data points. The relatively large standard deviation indicates that the data varies across the countries. In instances when WEEE mixed in metal scrap is treated according to equivalent standards to dedicated WEEE treatment facilities and reported as a substantiated estimate, the information is not included in the WEEE in the metal scrap total in order to avoid double-counting with other flows.

Infographic 1

WEEE in Metal Scrap



4.1.2 WEEE in waste bins

WEEE is also often disposed of by households, enterprises, and public institutions into waste bins, thus entering into the mixed residual waste. It is then managed with mixed waste and most likely either incinerated or landfilled in Europe – though, in some cases, it may travel via a transfer station to a Materials Recycling Facility, where a range of recyclable waste is separated out. In such cases, WEEE would be expected to be recycled with metal scraps. WEEE in household waste bins are mostly comprised of small equipment, small IT and lamps, and occasional larger items, such as laptops. This data can be collected by using household surveys, in which the households are asked to report on their disposal behaviour, or by taking a representative sample of mixed residual waste and quantifying the weight of the WEEE present. The average amount of WEEE in waste bins is summarized below and is taken from the ProSUM project; it has been updated where more recent data was available. The ranges shown indicate the standard deviation, calculated from the countries' individual data points.

Data quality

The methodology for quantifying the other WEEE flows is not always comparable between countries. In some cases, the methodology uses household surveys, business surveys, or a physical sample of a waste stream. In some cases, recent data was not available for a country and had to be taken from older reports. Nonetheless, the overall mass balances of the WEEE flows were checked and are consistent for each country. As well, the data of the survey's findings agree with the WEEE Forum Members, thus indicating that the findings are representative of the countries' WEEE management.

Infographic 2

WEEE in Waste Bin

4.1.3 Used-EEE exported for reuse

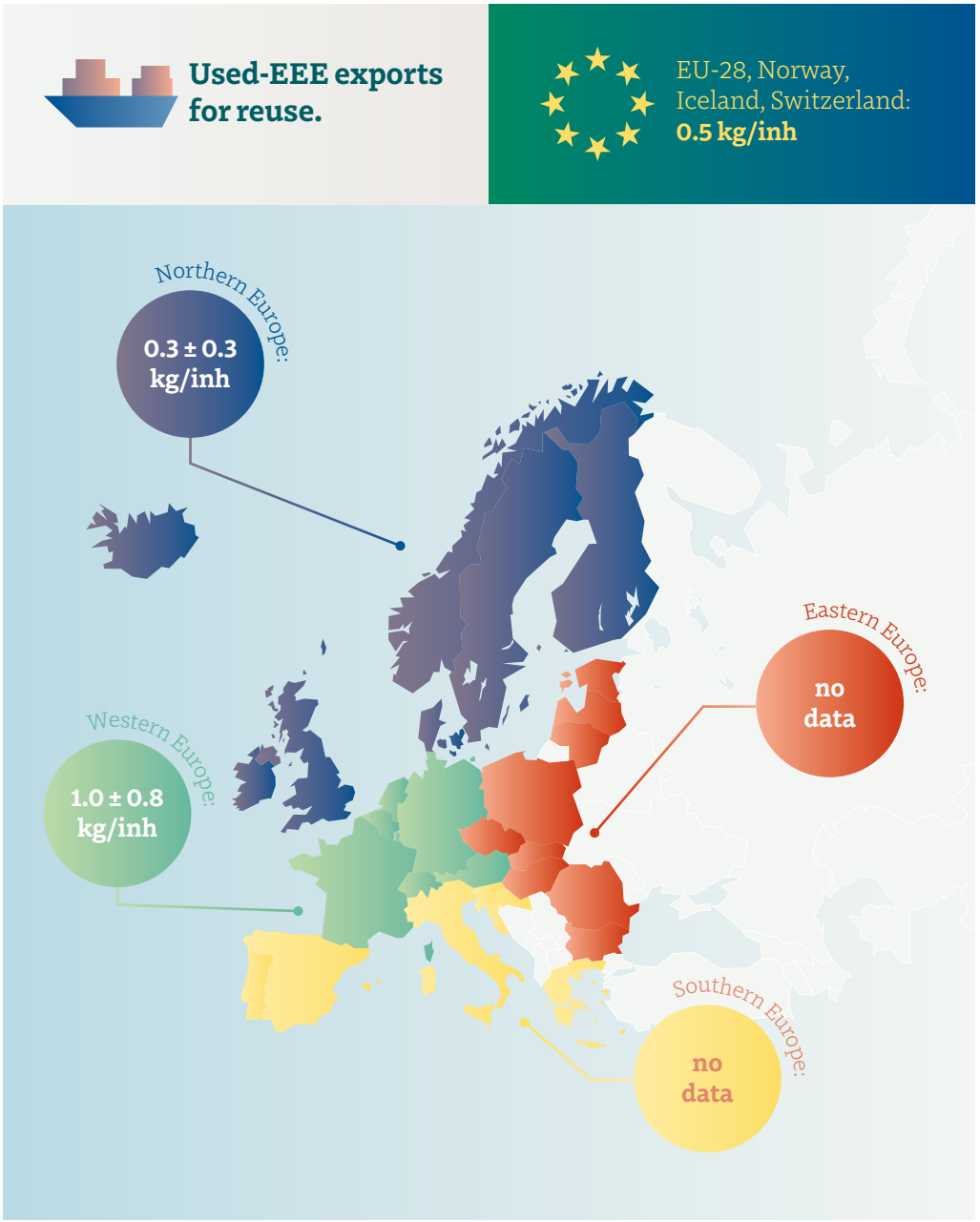
Used-EEE, or second-hand products, are sometimes exported to other countries and, therefore, do not become WEEE in the country of origin. However, the calculation methodology for the collection target is based on the EEE POM or WEEE Generated and unfairly includes the EEE POM of the exported used-EEE. Therefore, these used-EEE exports need to be documented, and imports of used-EEE should also be counted as EEE POM in the receiving country.

In Northern and Western European countries, the used-EEE exports mostly consist of B2B equipment – such as servers, main frames, printers, or medical devices – but also include automatic dispensers; power generators that are likely to undergo a functioning check are likely to be refurbished. However, exports for reuse also include more common household-related EEE, such as fridges and microwaves, phones, and laptops. Some of these exports may be shipped to Western Africa in consignments mixed with broken equipment, and these flows should be considered as illegal exportation of WEEE [20].

Swedish authorities indicated via correspondence that exportation of EEE for reuse is one of the factors leading to a decrease in the WEEE collected in Sweden – from 18.4 kg/inh in 2013 to 14.1 kg/inh in 2017 – but authorities could not produce exact figures on the exports for reuse. Recent studies in Belgium and the Netherlands show that, respectively, 1.5 and 1.8 kg/inh of used-EEE are exported for reuse [16], [17]. In the United Kingdom, exports for reuse were recently assessed to be 0.24 kg/inh (16 kt) [15]. In France, preliminary estimates from a 2018 study for professional B2B medical devices, IT, automatic dispensers, and power generators indicated that roughly 0.5 kg/inh of used-EEE are exported. This number is underestimated, as it does not include other professional B2B EEE or consumer equipment that is exported for reuse [21], [22]. Slightly older research from the ProSUM project indicates that 1.1 kg/inh is exported for reuse from Germany, and 2.3 kg/inh is exported from Austria [19]. The questionnaire among selected WEEE Forum members indicated that Greece, Switzerland, Italy, Malta, and Portugal are also monitoring used-EEE exports, but the data was not available. The data is unknown for the most EU countries and are therefore set to zero. Thus, the presented averages for the region are underestimated.

Infographic 3

Used-EEE exports for reuse

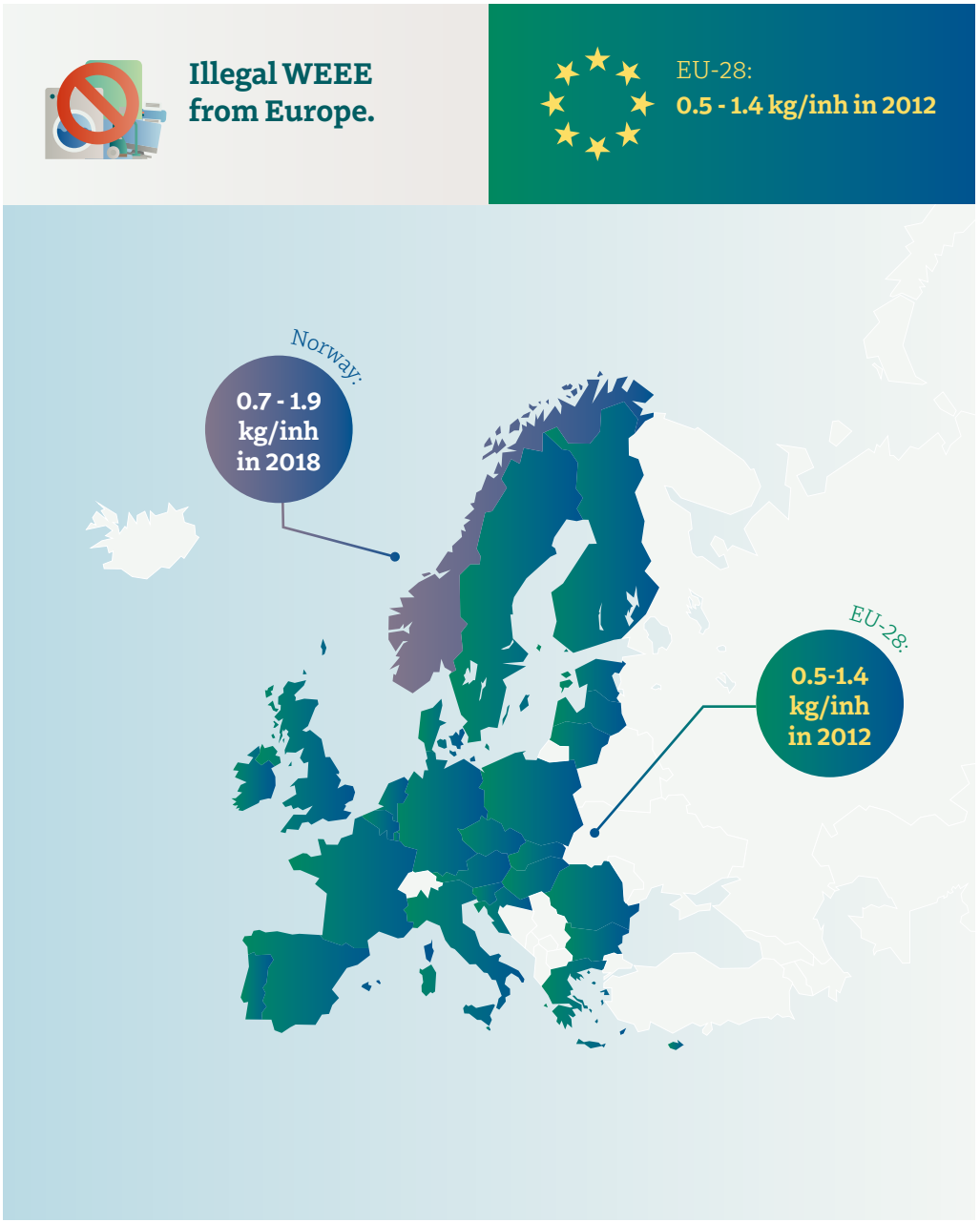


4.1.4 Illegal WEEE exports

Transboundary movement of WEEE outside the OECD area is illegal, due to the absence of environmentally sound management infrastructure in the receiving countries, EC No.1013/2006.[5] Illegal WEEE exports could be mixed with metal scrap and thus could be partly overlapping with data in section 4.1.1, or there are also illegal WEEE exports where the WEEE is exported in containers or stuffed into used vehicles [20]. Often, used-EEE and illegal WEEE are exported together in the same shipments, and it is not easy to get separate data in practice. Data on illegal WEEE exports is, due to its illegal nature, very difficult to obtain. Moreover, when available it is generally not complete, not harmonised, and cannot be substantiated. There is evidence of WEEE exports out the EU, but there is limited information on the quantities, origins, or destinations [23]. These exports can be considered common practice, but unfortunately are not typically being investigated. Hence, the real magnitude of these flows is unknown. The most comprehensive report on WEEE illegal trade in Europe was developed by the United Nations University, WEEE Forum, Interpol and others in the Countering WEEE Illegal Trade Project (CWIT) [23]. The study investigated records from Interpol on illegal, intercepted WEEE and used those to extrapolate the illegal exports of WEEE in the EU. The extrapolation undertaken in the CWIT project showed that between 250 kt and 700 kt of illegal WEEE shipments were occurring from the EU-28 in 2012. These shipments total between 0.5 and 1.4 kg/inh. It is unknown whether this quantity has changed from 2012 to 2018. In Norway, the illegal exportation of WEEE has been identified as one of the causes of the decrease in the WEEE collected registered from 2013 (20.7 kg/inh) to 2017 (18.7 kg/inh). A report on Norwegian WEEE flows in 2018 estimated that between 4 and 10 kt (0.7 and 1.9 kg/inh) of WEEE is likely to disappear – most of it illegally exported out of the country [24]. The United Kingdom extrapolated from the Basel Action Network report [25] that 32 kt, or 0.5 kg/inh, of WEEE is illegally exported [15].

Infographic 4

Illegal WEEE from Europe



[5] Regulation (EC) No 1013/2006 of the European Parliament and of the Council of 14 June 2006 on shipments of waste.

4.1.5 WEEE from businesses

The collection of WEEE from businesses and public services (B2B) has been assessed by comparing the share of B2B in the EEE POM and in the WEEE collection. The WEEE Forum Key Figures for Austria, France, Lithuania, Spain, United Kingdom, and Belgium had data split between B2B and business to consumers (B2C). Those countries had a total (B2B and B2C) market share of 4.6 Mt for EEE POM and 1.7 Mt for WEEE collection; this is considered to be representative for Europe. The total share of B2B for EEE POM from the WEEE Forum Key Figures is 17%, and B2C is 83%, as shown in Table 2. For WEEE collection, 5% of the total is B2B – a significantly lower proportion than EEE POM (17%). The lower proportion for B2B was also observed for all categories, except for lamps (see Table 2). The categories with the largest B2B share in EEE POM are IT (excl. screens) and mixed WEEE that contains many dual use products, such as laptops, desktops, and professional IT (e.g. servers and printers).

Table 2

Share of B2B and B2C in EEE POM and WEEE collection from the WEEE Forum Key Figures data from Austria, France, Lithuania, Spain, United Kingdom, and Belgium

	EEE POM		WEEE Collection	
Category	**B2B**	**B2C**	**B2B**	**B2C**
Large Household Appliances	8%	92%	2%	98%
Cooling and Freezing Appliances	13%	87%	3%	97%
Mixed WEEE	25%	75%	7%	93%
IT (excl. Screens)	42%	58%	19%	81%
Screens	7%	93%	0%	100%
Lamps	6%	94%	19%	81%
Total	**17%**	**83%**	**5%**	**95%**

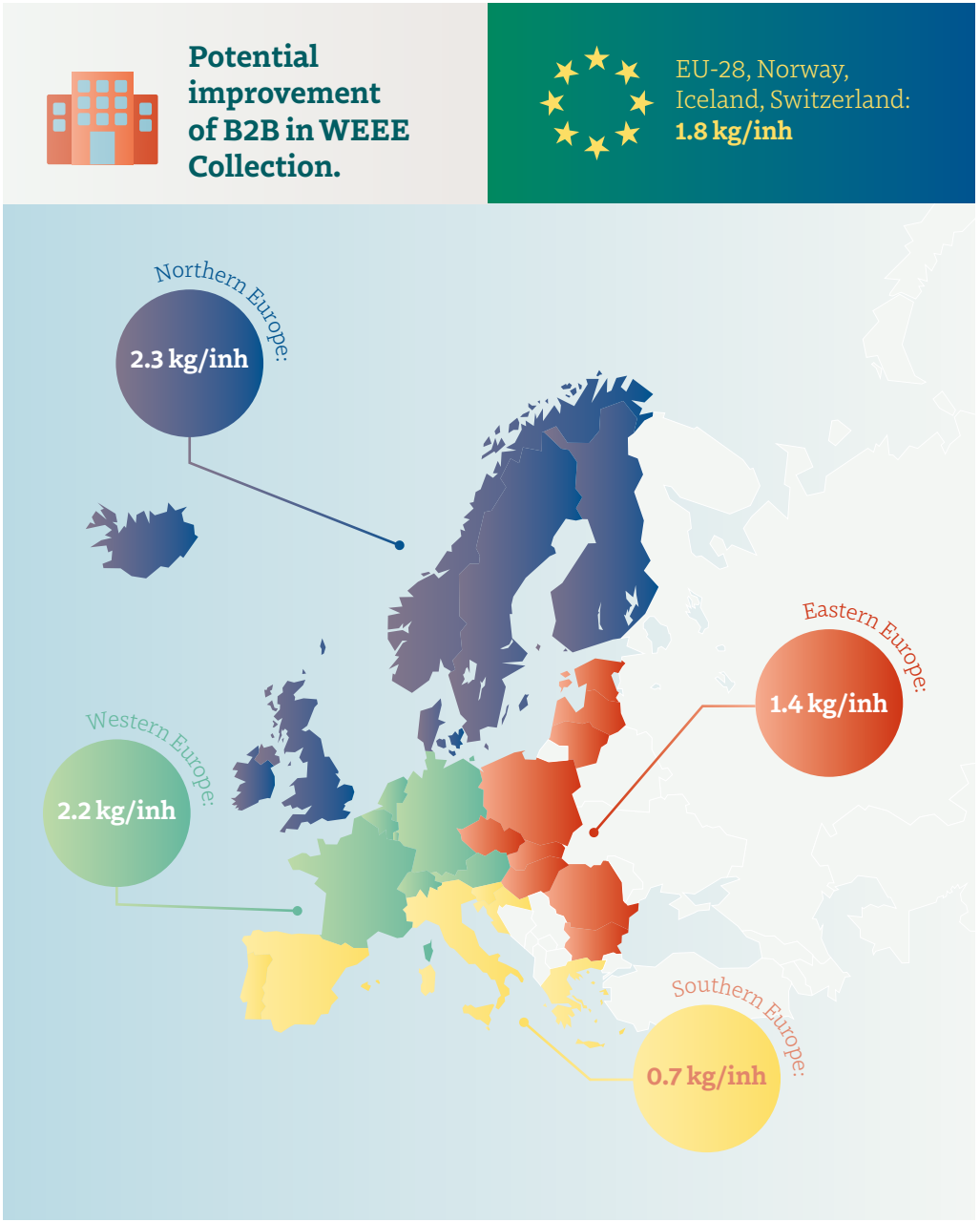
There are several explanations for the low collection rate. The first explanation could be that B2B equipment has long lifespans and, therefore, has a long delay before reaching the collection point. However, this cannot be tested further due to the lack of data on B2B EEE POM since 1990. The more logical explanation, as mentioned earlier in chapter 4.1.3, is that B2B equipment has a large reuse or refurbishment potential, or may be collected by specialist companies. Consequently, this waste is not being collected by PROs particularly in countries with little requirement or no specific target to do so, or may not be arising as waste in the country. Another explanation could be that some B2B WEEE may be collected with B2C or are currently still not registered.

The maximum potential for a country to collect B2B WEEE has been assessed using Eurostat data. The countries must report both on waste collected from households as well as other sources in the reporting to Eurostat. The other sources are interpreted to be B2B, and the collection from households is interpreted to be B2C. Note that there is no such distinction in the EEE POM at Eurostat, as opposed to the WEEE Forum Key Figures data. The analysis reveals that Greece, Latvia, Portugal, and Luxemburg report to collect less than 0.15 kg/inh from B2B sources, whereas Norway and Iceland report 6.44 and 3.49 kg/inh, respectively, for B2B waste in 2017. Austria, France, Lithuania, Spain, United Kingdom, and Belgium collected and reported, on average, 0.41 kg/inh of B2B in WEEE, which seems rather low. Thus, significant differences between the countries exist.

A conservative approximation of the potential that could be collected has been made from the reported data. The potential of WEEE to be collected from businesses has been calculated as follows. The share of WEEE collection from other sources has been calculated per country as a first step. Then, the average percentage from the top 10 countries (one-third of them) has been used as the maximum share of B2B and is calculated at 21%. If a country has a share lower than the 21%, the difference has been attributed to the potential to increase the collection of B2B. A part of this potential would lower the B2C collection, but the majority is expected to be currently unreported B2B WEEE. The potential amount of B2B that could be covered in WEEE collection is 1.8 kg/inh, of which the most potential is expected to be in Northern and Western Europe, with 2.3 and 2.2 kg/inh, respectively.

Infographic 5

Potential improvement of B2B in WEEE Collection



4.2 Implementation of WEEE legislation

Following adoption of the WEEE Directive 2012/19 by the EU, it was subsequently transposed into national legislation by each Member State. Though all Member States are required to meet the objectives set by the Directive, they have some discretion over how the Directive is implemented in national legislation. Selected WEEE Forum members were surveyed to establish how implementation varied between the countries. The information has been grouped into broad 'implementation models', which are presented in Table 3. The X denotes that the type of implementation model in question is in use in that Member State. The implementation models have been assessed against the reported collection rates to establish whether there is a direct relationship; this is discussed in the sections on the right.

4.2.1 Application of the WEEE collection targets

The WEEE Directive 2012/19/EU introduced a minimum collection target of 45% of EEE POM from 2016 on and, rising in 2019 to 65% of EEE POM, or 85% of WEEE Generated [9]. The Directive allows the Member State to report against either target[6]. Based on the WEEE Forum Member responses, Member States are using the 65% EEE POM methodology to calculate and report their national target. Since Switzerland is not an EU member, it has no obligation to comply with the WEEE Directive, but it has implemented the methodology to calculate the collection rate at the national level using the EEE POM.

For 2019, some countries have a derogation to collect a lower percentage of EEE POM, such as Lithuania (60%), Malta (55%), Poland (55%), and Romania (45%). These Member States have to meet the 65% collection target starting in 2021.
In addition to the target methodologies defined by the WEEE Directive for all Member States, some countries have implemented more specific targets per category, namely Poland, Portugal, Romania, France, and the United Kingdom. Poland calculates the target based on the EEE POM approach and has established a collection rate of 55% for all the EU-6 categories, except Cat. III (lamps), for which there is a higher target of 60%. Portugal has also introduced some additional requirements for the PROs, stating that beginning in 2019, they must ensure that at least 50% of the total WEEE collected and reported comes from their own collection network. PROs have to guarantee a collection rate of 70% for the categories of temperature exchange equipment (Cat. I of EU-6) and lamps (Cat. III). Romania applies a category-specific target of 45% for lamps (Cat. III), but it is expected that

Table 3

Overview of implementation models for selected countries

Country	EEE POM Target Method	Substantiated Estimates	All Actors Approach	Mandatory Handover	Clearing House
BEL	x		x	partial	
CHE	x		x		
CYP	x		x		
FRA	x			x	x (b2c only)
GBR	x	x			
GRC	x		x	x	
IRL	x		x	x	
ITA	x		x		x
MLT	x				
NLD	x		x	x	x (partial and private)*
ESP	x	x	x		x (private) *
PRT	x	x			x
ROU	x			x	

* Private means that it has been established among several collective PROs, and there is no involvement of government or authorities. All of them are controlled, financed, and coordinated by PROs.

[6] This is explained in the frequently asked questions on the WEEE Directive in point 7.3.

it will be set to 65% starting in 2021, as well as for the other categories of the WEEE Directive. France fixed collection targets equal to 65% of POM per category from 2019 and defined specific targets for B2B categories. The United Kingdom sets targets in 14 categories for B2C WEEE, which reflect trends in POM and WEEE collected in the previous 5 years. For more information, see the United Kingdom Country Study [15].

Concerning reuse, explicit targets have been implemented in Portugal and Spain. In Portugal, PROs must maximize preparation for reuse, and a minimum of 5% of total WEEE collected must be reused. In Spain, targets for preparation for reuse have been implemented since 2018, and producers must achieve targets of 3% reuse for large equipment collected (Cat. IV of EU-6) and 4% for small IT collected (Cat. VI). In Wallonia, a province of Belgium, The Walloon Government Decree requires that 2% of WEEE be 'prepared for re-use' beginning in January 2020. The target covers six categories of waste appliances. Additionally, France mentions preparing for re-use targets in the latest transposition of the Waste Framework Directive. The level of this target will be determined later by decree for the period 2021-2025 and renewed every five years.

4.2.2 Enforcement

The monitoring and enforcement of the correct collection and treatment of WEEE are essential to fair and effective implementation of the WEEE Directive. Enforcement is a key cross-cutting factor that impacts many aspects of WEEE management. For example, requirements for mandatory handover are only effective if properly policed. It is not possible to quantify the impact of enforcement on WEEE collection from available data or information. One could argue that if an undesired WEEE flow is significant or increases over time, it could be due to lack of enforcement. However, quantification of the level of enforcement and the cross-country comparison are not possible with the current data. This section will therefore provide an overview of these challenges, based on the responses from the WEEE Forum member questionnaires.

The main issues raised with respect to enforcement of WEEE legislation are:

- the lack of monitoring of used-EEE and WEEE exports
- WEEE managed by metal scrap dealers and dismantlers
- the theft of whole products and components, e.g. compressors
- free riders who are selling their products in the EU without being registered and without having an obligation to administer appropriate end-of life treatment.

4.2.3 Substantiated estimates

The WEEE Directive 2012/19/EU, Article 16, paragraph 4 states that "Member states shall collect information, including substantiated estimates, on an annual basis, on the quantities and categories of EEE placed on their markets, collected through all routes, prepared for re-use, recycled and recovered within the Member State, and on separately collected WEEE exported by weight" [2]. Substantiated estimates, as the name indicates, are estimates that Member States can use to report to the EC and are based on reliable scientific research studies of WEEE. Both the research conducted and the audits should be reproduced periodically in order to revise the substantiated estimate. At the time of implementation of the WEEE Directive, it was already envisaged that the targets are ambitious for some countries, and as such, the use of substantiated estimates for reporting WEEE collection was considered appropriate.

Government officials, Eurostat, and PROs have provided information on substantiated estimates for Austria, Portugal, Spain, and the United Kingdom. According to a position paper published by EERA in 2019 [26], EERA claims that Greece has also adopted substantiated estimates for reporting purposes. However, this claim has not been confirmed by the authority in charge of submitting official data to Eurostat. The PRO Appliances Recycling SA, which is active on the Greek territory, has indicated that substantiated estimates are not in use. The overview per country, where information on substantiated estimates is available, is provided on the next pages.

Austria

Substantiated estimates are used to annually calculate the amount of WEEE in other collection streams that is not covered and reported in the WEEE system. In particular, the estimates are applied to quantify the volume of large household appliances in the municipal collected volume of iron and steel waste, based on the waste balances made by waste collectors and recyclers. To be included in the reported quantity, the amount of WEEE estimated as collected with other iron and steel waste must be treated in the same way as other WEEE, according to the obligations listed in the Austrian Treatment Obligation Ordinance (in German: Behandlungspflichtenverordnung). These obligations include the removal of pollutants and hazardous substances, and the removal must meet recycling targets, according to the Austrian WEEE-Ordinance. A study conducted by the Austrian Environmental Agency in 2018 identified that 90% of the official figures is based on directly reported data, while approximately 10% (1.3 kg/inh) is obtained through substantiated estimates.

The United Kingdom

The country uses substantiated estimates to report additional data regarding large household appliances (e.g. cookers, washing machines, etc.), excluding cooling equipment, which is treated as metal scrap within the light iron stream. The recycling process used on most of the light iron flow in the United Kingdom observes the standards set by the WEEE Directive. Data estimations took place in 2013 and 2014 and revealed that the amount of LHA treated within the light iron stream accounts for 11% of the flow, or 273 kt [27]. Therefore, it can be inferred that 28% (4.1 kg/inh) of the WEEE collected reported by the country in 2016 is linked to the application of the substantiated estimates.

Portugal

Substantiated estimates have been in use in Portugal for large household appliances, small household appliances, and IT equipment until 2018. They were used to quantify and report, systematically and in a statistically representative way, the portion of WEEE that is found in metal scrap or is undergoing substandard treatments, among other unsorted waste. The methodology developed was based on the characterization of representative samples performed through technical verification of the waste management plants. While in use, substantiated estimates accounted for roughly 50% (25.8 kt) of the total WEEE collected reported by the compliance schemes, or 3.3 kg/inh in 2018 (Electrão data, 2019).

Nonetheless, starting in 2019, the licence provided to compliance schemes does not foresee the possibility of using substantiated estimates further, as the requirements defined by the National Authorities indicate that the PROs network should be structured in order to prioritize the selective collection of WEEE. In the legislation, it is also noted that the PRO should take measures to ensure the integrity of WEEE sent for treatment. However, the compliance scheme Electrão developed a study on substantiated estimates, including all the information gathered in the past years to be shared with the authorities, but it is still unclear whether or not the National Environmental Agency will adopt the substantiated estimates at the national level for the future as well.

Spain

The authority responsible for the data transmitted to Eurostat clarified that estimations, exclusively, are used to convert the different classification system for waste that is adopted in Spain at a national level with the collection categories defined by the WEEE Directive. The aforementioned estimations are made by treatment facilities and waste operators for the list of waste codes they treat, and the estimations are based on previous experience and studies conducted using sampling methods and sorting surveys. This is a different type of substantiated estimate than in Portugal, United Kingdom, and Portugal.

Other Member States have also indicated that they are undertaking work to establish the potential to report substantiated estimates in the future, including:

The Netherlands

The Netherlands does not currently use substantiated estimates. The possibility of using substantiated estimates for used-EEE exported for reuse is under evaluation. It is estimated that this flow could potentially account for 1.8 kg/inh of exports of used-EEE.

Ireland

Substantiated estimates are not currently used in Ireland, but a national study by EEE2WEEE is underway to quantify some specific flows. In particular, this refers both to WEEE sent to recovery operators by business end users (and not directly collected by producers) as well as to the amount of WEEE arriving at waste metal handlers in mixed metal loads that is not recognised as WEEE.

Romania

The country does not use substantiated estimates when reporting to the EC. However, compliance schemes have developed a proposal for sampling the metal scrap flow. The aim is to quantify and report the amount of WEEE that is in the flow, as that material is following a recycling path, though without the same management standards of PROs. In this case, and since the WEEE in metal scrap is not recycled with the right treatment standard, the main goal behind quantifying that amount is to gain a better acknowledgment of the problem and take further steps to regulate the iron scrap flow, or to use substantiated estimates, if appropriate.

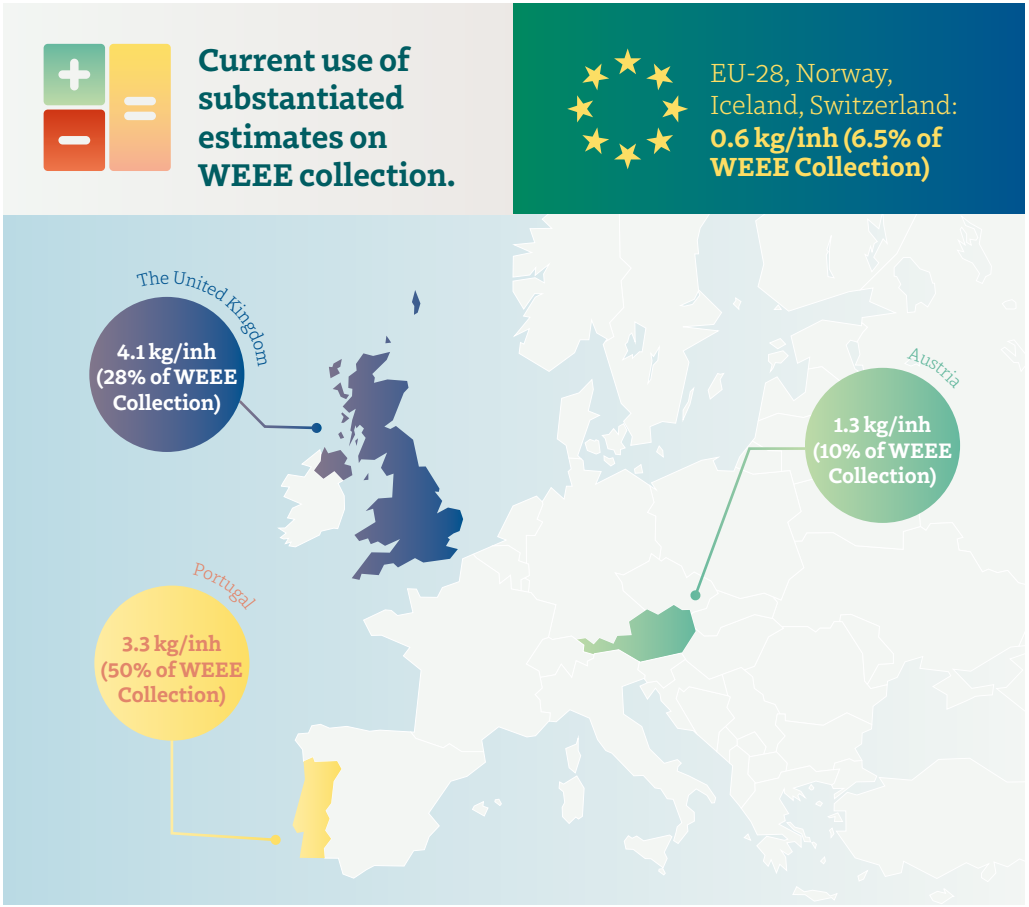
Malta

At the moment, substantiated estimates have not been adopted in the country, and even though no steps have been taken in this direction, interest was expressed by the compliance scheme WEEE Malta, which intends to study this solution for the future.

In conclusion, some countries use substantiated estimates to report collected amounts of WEEE. The impact of the substantiated estimates ranges between 1.3 and 4.1 kg/inh for Austria, United Kingdom, and Portugal. Four countries have indicated that they are considering the use of substantiated estimates in the future. For the entire EU-28, Norway, and Switzerland, 0.6 kg/inh of WEEE Collection has been reported from substantiated estimates.

Infographic 6

Current use of substantiated estimates on WEEE collection



4.2.4 All actors approach

The 'all actors' approach is a policy model which includes all natural and legal persons that have legal responsibilities in WEEE management, are handling WEEE (collection, logistics, preparation for reuse, refurbishment, treatment of WEEE), monitor WEEE, legislate and enforce WEEE legislation. All actors are obligated to abide by the WEEE Directive (such as on compliance, monitoring, and reporting) [5], [9]-[11], and work towards the common goal of responsible WEEE operations and transparent monitoring[7].

Under an 'all actors' approach, other actors as such waste operators, which are not necessarily representative of producers, have specific obligations concerning the WEEE they manage. One of the main benefits of this approach is that it does not interfere with existing commercial recycling and waste management operations but, rather, allows for management and reporting that is consistent with the WEEE Directive and that can therefore increase reporting of compliant-recycled WEEE and the collection rates. A coordination body, such as a national register, may be charged with consolidating and validating the data. The exact implementation differs per country.

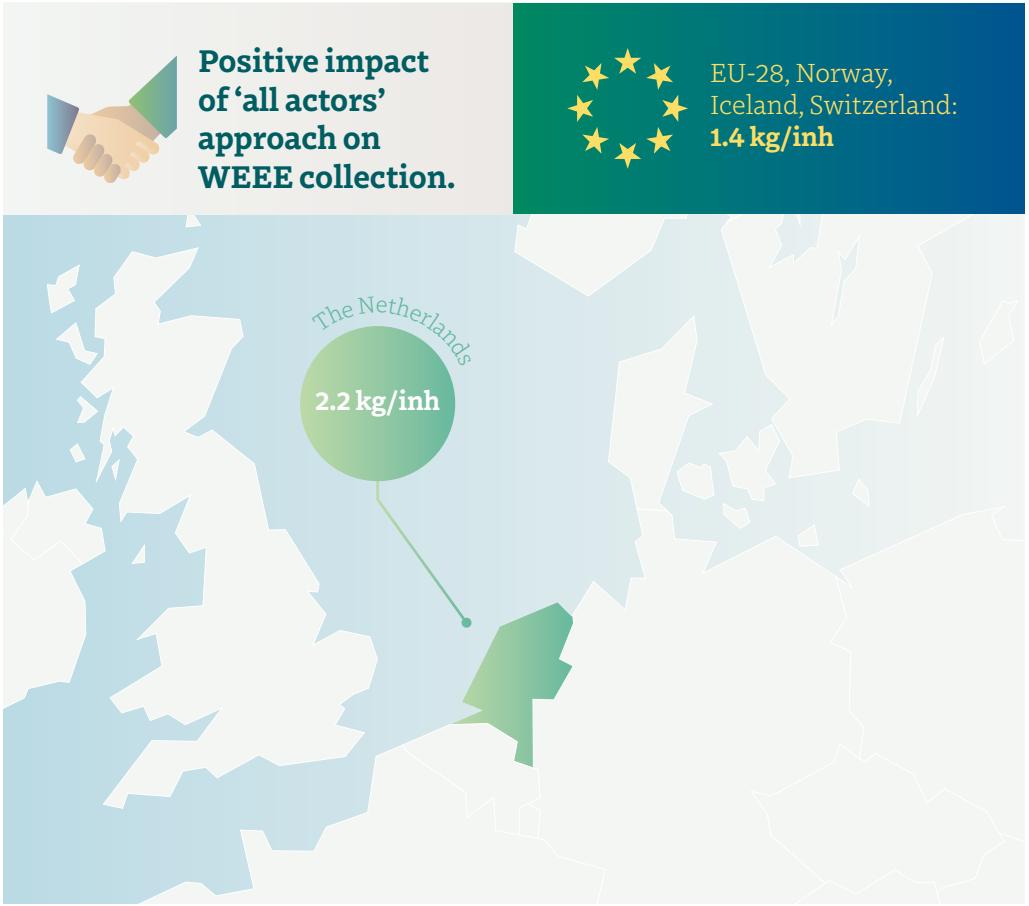
The reasons why the 'all actors' approach could be beneficial have been obtained from literature – [5], [10], [11], [28] – and from the survey responses from WEEE Forum members. A positive effect is that monitoring of WEEE is facilitated, as all actors contribute data. Thus, when properly regulated, the efficiency of WEEE collection can be improved, as the actors in the system would collaborate to meet their targets. Countries without an 'all actors' approach can face unfair competition among e-waste actors, and monitoring can be very challenging, due to the number of actors involved. The implementation of the WEEE Directive is also less fair and inclusive, whereby some actors may benefit financially from some of the Directive's requirements despite bearing none of the costs of mandatory obligations.

Of the thirteen countries that were analysed in more detail, eight implement the 'all actors' approach (Table 3). In these countries, there may be differences in the actual implementation of the 'all actors' approach that have not been further investigated. The eight countries that have some form of 'all actors' approach have a collection rate of 45%, as compared to 39%, on average, for the countries that, based on POM, do not. The higher collection rate for countries that implemented the 'all actors' approach was also observed when comparing the collection rates within the regions of the EU. The difference in WEEE collection rate between countries that have implemented the 'all actors' approach and those that have not is 1.4 kg/inh.

The direct positive impact of the 'all actors' approach could only be quantified for the Netherlands, as the data from its National (W)EEE Register distinguishes the data. For the Netherlands, an additional 2.2 kg/inh of WEEE collected could be attributed to the 'all actors' approach. In Chapter 7, different implementation models – including the 'all actors' approach for Belgium, Italy, Ireland, and Spain – will be discussed in more detail.

Infographic 7

Positive impact of 'all actors' approach on WEEE collection



[7] This is also explained in the FAQ of the recast of the WEEE Directive in point 7.1.

4.2.5 Mandatory handover

According to the principle of mandatory handover, all the WEEE management is, by law, carried out exclusively by certified WEEE collectors and recyclers, and all WEEE that is collected outside the certified actors has to be handed over to certified ones. Mandatory handover can also be accompanied with financial compensation. The mandatory handover is expected to be a mechanism under which more WEEE is collected and registered, and thus will increase the collection rate.

In responses we have obtained from the questionnaires, this approach has been successful in countries that have fewer producer compliance schemes and good relationships and understanding with the authorities, such as France, Ireland, and the Netherlands. It is not known whether this is a condition for successful implementation of mandatory handover. Nonetheless, this model can only function if it is enforced well by authorities and can only function if the financial incentive for informal collectors not handing over the WEEE is minimal. However, this model should ensure both clear responsibility among actors and fair competition.

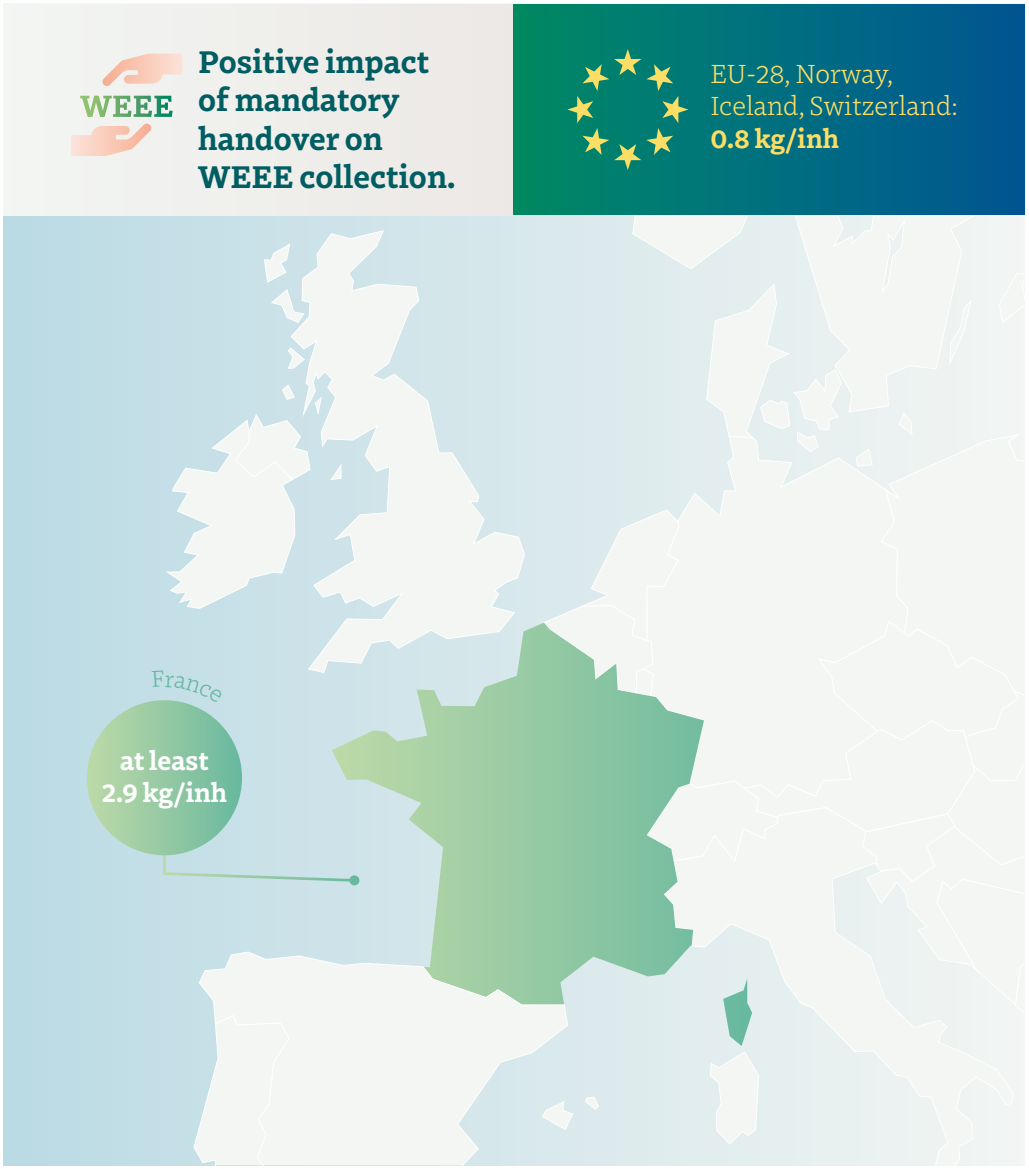
More information regarding Belgium, France, Greece, Ireland, the Netherlands, and Romania which have implemented mandatory handover, can be found in Chapter 7, where country profiles of the aforementioned Member States are presented, and their implementation models are further discussed.

Mandatory handover is not applied in all countries, and, as seen in Table 3, only five countries of the thirteen analysed in greater detail implement the approach. Both the implementation of mandatory handover – particularly with respect to whether there is a financial compensation or not – and the scope differ between countries. These differences have not been further analysed. Of the five countries with mandatory handover, the average collection rate based on EEE POM is 45%, compared to 41% for countries without. The difference between countries with mandatory handover and ones without it is approximately 0.8 kg/inh.

It might be logical to assume that mandatory handover directly yields additional WEEE to be registered in the central registers, i.e. reported as WEEE collected. However, consideration should be given to the legal instrument used with financial incentives and enforcement of the rules. Without the right framework in place, it can lead to anti-competitiveness and growth in informal activities looking to take advantage of the financial incentives. The direct positive or negative effect of the mandatory handover has not been quantified, except in the case of France, where there was sufficient data, and it is estimated to be at least 2.9 kg/inh in 2018.

Infographic 8

Positive impact of mandatory handover on WEEE collection



4.2.6 Clearing house

The clearing house is an impartial entity that monitors, coordinates, and financially clears the allocation of WEEE collection for each registered partner (which always includes the producers and may also include municipalities, retailers, recyclers and waste organisations, depending on the country). Additionally, the clearing house may report the figures to the competent authority. In some cases, it may include geographical allocation of collection points or similar ways of distributing collection responsibility between PROs.

Survey responses indicated that having several PROs, when not properly regulated, can result in an inefficient and disorganized management system, which can prevent Member States from reaching their collection targets and can lead to WEEE ending up in unreported flows (e.g. scavenging[8], illegal exports etc.). When properly established, the clearing house can ensure an efficient, transparent, and reliable WEEE management framework.

The operation of the clearing house and its framework differs from country to country, depending on its legislations, e-waste management, establishment (voluntary, PRO-based, national), and the actors involved (retailers, municipalities). The survey showed that the five countries that implemented a clearing house all have more than one PRO and that the clearing house acted as an entity. Depending on the country, this entity allocated WEEE collection to PROs (i.e. quantity and types of WEEE), distributed collection points to PROs (depending on the country's framework, this can be done in collaboration with municipalities), regulated which actors could contribute in the collection (e.g. retailers), monitored the operation of the system, reported to national authorities (e.g. Ministry of Environment) and to the EC, defined financial obligations and sanctions, etc.

A clearing house is not in operation in all countries, and, as seen in Table 3, five countries of the thirteen analysed in greater detail implement the approach. Of the five countries that have a clearing house, the average collection rate, using the EEE POM methodology, is 47%, compared with 40% for the countries that do not implement a clearing house. The difference between countries that have a clearing house was estimated to be approximately of 1.4 kg/inh. More information regarding the clearing houses of France, Portugal, Italy, and Spain can be found in Chapter 7, where the aforementioned countries' profiles are developed and their implantation models are further discussed.

Infographic 9

Potential positive impact of a clearing house on WEEE collection

[8] Scavenging refers to taking either whole items or components of WEEE from places where electrical equipment has been left for recycling, such as at designated collection facilities.

4.2.7 Financial incentives

In order to encourage reaching the collection target and to facilitate economies of scale, the authorities or PROs active on the territory may provide a financial incentive to other actors active in the WEEE management chain to gain access to the waste or to pay for any additional administration. As a result, the financial incentives facilitate compliant WEEE collection by PROs and can divert non-compliant WEEE. Many PROs will use some form of financial compensation to access WEEE as part of their commercial operation.[9] However, this information is not in the public domain since it is commercially sensitive.

From this analysis, the financial incentive mechanism put in place might explain the higher collection rates for Switzerland. The authorities provide a fair, publicly known, and transparent financial incentive for the sorted collection of WEEE. All collectors (municipal collection points, private collectors, producers, importers, etc.) and recyclers are given a sufficient fee for compensating the additional cost, which is set sufficiently high to stimulate registration. It is also set on an annual basis, considers the metal scrap market prices, is transparently set, and covers the fee for sorting and registering the WEEE, thus facilitating sound management of the WEEE. Consequently, most metal scrap dealers in Switzerland are included in the formal system and have partnerships with the country's various collection schemes. The result of this measure is that there are not significant informal flows and limited quantities of WEEE that can be found mixed in with metal scrap, according to Swiss authorities. The measure comes with a cost, however, as between 74 CHF/t (68 EUR/t) for large household appliances and 222 CHF/t (204 EUR/t) for temperature exchange equipment is paid to the WEEE collectors. The fees for power tools and garden equipment, including batteries, can be up to 692 CHF/t (636 EUR/t) [29]. All fees exclude the 7.7% sales tax, and recyclers retain the profits of recyclable fractions sales.

Similarly, in France, a part of the revenues obtained through the visible fee applied to household EEE collected by the PROs is used to financially compensate for collection through municipal collection points and retail collection. The compensation is also a financial incentive for the economies of scale that they provide to the collective scheme.

The exact relationship between the use of financial incentives and WEEE collection is not possible to quantify, since the incentives, compensation, or payments differ between countries, between PROs, and by category. In the case of Switzerland, a formal financial incentive approach appears to lead to a higher collection rate.

4.3 Behaviour and Economic factors

4.3.1 Economic and business cycle

The impact of the economy and business cycle on WEEE has not been researched much, per the literature. To study the effect of the economy and business cycles, the trends for total consumption of EEE in weight have been assessed against the WEEE Collection data between 2010 to 2018 for each country.

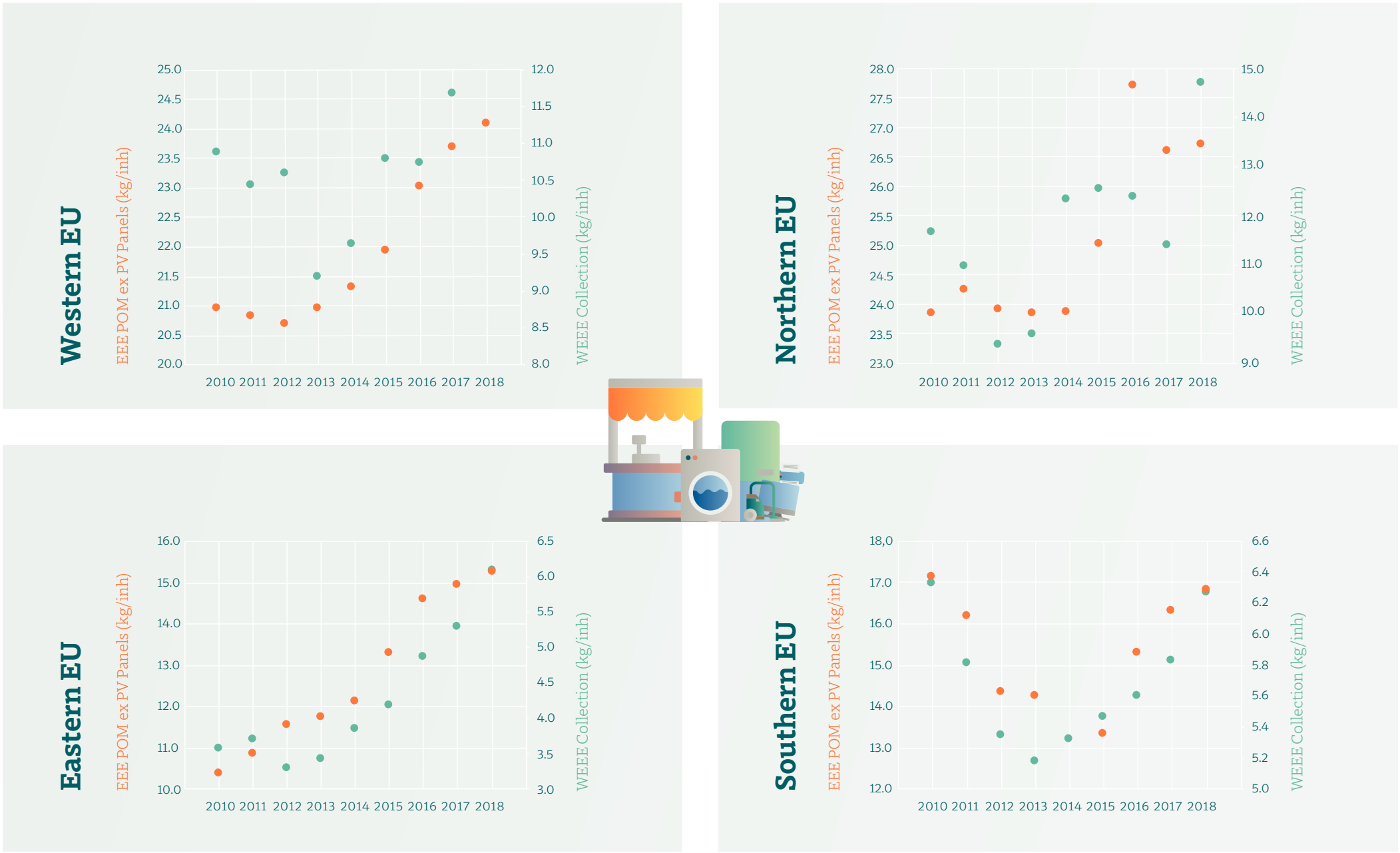
The regional trends for EEE POM (excl. PV) and WEEE collection are shown in Figure 9. On first glance, it appears that there is a relationship between the EEE POM (excl. PV) and the WEEE collection. If EEE POM increases, WEEE Collection increases as well, and vice versa. This effect was especially visible in Southern Europe. The statistical correlation was significant.[10]

[9] The compensation is negotiated between the parties concerned, not controlled or set out by an authority.

[10] The statistical correlation is the weakest for Northern Europe with an R^2= 0.33, but is still statistically significant. The other regions had a higher correlation of 0.59 for Western Europe, 0.62 for Southern Europe, and 0.84 for Eastern Europe.

Figure 9

Trend across four European regions of EEE POM and WEEE collected, in kg/inh



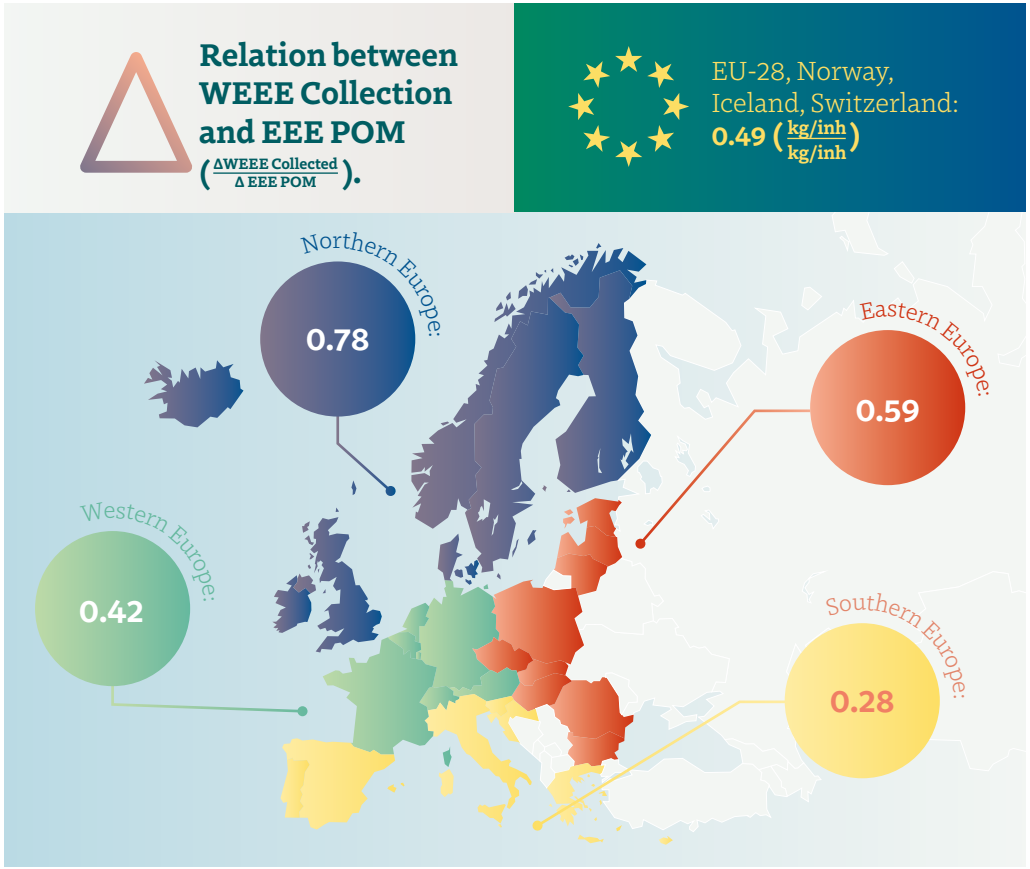
The relationship between the trend in EEE POM (excl. PV) and WEEE collection has been determined by the slope $\frac{\Delta WEEE\ Collection}{\Delta EEE\ POM}$ for 2010 to 2018. The slopes are 0.59, 0.28, 0.42, and 0.78, respectively, for Eastern Europe, Southern Europe, Western Europe, and Northern Europe. The slope for the entire region is 0.49 kg/inh. This means that if the EEE POM decreases by 1 kg/inh, the WEEE collection decreases, on average, to 0.49 kg/inh in Europe.

Thus, the conclusion is that:

- if the EEE POM increases, WEEE collection also increases.
- if EEE POM decreases, WEEE collection also decreases.

Infographic 10

Relation between WEEE Collection and EEE POM $\frac{\Delta WEEE\ Collection}{\Delta EEE\ POM}$



4.3.2 Behaviour (hoarding and reuse)

The behaviour of households and businesses directly impacts WEEE collection. One direct effect is that WEEE is discarded in waste bins by households, as shown in section 4.1.2 above. Another effect is that consumers put WEEE on the street (without arranging for it to be collected, or in some cases prior to an arranged collection) which increases the chance that WEEE is collected by non-compliant collectors and is either processed by non-compliant metal scrap dealers (section 4.1.1) or illegally exported (section 4.1.4). Two other behavioural aspects that might influence WEEE collection are hoarding and reuse.

Hoarding and reuse extend the lifespan of the equipment, as the equipment stays in the households or businesses longer before being discarded and becoming WEEE. Cultural and economic aspects likely influence the behaviour of hoarding and reuse, which could lead to differences across Europe.

A recent study indicates that the reuse culture in Romania could be significantly different than in other European countries [18]. However, the study did not determine actual lifespans that included the reuse time, split the lifespan into the different stages, or linked them to measured WEEE collection. Therefore, the actual impact on WEEE collection is still uncertain, and the real impact of reuse remains nebulous.

Hoarding will likely have an impact on discarding behaviour throughout EEE lifespans, and it will, consequently, impact WEEE collection. If people are hoarding more, lifespans will increase, and less WEEE is generated and collected. Conversely, when people clean out their homes, lifespans decrease, and more WEEE is generated and collected.

An estimate of the number of non-functioning items has been calculated from internal data from France, revealing that approximately 5 kg/inh of non-functional EEE is in households, and an additional 17 kg/inh of EEE is functional but rarely used. Of the functional, but rarely used items, small equipment is the largest group (7 kg/inh), followed by large equipment (5 kg/inh). The total hoarded equipment (functional but rarely used and non-functioning) is the same order of magnitude as WEEE Generated. One might not be able to extract the items from the households that are still functioning, as people are often emotionally attached to them and might want to use them in the future or give them to friends or charity shops.

Infographic 11
Hoarded WEEE

The items of hoarded EEE that can more easily be extracted and thus potentially collected as WEEE are the WEEE items that have not yet been discarded (5 kg/inh). Such items can probably be collected in hoarding campaigns. When extrapolating the French data to the entire region and correcting for different WEEE generation levels, the average impact is between 4 and 5 kg/inh. The amount of hoarded WEEE can only be collected once every 3 to 5 years, as the hoarded items decline after a campaign.

In the United Kingdom, empirical data on hoarding researched, and the 175.4 kt, or 2.6 kg/inh, entered into hoarding in 2017 [15]. The outflow of hoarded equipment was also 2.6 kg/inh, thus rendering the net effect of hoarding for 2017 negligible. Thus, the net effect of hoarding in the same year, and especially over several years, will be negligible too for other countries.

4.4 Synthesis of factors affecting WEEE collection

The key factors impacting WEEE collection for 2018 are summarized in Table 4. The data are split into the current impact on WEEE collection and the potential to increase WEEE collection. The current impact is what has actually been measured or estimated, based on available data. The potential is an estimate based on interpretation and extrapolation of the flow. The previous sections explain the methods used. The numbers presented are not mutually exclusive and, thus, might contain some overlap.

The factors that had the biggest impact on the collection rate are related to other WEEE flows:

- Approximately 2.1 kg/inh of WEEE is metal scrap, is not declared as WEEE, and may be non-compliantly recycled.
- Approximately 1.4 kg/inh of WEEE is discarded in waste bins and subsequently landfilled or incinerated.
- Illegal exports of WEEE outside the EU are between 0.5 and 1.4 kg/inh.
- A special case is exports for reuse, in which B2B equipment are often refurbished, repaired, or directly exported for reuse. The volume of exports for reuse is potentially between 1 and 2 kg/inh, but these exports are often not reported in the countries examined.
- Also, better reporting of B2B WEEE could increase WEEE collection to approximately 1.8 kg/inh.

The data presented shows the potential impact, but may be outdated in the case of illegal WEEE exports. Moreover, the unreported flows are not entirely 'divertible' to reported flows, since the behaviour of consumers and financial value will always influence where the WEEE flows. Other WEEE flows and undocumented used-EEE exports of WEEE account for approximately 6-7 kg/inh when corrected for potential double-counting of data.

Table 4

Summary of factors that affected the amount of WEEE collection in 2018

Factor	Current Impact (kg/inh)	Potential Impact (kg/inh)
Other WEEE flows		6 to 7 *
WEEE in metal scraps		2.1
WEEE collection from B2B		1.8
Used-EEE exports for reuse	0.5	1 to 2
WEEE in waste bins		1.4
Illegal exports		0.5 to 1.4
Implementation Mechanisms in place	> 2.0	
All actors approach	1.4	
Clearing House	1.4	
Mandatory Handover	0.8	
Substantiated estimates	0.6	
Behavioural aspects		
Reuse	-	-
Hoarded amount **		4 to 5
In/outflux hoarding		Net zero
WEEE in waste bins	-	1.4

* This amount has been calculated by totalling the underlying flows and correcting for double-counting.
** The potential of WEEE from hoarding can be only be obtained once and is not structurally available, as the stock of hoarded WEEE declines after a hoarding campaign. The average net in/outflux is probably close to zero.

The second group of factors relate to the national mechanisms in place (implementation models), which set the rules for producer responsibility and collection of WEEE. The analysis for a selected group of countries revealed that countries that use an 'all actors' approach, use clearing houses, and have mandatory handover of WEEE have a higher collection rate than countries that have none of these models:

- Countries that have implemented the 'all actors' approach collect, on average, roughly 1.4 kg/inh more WEEE than comparable countries that have not implemented the approach.
- A similarly positive effect of 1.4 kg/inh has been observed for countries using some form of clearing house.
- The effect of mandatory handover was approximately 0.8 kg/inh.
- The use of substantiated estimates is still moderate in the EU. To date, 0.6 kg/inh of collected WEEE comes from substantiated estimates in the EU average, and substantiated estimates are being used in three countries. For those, collected WEEE range between 1.3 and 4.1 kg/inh.
- The use of financial incentives facilitates the collection of WEEE, but the effect could not be determined for 2018, so potential, future effects could not be determined, either.

As such, the highest impact that could be quantified has been taken as a lower limit of 2.0 kg/inh, which has been calculated by totalling the 'all actors' approach and the current use of substantiated estimates. The potential impact of different implementation models on WEEE collection and the collection rate could not be determined, as countries' practices could not be extrapolated.

The third group of factors are comprised of behavioural and economic business cycle aspects. Quantifying these effects proved more difficult. The primary findings are summarized as follows:

- The amount of hoarded WEEE was roughly estimated to be between 4 and 5 kg/inh. This WEEE could be once every several years, collected by raising awareness to reduce hoarding. However, in regular years, the influx and outflux WEEE that is hoarded is net zero.
- The effects of reuse could not be established.
- Around 1.4 kg/inh of WEEE is discarded by consumers, due to wrong behaviour and disposal in waste bins.
- The economy and business cycles have an impact on the WEEE collection. Generally, when consumption increases (EEE POM), there is more WEEE collection and more WEEE Generated. The reverse trend is also true. On average, if EEE POM declines by 1 kg/inh, WEEE collection declines by 0.49 kg/inh.

In conclusion, the most significant factor to increase the amount of WEEE that is reported as collected, is to divert or account the WEEE in metal scrap. In some countries and to varying success and extent, scrap flows are being addressed by the use of substantiated estimates, the 'all actors' approach, mandatory handover, and/or financial incentives.

Chapter 5.
Review of methods for collection target calculation

From 2019, Article 7 of the WEEE Directive states that the minimum collection rate – referred to herein as the collection target – to be achieved annually by a Member State shall be either 65% of the average weight of EEE POM in the three preceding years or 85% of WEEE Generated on the territory of a Member State. This chapter's objective is to improve the understanding of the pros and cons of the WEEE Generated and EEE POM methodologies. The two methodologies for calculating collection targets will be reviewed in this chapter. Chapter 5.1 will assess the WEEE Generated methodology, and chapter 5.2 will review the EEE POM-based methodology.

5.1 WEEE Generated-based methodology

A high proportion of WEEE Forum members expressed concerns about the 85% target methodology, based on WEEE Generated. To illustrate a few examples:

- Cyprus experienced a significant decrease in the EEE POM, due to an economic recession. The WEEE Generated is still high, due to the presence of historic POM. As a consequence, Cyprus does not regard the WEEE Generated methodology as a good measure for calculating the target.
- In Spain, the Ministry of Environment has not foreseen the option of calculating the collection target based on the WEEE Generated approach so far, due to the absence of information about the methodology.
- The WEEE Generated methodology is not currently considered an option at the national level in Belgium, due to the unreliability of the underlying data available. However, in the country's three regional legislations, both the WEEE Generated and EEE POM approaches could feasibly be used.

The mathematical description of the WEEE Generated methodology – defined in the implementing regulation of the WEEE Directive Commission (EU) 2017/699, which is also referred to as the common methodology – is a sales-lifespan distribution model and depends on two parameters, the data on EEE POM and product lifespans by UNU-KEY. This methodology was chosen following an assessment of various methodologies, in which data availability, accuracy, simplicity, and harmonisation were evaluated [12]. It was the only model where the accuracy of the available data is good and methodologically sound, and data is available for calculating it for each of the EU's Member States. This model calculates WEEE Generated from a time period's product sales over all historical years by including their respective obsolescence rates (expressed in lifespan distribution) in the evaluation year.

The classification system used in the calculations are the UNU-KEYs (see Annex 1). The products in the UNU-KEYs have similar lifespan profiles, average weights, and environmental relevance and can be converted between the EU-6 to EU-10 product category groups. For the assessment of the current WEEE Generated methodology, the impact of EEE POM on the WEEE Generated as well as the impact of lifespans are reviewed in 5.1.1 and 5.1.2. Chapter 5.1.3 discusses the impact of the economy on the EEE POM and WEEE Generated target, and other options for calculating WEEE Generated are reviewed in 5.1.4.

5.1.1 Review of EEE POM impact on WEEE Generated

The apparent consumption methodology [12] was the data source for determining the EEE POM data for the WEEE Generated calculations. This data has been established by an evaluation of data availability, data harmonisation, level of detail, time series, accuracy, simplicity, future availability, and the data's suitability for the WEEE Generated calculations. In the apparent consumption methodology, the domestic production has been added to the imports and subtracted from the exports; see equation below.

The data has been obtained from PRODCOM statistics (domestic production) and International Trade statistics for imports and exports. Unit conversions used average weights, and statistical routines must be used to detect and replace outliers [12], [30].

EEE POM = Domestic Production + Imports – Exports

Consequently, the methodology and data source of the EEE POM from the national register differs from the EEE POM from the apparent consumption method. In cases where the outcome of EEE POM differs, the outcome of WEEE Generated differs as well. The potential impact of EEE POM on the WEEE Generated has been assessed by calculating the sum of the EEE POM for the apparent consumption method and the sum of the EEE POM reported to Eurostat for two timeframes. The first time frame is from 2013 to 2017, and the second time frame is from 2008 to 2017. The results are then assessed to determine whether or not the data are comparable. If the deviations were within ± 10% for both, individually, then it was assessed as comparable. If deviations for both were individually within ±15%, then it was assessed as moderate. If they were larger than that, then they were assessed as not comparable. The results are shown in Table 5. However, the results per country vary considerably, with the data for seven countries assessed as comparable (green). The data for eight countries have been assessed as moderately comparable (yellow), and the data for eleven countries have been assessed to be not comparable (red).

Secondly, the impact of the EEE POM from the apparent consumption methodology on the WEEE Generated has been assessed, and is shown per country in Table 5.

- ←→ means that the impact is minor and the WEEE Generated is probably accurate.
- ↑ means that the WEEE Generated might be overestimated with the EEE from apparent consumption methodology, but additional evaluations are needed.
- ↓ means that the WEEE Generated might be underestimated estimated with the EEE from apparent consumption methodology, but additional evaluations are needed.

Table 5a

Assessment of EEE POM from apparent consumption methodology and national register

	Deviation* 2013-2017**	Deviation* 2008-2017**	Potential over- or underestimation of WEEE Generated with Apparent consumption method
Eastern Europe			
CZE	2%	4%	←→
LVA	0%	4%	←→
POL	5%	0%	←→
LTU	10%	12%	↑
HUN	35%	24%	↑↑
ROU	39%	36%	↑↑
SVK	27%	26%	↑↑
EST	18%	19%	↑↑

Table 5b

Assessment of EEE POM from apparent consumption methodology and national register

	Deviation* 2013-2017**	Deviation* 2008-2017**	Potential over- or underestimation of WEEE Generated with Apparent consumption method
Northern Europe			
GBR	9%	7%	←→
IRL	7%	2%	←→
SWE	-5%	-5%	←→
FIN	-5%	-15%	↓
DNK	-21%	-16%	↓↓
Southern Europe			
ITA	6%	3%	←→
SVN	8%	8%	←→
HRV	12%	12%	↑
CYP	28%	8%	↑↑
ESP	33%	29%	↑↑
GRC	16%	11%	↑↑
PRT	18%	15%	↑↑
MLT	-77%	-80%	↓↓↓

	Deviation* 2013-2017**	Deviation* 2008-2017**	Potential over- or underestimation of WEEE Generated with Apparent consumption method
Western Europe			
NLD	15%	14%	↑
AUT	-12%	-4%	↓
DEU	-15%	-14%	↓
FRA	-11%	-11%	↓
LUX	7%	-8%	↓
BEL	-12%	-22%	↓↓

←→ The impact is minor and the WEEE Generated is probably accurate.

↑ The WEEE Generated might be overestimated with the EEE from apparent consumption methodology, but additional evaluations are needed.

↓ The WEEE Generated might be underestimated with the EEE from apparent consumption methodology, but additional evaluations are needed.

Colour coding:
green ~ comparable;
yellow ~ moderately comparable;
red ~ not comparable.

* The deviation is calculated by taking the sum of all years for Apparent Consumption method – sum of all years for Eurostat WEEE Directive Data / sum of all years for Apparent consumption method * 100%.

** Or the most recent year if data for 2017 was not available at the time of extraction.

The regional outcomes are shown in infographic 12, and indicate that the apparent consumption methodology is accurate for the region as a whole and for Northern Europe, with minor deviations of 2% (or 0.3 and 0.4 kg/inh respectively). However, the apparent consumption methodology might over-estimate of WEEE Generated with 1.7 kg/inh in Eastern Europe, and 2.5 kg/inh in Southern Europe, and might under-estimate WEEE Generated for 2.0 kg kg/inh in Western Europe. However, further evaluation is needed to determine where the observed differences between EEE POM from national registers and the apparent consumption method stem from.

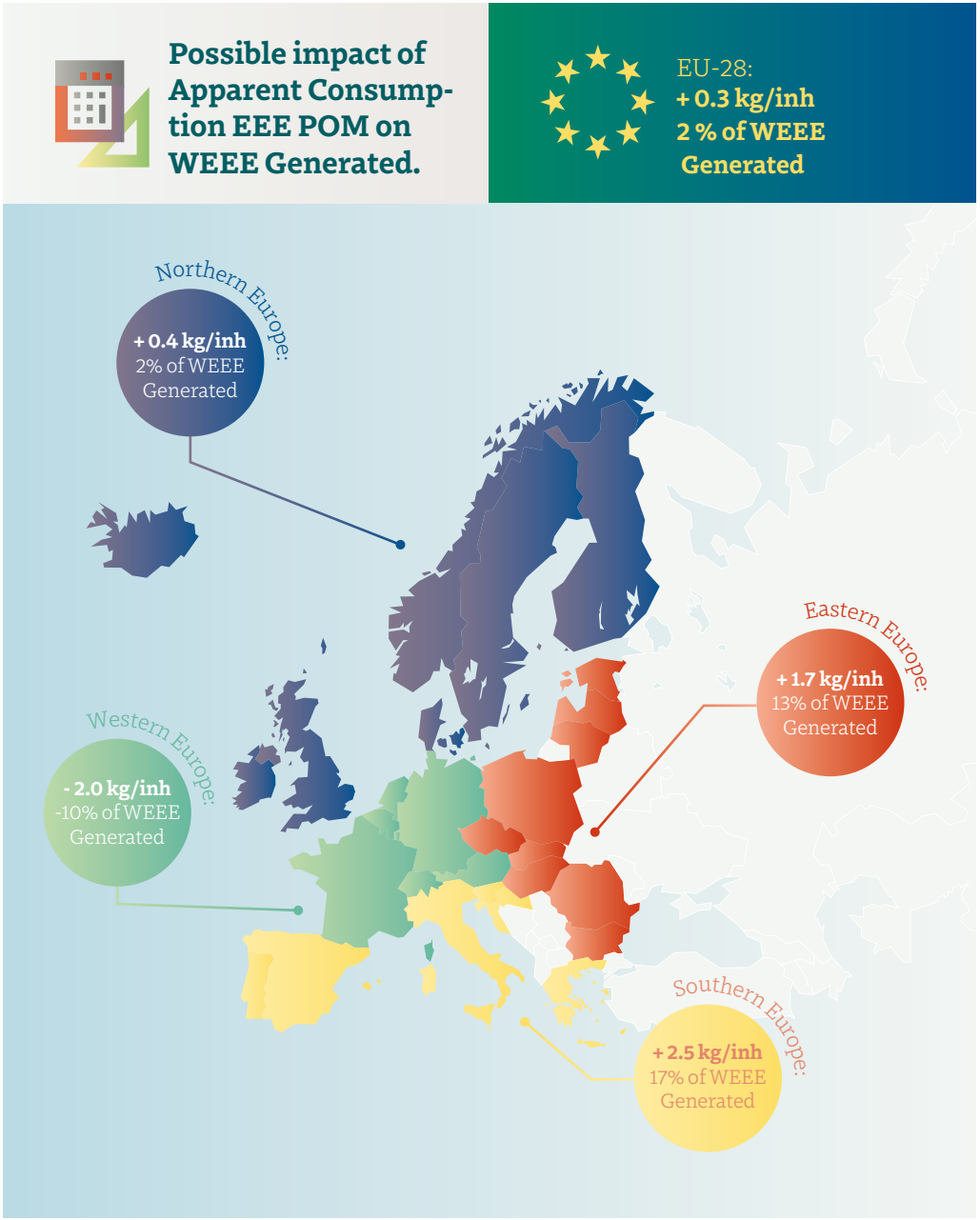
Several explanations are possible:

- The differences could be due to a lack of reporting for POM by all parties in the national registers that place EEE on the market – the so-called free riders lead to under-coverage in the EEE POM data in the national registers. The increase of internet sales could also have an effect on the data.
- The difference could also be result of undeclared used-EEE imports, especially in Eastern European countries.
- Another explanation is that the apparent consumption methodology itself leads to an over- or under-reportage of the data.

Therefore, a thorough check is recommended for the Member States coded in yellow and red where the EEE POM in Table 5 differs substantially. Such a check requires a national assessment of the EEE POM, lifespans, and items that are in use and in hibernation for each individual UNU-KEY. This check has recently been carried out in the Netherlands by UNITAR [17], where a national version of the WEEE Generated has been calculated and the time series of EEE POM of the national register were further assessed. Such assessments are necessary for changing the EEE POM for the WEEE Generated calculations. However, such checks are not currently being performed in most countries. During the writing of this report, studies were being undertaken in the United Kingdom and France. Still, without having access to better data, the observed differences between the EEE POM in Table 5 were considered for assessing the potential impact of the EEE POM on the WEEE Generated; these differences are shown in infographic 12.

Infographic 12

Possible impact of Apparent Consumption EEE POM on WEEE Generated



5.1.2 Review of lifespan on WEEE Generated

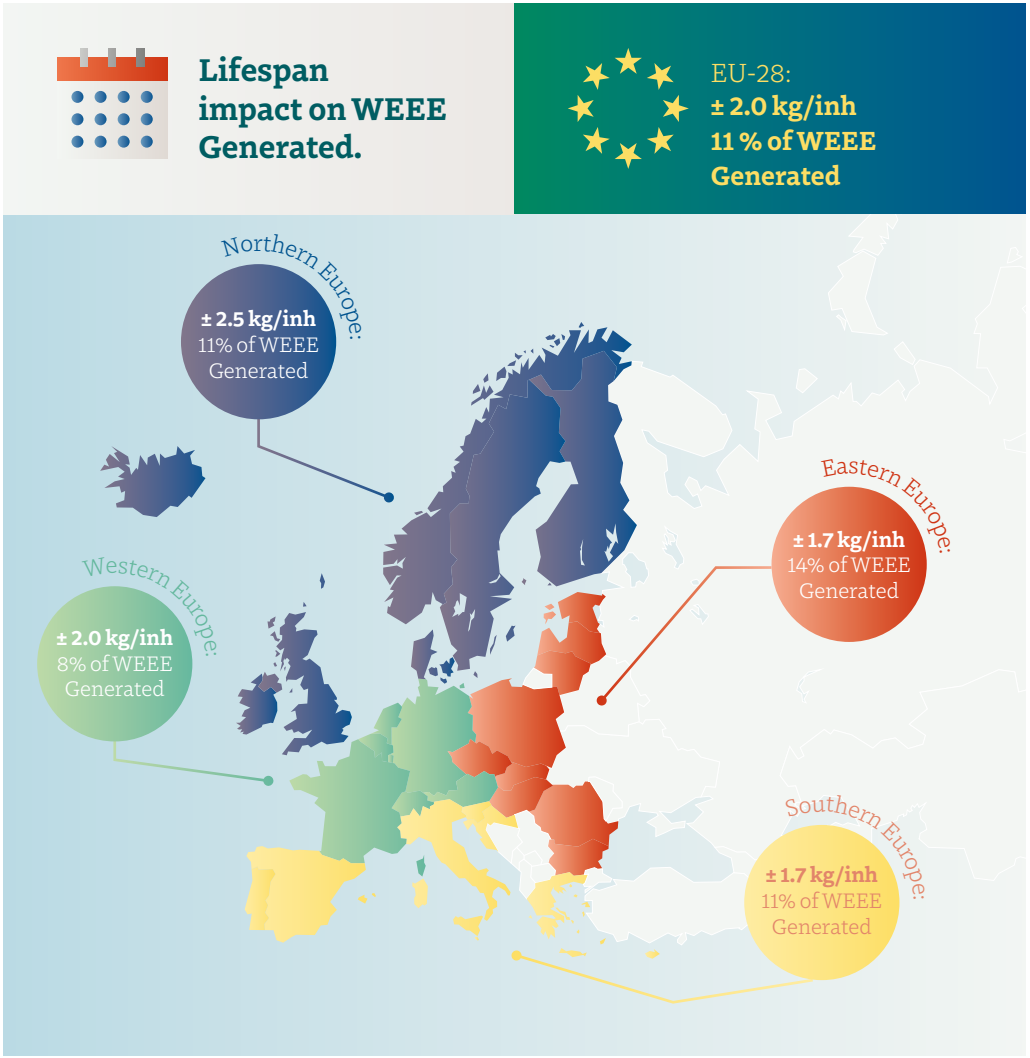
Another factor that can influence WEEE Generated is lifespan. The so-called Article 7 Project shows the impact of lifespans on WEEE Generated, and was undertaken by running two extreme scenarios when all lifespans are either 30% longer or 30% shorter [9], [12]. The countries with most impact from lifespan are Bulgaria, Cyprus, Slovakia, and Ireland, in which the margin of errors reach ±15% of the WEEE Generated, compared to the baseline scenario. This margin may be caused by the steadily increasing amount of POM over the past ten years in these countries. Countries with more stable POM rates (such as Germany, Austria, or Estonia) have tended to experience less impact from the changing lifespan; the margins of error in these countries is lower than ±10%. The country with the lowest margin of error is 5%, and the highest is 19%. Seven countries have a margin between 5% and 10%, and 21 countries have a margin of error between 10% and 15%.

The recent Dutch WEEE Flows Study researches the deviations per category. The Dutch report shows deviations of 35% for WEEE Generated of PV Panels, but merely 5-6% on WEEE Generated for the other categories [17]. Note that the total bandwidth of WEEE Generated is 1.5 kilotons (kt) in the Netherlands, i.e. 0.4% of the total WEEE Generated. The large relative deviation for PV panels is sensible in light of the long lifespans and the fact that they are relatively new on the market. In the upcoming French study, similar investigations have been undertaken and revealed that the total WEEE Generated is influenced only modestly by variations in the total lifespan, as the total POM (by weight) has been relatively stable over the past 10-20 years [31]. A 50% increase in the lifespan reduces the calculated WEEE Generated by only 13%. On the other hand, the WEEE Generated by category can be much more sensitive to variations in the total lifespan, particularly for PV panels and Temperature Exchange Equipment. Therefore, collection targets based on the WEEE Generated by category may be significantly influenced by variations in total lifespan.

The lifespan of a device depends, to some extent, on the working lifespan, but cultural aspects – such as hoarding, reuse, and repair – also influence it. Recent insights from a consumer survey indicate that Eastern European countries often have a different reuse culture, and lifespans might vary from the lifespans used in the WEEE Generated calculations [18]. Hoarding can also impact WEEE Generated, but the lifespans already factor in consumer reuse [38]. However, if a country has significantly more amounts of hoarding or reuse that are not reflected in the current lifespans, the lifespans may need to be adjusted. A recent study identified the reuse culture in Romania as another reason that affects the WEEE Generated. The study did not calculate country-specific lifespans, so the lifespans cannot be related to the ones used in the WEEE Generated calculations, and the real impact could not be quantified [18].

Infographic 13

Lifespan impact on WEEE Generated



5.1.3 Impact of the economy on WEEE Generated

The impact of the economy on WEEE Generated has not been discussed much in literature. Only one recent study assessed the impact of the WEEE Generated for economic changes for UNU-KEY 0108 – refrigerators in the United Kingdom [14]. It was a very detailed econometric analysis of the dependency of the WEEE Generated on the economic fluctuations that used a model with parameters such as EEE POM, price variations for fridges, changes in the stock, and a modelled factor on the replacement boost elasticity to GDP and prices. During the recession starting the 2008, the WEEE Generated declined by 350,000 products, from approximately 1.6 million to 1.25 million, i.e. -20%. The WEEE Generated was subsequently higher in the years that followed. Without further empirical validation, it is unclear whether the results can be transferred to other categories or countries.

The impact of the economy on WEEE Generated has also been adjusted, using a novel methodology presented in this study. The method begins by using the WEEE Generated from the common methodology. The adjustment for the economy is made by using the year-to-year change of the EEE POM, excluding PV panels in tonnage. In a year when the EEE POM (excl. PV panels) declines from the previous year, the WEEE Generated is adjusted downward in reference year t. The downward correction uses the following formula:

$$\text{Correction for } \textit{WEEE Generated}_{(t)} = \frac{\Delta\text{WEEE Collection}}{\Delta \textit{EEE POM}} * (\text{EEE POM}_{(t)} - \text{EEE POM}_{(t-1)}) * \frac{\text{WEEE Generated}_{(t)}}{\text{WEEE Collection}_{(t)}}$$

First, the slope between the WEEE Collection and EEE POM (excl. PV), $\frac{\Delta\text{WEEE Collection}}{\Delta \textit{EEE POM}}$, has been determined for a region for 2010 to 2018. This slope is then multiplied by the annual change of the EEE POM (excl. PV), i.e. $(\text{EEE POM}_{(t)} - \text{EEE POM}_{(t-1)})$. It is then multiplied by the fraction between WEEE Generated and WEEE collection in year t, i.e. $\frac{\text{WEEE Generated}_{(t)}}{\text{WEEE Collection}_{(t)}}$.

The downward correction has been applied per country when the annual change of EEE POM (excl. PV) was negative. The correction of the WEEE Generated is placed back in the use phase and disposed of when the EEE POM increases again in the next years, with a Weibull function of shape parameter of 1.3 and scale parameter of 7 years (median lifespan = 5.3 years). The correction will cause the WEEE Generated to be lower in times when EEE POM declines and higher roughly 3-7 years later.

The impact of the economy on the WEEE Generated has been calculated with sales-lifespan distribution with an economic adjustment. The impact has been calculated for each country from 2010 to 2018. The WEEE Generated was adjusted downward in years when the EEE POM decreased from the previous year. Thus, the amount of the adjustment depends on the severity of the year-to-year EEE decrease. The results (Table 6) show that the impact varied significantly across countries. The largest impacts were on Malta, where the WEEE Generated had to be adjusted in 2015 by -7.2 kg/inh (equivalent to 51% of WEEE Generated), Luxemburg in 2012 (-7.6 kg/inh, or 44% of WEEE Generated), and Hungary in 2012 (-4.7 kg/inh, or -44% of WEEE Generated). However, for most countries, the downward adjustment stayed within the -10% for the period of 2010-2018. The upward adjustment was considerably lower, as the items were placed back in the use phase and distributed over WEEE Generated, with a median lifespan of 5.3 years.

Note that these outcomes should be validated further to ascertain their accuracy, as the relationship between EEE POM and WEEE Generated was calculated depending on the slopes between EEE POM and WEEE collection from 2010-2018, and other factors could have impacted it as well. Thus, more empirical and behavioural research is necessary, especially research on what consumers do in the year after the EEE POM increase and when the consumer will begin disposing the WEEE again. Whether that is in the year after the decline or several years later is currently unknown. Nonetheless, it is evident that the WEEE Generated impacts the economy. The past decade was within the ±10% bandwidth of total WEEE Generated. However, in some exceptional cases, the downward adjustment might be as large as -50% of the WEEE Generated, as seen in Table 6, but such deviations should be further-researched.

Table 6a

Impact of WEEE Generated for economic adjustment [11]

	Year of Maximum Downward Adjustment	Maximum Downward Adjustment (% of WEEE Generated)	Maximum Upward Adjustment (% of WEEE Generated)	Maximum Downward Adjustment (kg/inh)	Maximum Upward Adjustment (kg/inh)	Potential impact of downward adjustment
Eastern Europe						
BGR	2011	0%	0%	- 0,0	0,0	←→
LVA	2016	-3%	0%	- 0,3	0,0	←→
LTU	2013	-3%	1%	- 0,4	0,1	←→
SVK	2011	-8%	1%	- 0,8	0,1	↓
EST	2013	-9%	1%	- 1,1	0,1	↓
CZE	2012	-13%	2%	- 1,7	0,3	↓↓
POL	2012	-14%	1%	- 1,2	0,1	↓↓
ROU	2011	-18%	2%	- 1,5	0,2	↓↓
HUN	2012	-44%	6%	- 4,7	0,6	↓↓↓

	Year of Maximum Downward Adjustment	Maximum Downward Adjustment (% of WEEE Generated)	Maximum Upward Adjustment (% of WEEE Generated)	Maximum Downward Adjustment (kg/inh)	Maximum Upward Adjustment (kg/inh)	Potential impact of downward adjustment
Northern Europe						
DNK	2011	-7%	1%	- 1,5	0,2	↓
NOR	2013	-7%	1%	- 1,6	0,3	↓
SWE	2012	-10%	1%	- 1,9	0,3	↓↓
GBR	2012	-10%	1%	- 2,2	0,3	↓↓
FIN	2014	-15%	4%	- 2,8	0,8	↓↓↓
IRL	2012	-26%	4%	- 4,5	0,6	↓↓↓

[11] The impact could not be determined for Iceland, due to inconsistent trends in the EEE POM. Also note that the methodology is very sensitive for EEE POM changes. We could not verify and validate all EEE POM data and, so, used the data at Eurostat. Any reporting errors on EEE POM would have led to different conclusions.

Table 6b

Impact of WEEE Generated for economic adjustment [11]

	Year of Maximum Downward Adjustment	Maximum Downward Adjustment (% of WEEE Generated)	Maximum Upward Adjustment (% of WEEE Generated)	Maximum Downward Adjustment (kg/inh)	Maximum Upward Adjustment (kg/inh)	Potential impact of downward adjustment
Southern Europe						
SVN	2012	-4%	0%	- 0,5	0,1	←→
ESP	2012	-9%	2%	- 1,6	0,4	↓
ITA	2011	-10%	2%	- 1,7	0,4	↓↓
HRV	2012	-12%	1%	- 1,2	0,1	↓↓
GRC	2011	-13%	3%	- 1,9	0,5	↓↓
PRT	2011	-14%	2%	- 2,1	0,3	↓↓
CYP	2011	-26%	7%	- 3,9	1,0	↓↓↓
MLT	2015	-51%	10%	- 7,2	1,4	↓↓↓

	Year of Maximum Downward Adjustment	Maximum Downward Adjustment (% of WEEE Generated)	Maximum Upward Adjustment (% of WEEE Generated)	Maximum Downward Adjustment (kg/inh)	Maximum Upward Adjustment (kg/inh)	Potential impact of downward adjustment
Western Europe						
AUT	2011	-3%	1%	- 0,5	0,1	←→
FRA	2012	-4%	1%	- 0,8	0,2	↓
CHE	2013	-8%	1%	- 1,8	0,3	↓
DEU	2013	-9%	1%	- 1,7	0,3	↓
NLD	2011	-14%	2%	- 2,8	0,4	↓↓
BEL	2013	-23%	4%	- 4,6	0,8	↓↓↓
LUX	2012	-41%	4%	- 7,6	0,8	↓↓↓

[11] The impact could not be determined for Iceland, due to inconsistent trends in the EEE POM. Also note that the methodology is very sensitive for EEE POM changes. We could not verify and validate all EEE POM data and, so, used the data at Eurostat. Any reporting errors on EEE POM would have led to different conclusions.

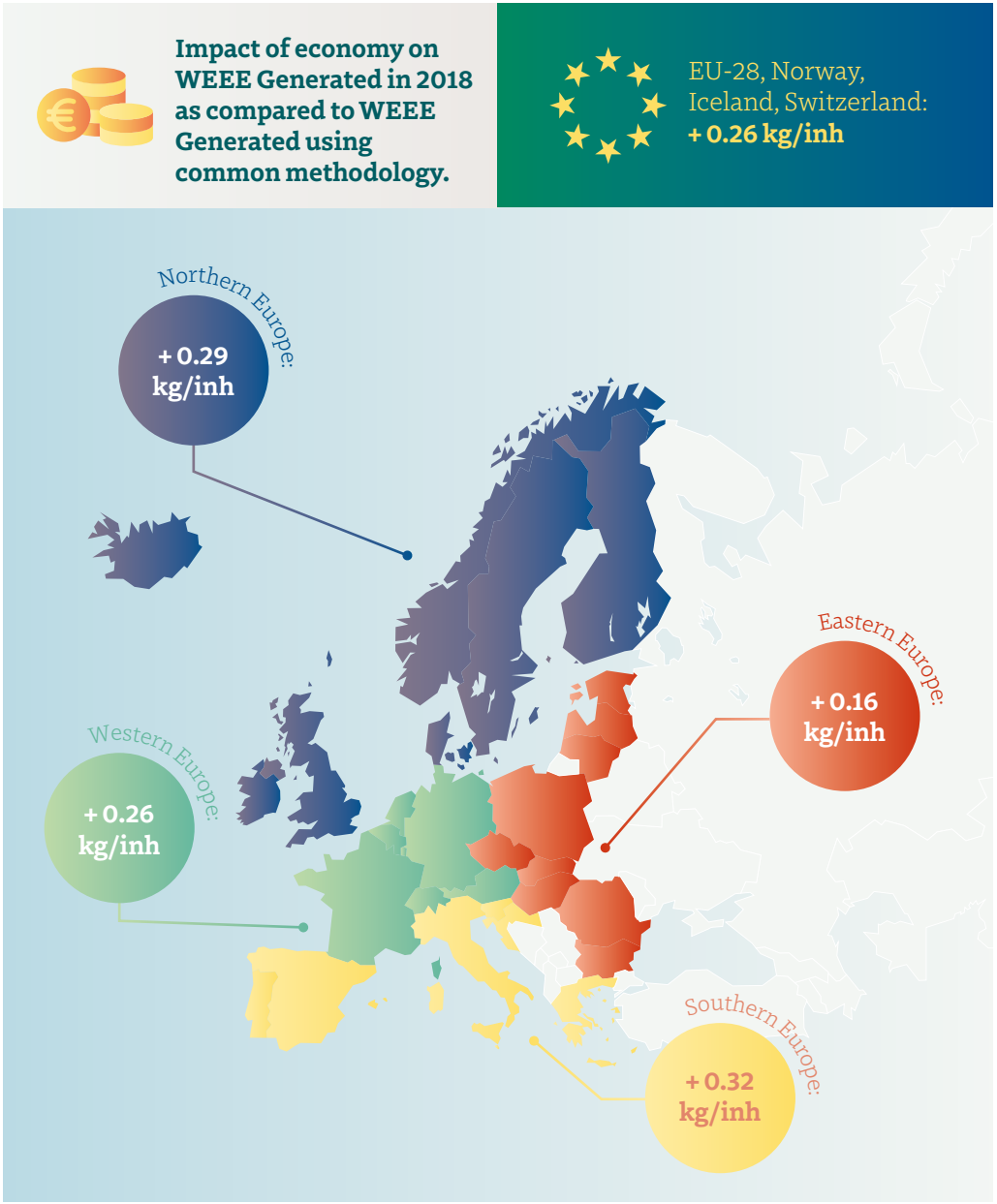
Most downward corrections, as shown in Table 6, occurred mostly between 2011 and 2013. In the subsequent years, the WEEE Generated will need to be upward-adjusted. The economy and business cycles also impact the WEEE Generated. In extreme cases, the WEEE Generated may need to be adjusted between -5 kg/inh and -7 kg/inh for a given country, but such deviations should be further-researched.

The EEE POM, excluding PV (as well as GDP), has increased from 2014 to 2018 for most countries. Therefore, in 2018, the WEEE Generated, with the sales-lifespan distribution including an economic correction, only needs to be adjusted upward by +0.26 kg/inh, and so is very close to the WEEE Generated from the common methodology.

In summary, in 2018, the WEEE Generated was not affected, as there has not been a significant decline in consumption in the preceding years. Using the above approach, the WEEE Generated would need to be slightl y upward-adjusted by 0.3 kg/inh. As mentioned earlier, the WEEE Generated is only adjusted downward if the year-to-year change of EEE POM is negative, and it is adjusted upward in the years to follow.

Infographic 14

Impact of economy on WEEE Generated in 2018 as compared to WEEE Generated using common methodology [12]



[12] In 2020, with the current and ongoing COVID-19 pandemic and projected economic impact, it could become significant. However, unprecedented effects might also play a novel role in the COVID-19 pandemic, such that the prolonged times of people at home may have resulted in more cleaning and handing over of hoarded equipment, which in turn would result in higher WEEE collection rates.

5.1.4 Review of other models to calculate WEEE Generated

The Article 7 study illustrated that the sales-lifespan distribution model is the best available option in terms of data availability, cost aspects (specifically, the costs incurred in gathering additional data), and data quality [10]. The accuracy mainly depends on the availability of national tailor-made EEE POM, lifespans, and WEEE Generated calculations. As well, sudden changes in lifespans, resulting from, e.g., an economic recession, might not be well-reflected. Therefore, we have assessed other models for calculating WEEE Generated.

The article 7 study showed that only two others models yielded more accurate data than the sales-lifespan distribution model: the time-step model and the multivariate input-output model. These models have been reviewed alongside the current sales-lifespan distribution model, the dynamic WEEE Generated model, a novel sales-lifespan distribution method with correction on economic fluctuations, and a WEEE flows-based model.

Sales lifespan distribution methodology: this model calculates WEEE Generated from time series product sales over all historical years, with their respective obsolescence rates (expressed in lifespan distribution) in the evaluation year. This is used by the EU as the common methodology for calculating WEEE Generated, Implementing Regulation (EU) 2017/699.

Time-step methodology: With this model, the change of stock within a period in a system equals the difference between the total inflows (EEE sales) and outflows (WEEE Generated). Therefore, to calculate the weight of WEEE Generated, this method entails two types of data input: sales in the evaluation year and stock data for two consecutive years.

Multivariate IOA: This model is an advanced and flexible method, which can be used when multiple datasets are available. It links product sales, stock, and lifespan data together to construct mathematical relationships between various data points, based on best available data for calculating WEEE Generated. By applying this method, the data consolidation steps facilitate the production of more comprehensive time series datasets from the available datasets, which increases the reliability of WEEE estimates.

Dynamic WEEE Generated Model: Very detailed econometric analysis of the dependence of the WEEE Generated on the economic fluctuations, using time series of EEE POM, data on price variations, time series of stock, and a modelled factor on the replacement boost elasticity to GDP [14].

Sales lifespan distribution methodology with correction on economic fluctuations: This model calculates WEEE Generated from time series product sales over all historical years, with their respective obsolescence rates (expressed in lifespan distribution) in the evaluation year. In the year when the EEE POM declines from the previous year, the WEEE Generated is downward- adjusted (see chapter 5.1.3).

Additive WEEE flows Method: In this method, the WEEE Generated is build-up from the flows. WEEE Generated = WEEE Collection + WEEE in metal scraps or exported (not compliant-recycled) + WEEE in Waste Bins + WEEE illegally exported + used-EEE exports for reuse.

Consumer and business surveys: WEEE Generated can also be calculated using surveys conducted at home and by businesses. In this method, the household and several businesses are surveyed on the possession of EEE and discarded WEEE. So far, only Jordan has applied this method for the entire economy [32], but the method has only been used in Europe to sample household WEEE (in Italy, France, and Romania).

The models are evaluated against their data availability, accuracy, simplicity, harmonisation, and robustness for economic effects.

From a general data availability perspective:

- High-quality data of historical WEEE Generated, in the form of complete collection and WEEE flows data, is scarce, due to a lack of harmonised methods and measurement.
- The number of appliances in households and businesses is generally unavailable, especially in a harmonised manner.
- Lifespan is an important parameter for the assessment of WEEE Generated and can be determined by consumer and/or business surveys per product, with representative sample size. However, such in-depth investigations feeding and enabling the most comprehensive Multivariate IOA are only carried out in a

limited number of Member States [9], [17], [21], [33], [34].
- From similar household and business surveys, the WEEE Generated can also be assessed for the appliances that are often present in use and in hibernation. However, this data is not available for many countries in the EU and are not repeated annually, due to the high costs and administrative burdens associated.
- For the additive WEEE flows Model, crucial parameters, such as WEEE in metal scraps, WEEE in waste bins, and illegally exported WEEE are not currently available for all countries.

From an accuracy perspective:
- The time-step model can be only accurate if the POM and, especially, stock data are very accurate for each type of product. However, small deviations in the stock have a sizable impact on WEEE Generated.
- Sales-lifespan distribution methodology proves more accurate, however, when applying time-dependent lifespan parameters.
- Multivariate IOA is the most accurate method because it applies comprehensive mathematical functions and best-available data to consolidate model output. Still, it requires multiple datasets that are generally unavailable (as of yet) for all countries.
- The consumer and business survey methodology can be accurate if the sampling size is representative across countries and covers all the types of WEEE that are frequently discarded.
- The accuracy of the additive WEEE flows methodology depends on the quality of the flows' data. Data from WEEE in waste bins and WEEE in metal scraps have to be acquired via sampling, which typically yields 1-5% on a weight basis. The low concentration makes the sampling protocol, and extrapolation procedures for WEEE in waste bins and metal scraps is very important for reducing statistical errors.

For simplicity of approach:
- In general, methodologies that apply more variables (with a higher degree of freedom) can result in greater accuracy, but this also introduces more computation complexity, as more parameters must be estimated. This lowers the applicability for wider usage.
- Over-simplified methodologies, such as the time-step methodology and the WEEE flows methodology, rely heavily on availability and quality of data, which restrict their applicability.
- Complex methodologies (such as the Dynamic WEEE Generated Model and multivariate IOA) require multiple steps to process and consolidate data and are difficult to use or update. The methodology used is data-intensive, so it is not easily replicable for other countries.

For improved harmonisation of data:
- It is essential that the EU Member States have a consistent and comparable method for calculating the weight of WEEE Generated. This requires the method to be reliable, consistent in time and geography, and easy to implement by Member States.
- Methodologies with high complexity, especially ones using complex and comprehensive datasets (such as the dynamic WEEE Generated model), increase the difficulties of applicability at the national level, thus jeopardizing the availability of harmonised and comparable results across Member States.
- Many data sources must be combined in using the additive WEEE flows method, and special care usually has to be considered to remove double-counting and assess and estimate data gaps. As such, the method is very difficult to harmonise across countries.
- For the consumer and business survey methodology, harmonisation is essential. It is crucial that the samples are representative, as are the types of WEEE surveyed for households and per type of industry. Since there are no standards as such, the samples are currently not harmonised, and harmonising them will be very costly for all types of WEEE (all 54 UNU-KEYs) across all sectors of industry. Another factor for harmonisation is the required unit to average weight conversion factors.

For capturing the economic and business cycle changes:
- If all accurate data are available, the time-step model, the WEEE flows method, and the WEEE survey method are the preferred options for capturing economic effects on WEEE Generated.
- The sales-lifespan distribution model probably shows both deviations in times of recession and the period after recession in a country. These effects can be modelled using multivariate-IOA and sales-lifespan distribution with economic correction.
- Yearly measurement of all sectors is essential for capturing the economic effects when using the surveys methodology.

For reducing administrative burdens and associated costs:

- The more data intensive methods that use surveys are not favoured, as they place a large administrative burden on respondents. Such methods include surveys, the time-step methodology, and the dynamic WEEE Generated model. These methods will cause a large administrative burden on households, all sectors of economy, and the public sector, and they will have high costs as well. The additive WEEE flows method would only have to survey specific parts of the industry and, thus, would lead to fewer administrative burdens.

Calculation methodologies that can rely on administrative sources and minimize the use of surveys, such as the sales-lifespan distribution methodologies, are usually favoured.

The assessment's overview is shown in Table 7. The overview concludes that countries might wish to experiment and acquire other means for calculating WEEE Generated in their own country by using other methodologies, when data is available. However, from an EU harmonisation and data availability perspective, sales-lifespan distribution is still the best option to choose, and in recessions and periods that follow, changes can be corrected by factoring in an economic correction.

Table 7

Review of WEEE Generated methodologies

	Data availability	Accuracy	Simplicity	Harmonisation	Economic effects	Administrative burden
Time-Step	--	++	+	+	++	--
Sales-lifespan distribution	+	+	+	+	+/-	+
Multivari-ate IOA	+	+	--	--	+	-
Dynamic WEEE Generated Model	--	+	-	+/-	+	--
Sales-lifespan distribution – economic correction	+	+	+	+	+	+
Additive WEEE flows Method	-	+/-	+	-	+	+/-
Consumer and business surveys	-	+	+	-	++	--

5.2 POM in the three preceding years-based methodology

The most commonly applied methodology for calculating the collection target is the EEE POM methodology (see chapter 4.2.1). In this methodology, the average of the EEE POM of the three preceding years is used to calculate the collection target. This chapter reviews the impact of the PV panels on the EEE POM collection target (chapter 5.2.1) and the impact of the upcoming open scope on the collection target (chapter 5.2.2). The chapter ends with a review of the methodology in chapter 5.2.3.

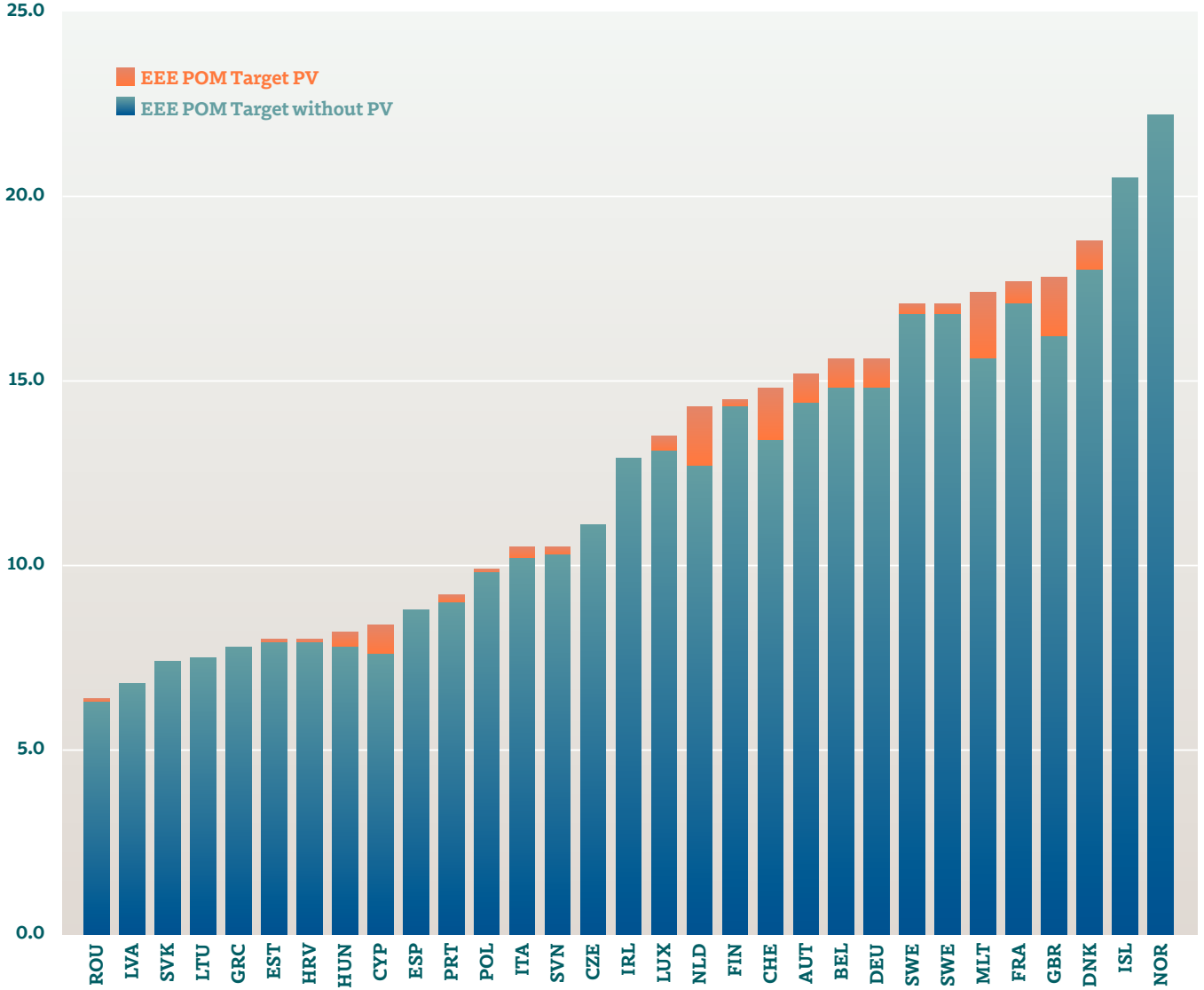
5.2.1 Impact PV Panels on EEE POM

Due to the long lifespans (of at least 13 years, but potentially up to 25 years) of PV panels and recent market penetration, PV panels are not yet arising as waste in significant quantities. Reuse and repair markets for PV panels could also become more prevalent in the future. Therefore, all EEE POM of PV panels contribute to the EEE POM target, but there is currently very limited waste available for collection. The effect of the PV panels has been researched by calculating the share of the PV panels in the EEE POM target in 2018. Figure 10 shows the overview.

The impact of PV panels on the EEE POM target is, on average, 0.6 kg/inh in 2018, or 4% of the total target. However, averages can be deceiving, as differences exist between countries. The two countries with the highest impact are the Netherlands, with 11% of the total, and Malta, with 10% of the total. Figure 10 shows that the EEE POM for PV panels was considerably higher in the early years after 2010. It peaked at 4.0 kg/in 2012 for the entire region, even being as high as 6.9 kg/inh in Eastern Europe (for 2011). As well, the future renewable energy policies might cause another increase of the POM of PV panels, which will affect the EEE POM collection target. Consequently, the PV panel POM are very volatile and lead to very volatile collection targets, based on EEE POM.

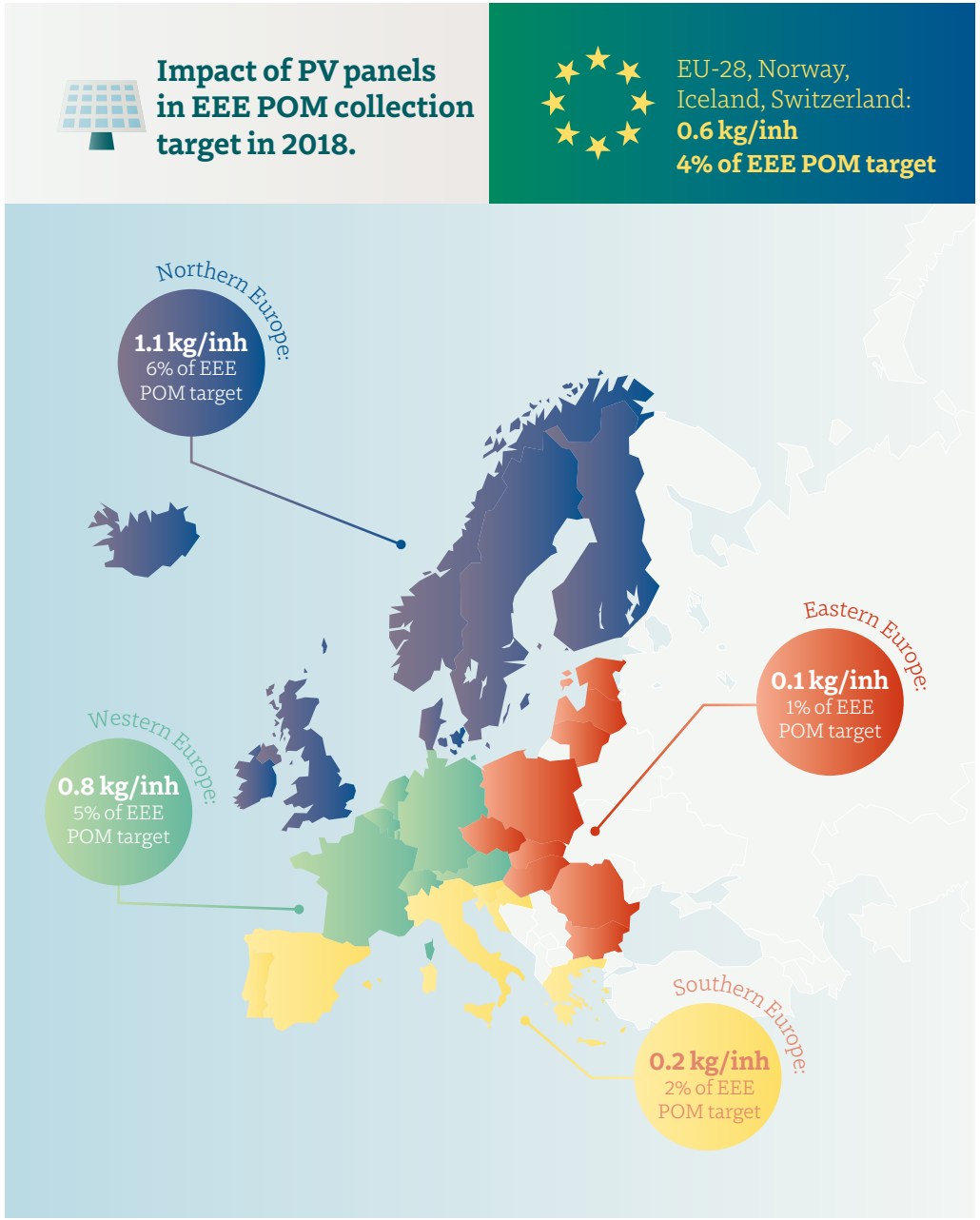
Figure 10

EEE POM target with and without PV panels for 2018 (in kg/inh)



Infographic 15

Impact of PV panels in EEE POM collection target in 2018



Logically, the 65% EEE POM collection target for PV panels is unreachable. Despite this fact, only France was identified as a country where the flow of photovoltaic panels is not subject to the collection target. PV Cycle France, the specific PV panel PRO in the country, is required to respond to all pick-up requests, which has been the case since the sector's launch.

5.2.2 Impact of open scope on EEE POM

Effective 15 August 2018, the WEEE Directive 2012/19/EU implemented the so-called 'Open Scope'. Open scope means that EEE products are a priori considered to be in scope unless specific exclusions are applied. The main implication of this measure has been the revision of the products put on the market that could fall under the scope by the producers and the consequent allocation to the WEEE categories for reporting purposes.

The recast of the WEEE Directive leads at least to the inclusion the inclusion of three additional products [35]:

- photovoltaic panels (in 2014),
- luminaires in households (2018), and
- electric two-wheel vehicles that are not type-approved, such as e-bicycles.

Table 8

Overview of the main products included, due to the move to open scope

Country	Open scope item*	Allocation to EU-6 or EU-10
Belgium	Atmospheric, signage, and safety lighting | Professional electric and electronic machines and tools | Small electrical installation material	Cat. V, Cat. VI, Cat IX. (EU-10)
Czech Republic	Water boilers | Air-conditioning equipment	Cat. I, Cat. IV. (EU-6)
France	Household luminaires | Ink cartridges (act 14) | Energy production, storage, and conversion equipment / Electric generators / transformers (cat 13) | Installation equipment for low-voltage electrical power network and communication network (cat 12)	Cat. V (EU-10) and additional French B2B category
Greece	Large fixed installation | Large fixed tools | PV panels	Depending on the function
Ireland	Household lighting	Cat. IV, Cat. V. (EU-10)
Italy	Equipment using heat pumps | Gas boilers / heaters	Cat. I, Cat. V. (EU-6)
Romania	Toner cartridges | Plugs, switches, and other electrical installation products | Cables	Not indicated
Spain	Cables, motors, toners, switches | Electrical components | Domestic luminaires	Cat. IV, Cat. V, Cat. VI. (EU-6)
The Netherlands	Desks with integrated electrical adjustment functions | Products in which a chip has been processed, such as a debit card, SIM card, RIFD, etc. | E-bikes without type approval | Consumer luminaires	Cat. IV, Cat. V and Cat.VI. (EU-6)
The United Kingdom	Lighting and luminaires | Large-scale fixed installation	Cat. V, Cat. VI. (EU-10)

* Some products currently included in the scope within a country were previously in scope in other countries

Table 8 shows examples of the main products considered as part of the open scope and the categories in which they have been allocated, as reported by various countries and based on responses from our survey among WEEE Forum members. It appears that the open scope is not the same for each country. For example, Italy adds gas boilers, requiring electricity to comply with their open scope, while Belgium adds only small electrical installation equipment.

Table 9
Estimated impact of the open scope on EEE POM

Country	POM of open scope (kg/inh)	Share of open scope in 65% of EEE POM Target
Belgium	0.15	0.3%
Czech Republic	0.95	6%
France	0.66	3%
Italy	1.47	9%
Portugal	1.22	9%
Romania	0.19	2%
Spain	1.30	10%
The Netherlands	0.31	2%
The United Kingdom	0.80	3%

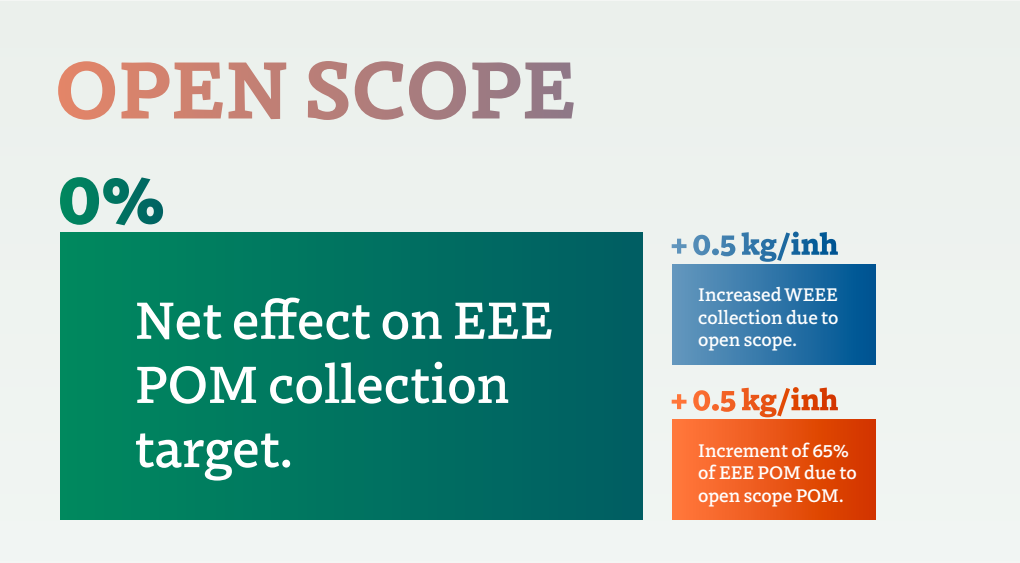
Data is reported for 2019, except for the Netherlands, which covered data from mid-August in 2018 to the end of 2018.

Though it is still early to draw conclusions on the effects of open scope in the 65% POM target, among countries that could provide separate data on the products included as a consequence of the implementation of the open scope, an average amount of 0.9 kg/inh on EEE POM was revealed. However, some countries showed a more significant influence, due to the open scope, such as Italy (1.47 kg/inh) and Spain (1.30 kg/inh). By contrast, Belgium recorded a very limited impact, with only 0.15 kg/inh EEE POM linked to the open scope. The data per country on the open scope and the impact on the EEE POM target are presented in Table 9. It should be noted that there is no information on the share of producers placing new products in scope that are already compliant with the WEEE legislation and reporting EEE POM to the national registers. It would be sensible to expect an increase in the amounts reported as more producers are informed and required to report. No figures on the historical appliances currently being collected are available either.

With regard to the other countries, Ireland registered an increase in the EEE POM for 2019, though the increase was only modestly linked to the open scope. Switzerland has not implemented the open scope requirement and does not foresee doing so in the future, while Cyprus is undergoing a process of license renewal for the compliance scheme and expects to introduce the open scope soon. Only a qualitative indication on the new products included could be gathered for Greece, while for Malta, no exhaustive information on the open scope could be accessed.

Infographic 16

Impact of open scope on EEE POM collection targets



For what concerns the WEEE collected under open scope, data availability is quite limited, and the effect of the open scope will be visible only starting in 2019. Nonetheless, an average increase of 0.5 kg/inh of WEEE collected could be estimated, though it might be not entirely representative for the European picture, as only four countries could provide quantitative information. In particular, it could be estimated that the contributions of products belonging to the open scope on the total WEEE collected is equal to 0.3% for the Netherlands, 0.5% for Romania, 0.7% for France, and 1.3% for the Czech Republic.

The impact of the open scope on collection targets depends on two variables: the impacts on the nominator (WEEE collection) and the EEE POM denominator. It is tentatively estimated (only on data for one year) that the impact on the nominator led to an increase of 0.5 kg/inh of WEEE collection. The impact on the EEE POM denominator was estimated to be approximately equal, as it led to an increase of 0.5 kg/inh. The increase of EEE POM could only be determined for one year, and it was assumed that the EEE POM of open scope was similar in the preceding years. Thus, with current data, the effects of more collection due to open scope and the increase of the EEE POM rule each other out in the calculations.

5.2.3 Review of the EEE POM methodology

The EEE POM target methodology has been reviewed in several respects. Some aspects are similar to the WEEE Generated-based methodology, such as data availability, accuracy, simplicity, harmonizing, and economic effects. On the other hand, other aspects included in the assessment are specific for the assessment of EEE POM target, such as the observed volatility of the PV panels and the impact of the open scope.

In general, data is available from the EEE POM, as this is usually the basis of the central register in a country. Other times, data comes from a clearing house or from the individual producer responsibility organisations. Since the data need is only for the three preceding years, the data will always be available, and the methodology is simple and easily understood. The real accuracy of the EEE POM data from the registers could not be assessed in this study, but it could be that the national registers are incomplete, due to free riders. An indication of the number of free riders might be derived from Table 5, where the EEE POM from the national registers are compared to the EEE POM from the apparent consumption methodology, but this requires more investigation. Table 5 shows that rather large differences are found, and it is unclear whether the differences are due to free riders and under-reporting of the EEE POM or from unregistered used-EEE imports, internet sales, methodological issues with the apparent consumption methodology, etc. The amount for free riders is unknown. Ascertaining the amount would require further assessment, and it is very likely to vary across countries. Therefore, the accuracy related to the EEE POM method can be perceived as accurate, as most of the EEE POM data is audited and controlled. However, the effect of free riders means that data is not harmonised across Europe, and this lack of harmonisation is rated as both positive and negative, thus indicated as "+/-" in the assessment.

Figure 6 shows that the 65% EEE POM collection target does not correlate with the WEEE collection. One important aspect is that the moving average of the EEE POM in the denominator is calculated based on the average of the three preceding years. Were there a recession in 2020, for example, the EEE POM target would still be based on EEE POM of 2017 to 2019 – years when no recession existed and the EEE POM was considerably higher. The WEEE collection is therefore lower in 2020, which seriously impacts the collection rate. Thus, the economic effects on WEEE collection are expressed in the EEE POM target calculation with a delay of a few years, as it was calculated by an average of the three preceding years. Therefore, the economic effects are rated as an "-" in Table 10. As well, the collection target of the EEE POM is highly volatile, due to the PV panels.

Although the methodology selected by all investigated countries is based on the EEE POM, the compliance schemes of several countries, such as Romania and Greece, have identified some difficulties with the methodology of the EEE POM target calculation. Indeed, Romania has experienced a considerable increase in the amount of EEE POM over the past ten years and foresees accomplishing the target in the short term to be a challenging goal, due to rapidly rising EEE POM. Greece emphasized that the approach is highly influenced by the fluctuations of the amounts of POM from year to year, which could be matched with a low consumption behaviour in the society, due to the country's unstable economic situation.

The impact of the open scope is, as discussed in 5.2.2, tentatively expected to be minor. The increase in the denominator, due to increases of EEE POM, rules out the effects on the nominator, the increase of WEEE collection.

Table 10
Review of the EEE POM target

	Data availability	Accuracy	Simplicity	Harmonisation	Economic effects	Volatility due to PV panels	Open Scope
EEE POM	++	++	++	+/-	-	-	+/-

In summary, most countries currently use the EEE POM target methodology because of its simplicity, accuracy, and data availability. Still, there are issues with the methodology's volatility, due to PV panels, insensitivity of economic effects, and harmonisation across the countries (i.e. the level of free riders).

5.3 Synthesis of target methodologies

The Article 7 of the WEEE Directive gives the Member State the option to calculate the collection target, with either 65% of the average weight of EEE POM in the three preceding years or 85% of WEEE Generated from 2019 [2]. Countries can change the methodology to calculate the target each year, if they so desire.

In terms of simplicity and data availability, the EEE POM is much easier to calculate than WEEE Generated, but there are some shortcomings that can be quite relevant for countries. The shortcomings that are reviewed for both EEE POM and WEEE Generated targets include:

- PV panels
- economic effects
- uncertainty in the data
- volatility of the data
- exports for reuse
- the collection target does not necessarily reflect what arises for collection in reality

These shortcomings are evaluated (below) to identify potential improvements to both methodologies.

PV Panels:

Issue:

- The biggest shortcoming is the impact of PV panels on the EEE POM. This is currently adding an additional 0.6 kg/inh to the EEE POM target, but can be considerably higher for some Member States in the future if the change to renewable energy leads to increases in PV panel POM. This makes the target very volatile with WEEE that is not yet arising and also makes the collection target much more difficult to reach.
- The WEEE Generated target calculation does not lead to the same problems with PV panels.

Solution:

- One option would be to have a separate target for PV panels, based on WEEE Generated.
- The WEEE Generated target calculation does not lead to any problems with PV panels.

Economic Effects:

Issue:

- Economic effects will directly affect WEEE collection (the nominator of the collection target calculation), but the denominator (three-year average of EEE POM and WEEE Generated) will not be affected in the current methodology.

Solution:

- An adjustment might be needed for some years when a country is in a recession for the denominator (EEE POM or WEEE Generated)
- However, there is not a clear methodology available for how to adjust the EEE POM denominator.
- A methodology is proposed in this report for adjusting the WEEE Generated denominator, and the results are shown in chapter 5.1.3. The results show a downward correction of WEEE Generated when a country is in a recession.

Uncertainties in data:

Issue:

- One concern for the WEEE Generated data is the uncertainty arising from the calculation methodology. From the current data, a maximum bandwidth was calculated, which shows that the maximum bandwidth for lifespan is ± 2.0 kg/inh and 0.3 kg/inh for EEE POM. The current lifespans are probably accurate for Western, Southern, and Northern Europe and, so, are probably less than 2.0 kg/inh, but this upper bandwidth is used as a precaution.

Solution:

- Countries would have to lower the uncertainty of the WEEE Generated calculations that may possible arise because of EEE POM and lifespans. This decrease could be accomplished by constructing lifespans specific to the country and creating a time series of EEE POM from 1980 to 2020 per UNU-KEY. The next step would be to cross-validate the EEE POM and lifespans with an empirical number of total number of EEE, both currently in use and in hibernation. The Netherlands has accomplished this recently [17] with UNITAR, and the steps are also being undertaken in the United Kingdom and France.

Volatility of the data:

Issue:

- The POM-based target is much more volatile than a WEEE Generation-based target. It is possible that not all EEE POM can be collected and counted toward WEEE collection. This is mostly prominent for products with long lifespans that are new to market or which are in an unsaturated market – e.g. products that do not replace an existing product.

Solution:

- For the EEE POM, one could create a sub-target for product groups that cause the volatility, such as the PV panels.
- A WEEE Generation-based target does not have the issue.

Exports for reuse:

Issue:

- Exported goods for reuse will not become waste in the country where it has been placed on the market.

Solution:

- Annually monitor the exports for reuse, and adjust the target by lowering the EEE POM.

When considering all the shortcomings and the availability of solutions, it appears that the EEE POM target does not always provide solutions, whereas the WEEE Generated methodology can provide methodological solutions. As such, the WEEE Generated is, in theory, a better measure of the amount of WEEE that is available on the market and, thus, for collection target methodology than the EEE POM target calculation methodology may be. However, the WEEE Generation methodology is more complex and data-demanding than EEE POM is, and with the current data gaps for lifespans, the methodology may give rise to inaccuracies in the WEEE Generated, but such inaccuracies could be addressed by continuously improving data quality and performing country studies.

Chapter 6. Recommendations

Under current national implementation strategies, the targets set by the WEEE Directive do not seem to be reachable. There are too many factors that impede formal collection, as highlighted in chapter 4, including competition for WEEE with metal scrap collectors, lack of collection of B2B, exports for reuse, WEEE disposed of in waste bins, etc. Additionally, the collection targets 65% of EEE POM and 85% of WEEE Generated are not equivalent in tonnage in most countries. In fact, the tonnage of 85% of WEEE Generated is much higher than 65% of the EEE POM for most countries.

The purpose of this study was to map current WEEE management, identify the current barriers that impede the attainment of the targets, identify limitations of target-setting, and propose solutions that are feasible across the EU.

This study concludes that the collection targets are not achievable under the status quo. Further measures are required for identifying how much more WEEE can feasibly be collected and/or reported upon, as well as what mechanisms need to be implemented. All information gathered in chapters 3 through 5 indicate a combination of actions that countries can take to move closer to the collection targets.

The necessary reductions of the unwanted flows to reach the collection target can be distilled from the integration of all mass balances (the WEEE flows), as shown in Figure 11.

The mass balance in Figure 11 reveals that in order to achieve any of the collection objectives, countries would have to divert a considerable amount of WEEE that is currently found in other WEEE flows – most notably:

- WEEE disposed of in waste bins
- most WEEE that is mixed in with metal scrap
- illegally exported WEEE

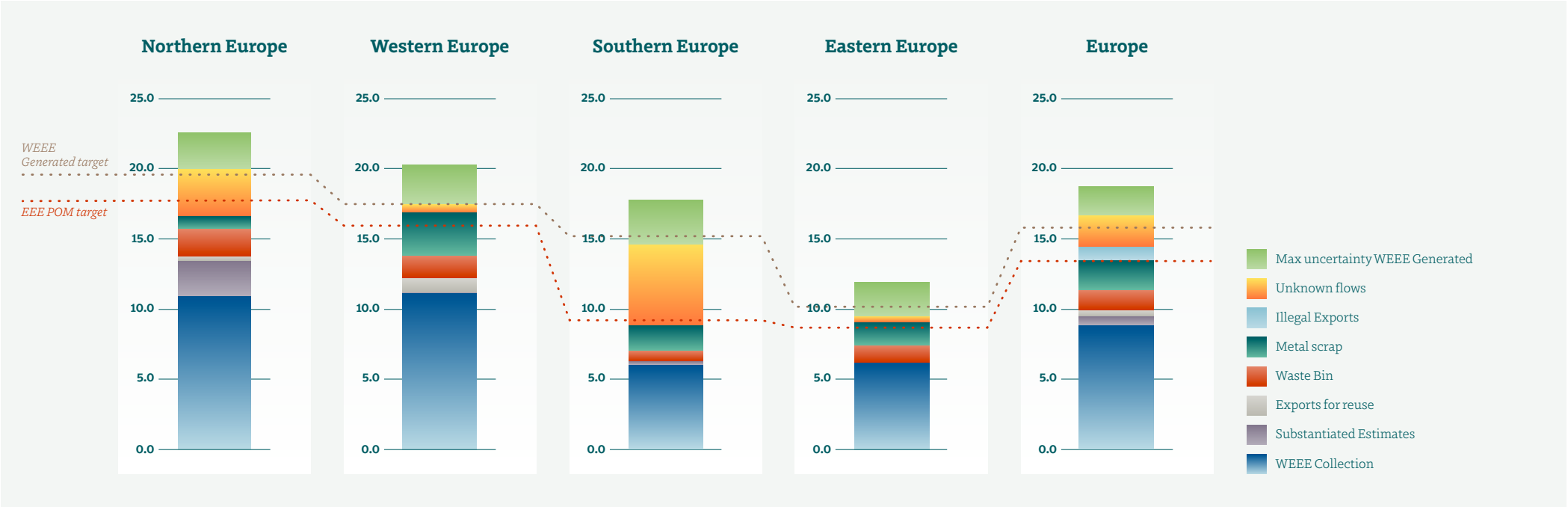
Furthermore, countries would need to start monitoring used-EEE exports in order to distinguish illegal WEEE from real used-EEE exports and to correct for them in the target setting.

The diversion of the other WEEE flows and the achievement of the collection targets can be summarized into four main recommendations, which are detailed into sub-recommendations:

1. Monitor all WEEE flows at national and EU level,
2. Design interventions to reduce unwanted WEEE flows and steer them into the compliant WEEE management regime,
3. Facilitate cooperation between the various stakeholders in the country through a coordination body,
4. Improve target calculation methodology when targets are unrealistic.

Figure 11

Overview of the WEEE flows that could be quantified for 2018 (in kg/inh)



Recommendation 1:
Monitor all WEEE flows at national and EU level

The most important aspect of improving WEEE collection is knowing where the missing WEEE flows are. Monitoring all WEEE flows will lead to better understanding of the WEEE flows that currently are not collected and will provide indications for reducing certain flows with specific interventions. To date, many countries do not periodically produce data on the WEEE flows in their country, and the quality reports submitted to Eurostat by the Member States do not provide the entire picture of the WEEE management, nor do they always provide explanations of the trends.

The national monitoring should at least include:

- EEE POM data in UNU-KEYs,
- WEEE Generated calculations in UNU-KEYs,
- WEEE collection data in at least 6 categories of the Directive and, separately, PV panels,
- WEEE that is mixed with metal scraps in at least 6 categories of the Directive,
- WEEE that is disposed of in waste bins in at least 6 categories of the Directive,
- WEEE exports (both legal and likely illegal) in at least 6 categories of the EU WEEE Directive,
- Exports of used-EEE in at least 6 categories of the Directive and, separately, PV panels,
- Gap analysis between the WEEE Generated and the WEEE flows in the 6 categories of Directive, but preferably at UNU-KEY level, which can be realized through sampling protocols.

It is essential to periodically monitor the previous flows by a Member State and make such monitoring part of the official monitoring framework, and a multi-stakeholder discussion, including setting and assigning targets on reductions of other WEEE flows, is also necessary.

Better monitoring allows countries to:

- know where the missing WEEE flows are,
- design targeted measures for improving collection per product or category,
- calculate a national version of WEEE Generated more relevant to their Member State,
- monitor the exports for reuse and stop illegal exports of WEEE that are often mixed with used-EEE exports,
- assess the WEEE in waste bins (and, to a lesser extent, in the packaging collection, commercial waste, and other streams in municipal collection points) and reduce it by raising consumer awareness and collaborating with local authorities,
- set specific actions for reducing WEEE collection by metal scrap dealers and illegal operators,
- identify areas, perhaps temporarily, for using substantiated estimates in case flows cannot be measured in a multi-stakeholder approach,
- better understand the relationship between economic changes and both the EEE POM target and the WEEE Generated target to provide information for a lower target in times of economic recessions, if necessary.

Monitoring should also be undertaken in a comparable, systematic manner across Europe and can be a basis for efficient benchmarking and evidence-based sharing of best practices. Therefore, we recommend quantifying all WEEE flows in the EU on a periodic basis by integrating national data, including data on illegal flows, from the Member States.

Additionally, national governments and the European Commission must actively seek the monitoring and enforcement of proper management of WEEE and freeriding on the EEE POM. Better enforcement will minimize the improper treatment of WEEE and the mixing of WEEE with metal scrap and residual waste, prevent illegal exports of WEEE, and more effectively control and monitor used-EEE exports. Such actions will positively affect the collection rate and strengthen the WEEE management at the EU level.

Substantiated estimates are allowed in the EU and increase the collection rate, but it must be guaranteed that the amount of WEEE estimated and reported in official figures respects the minimum depollution and recycling standards laid down in the WEEE Directive. Moreover, full transparency on the methodologies applied by the Member States should be called for and assured.

Recommendation 2: Design interventions to reduce unwanted WEEE flows and steer them into the compliant WEEE management regime.

Countries can only reach the WEEE collection targets if they reduce other WEEE flows and collect them in the compliant WEEE regime. The effectiveness can be monitored by the monitoring framework in recommendation 1 and facilitating a multi-stakeholder discussion, including setting and assigning targets on reductions of other WEEE flows. Based on the mass balance in this study as shown in Figure 11, four actions need to be prioritized:

Recommendation 2.1: to count WEEE collected with scrap and ensure proper treatment

The scrap metal processing facilities and treatment operators are required to operate to standards and report on the WEEE they recycle. Examples of measures on how to achieve this are:

- setting a mandatory handover of WEEE by all actors receiving WEEE to officially recognised PROs
- including the reporting requirement in scrap metal operators permits
- monitoring their reporting (and inspecting their activities) for WEEE
- promoting enforcement campaigns for ensuring participation of all facilities receiving WEEE mixed with scrap

Recommendation 2.2: to improve behaviour of consumers

Run national communication campaigns and events targeted at to consumers in order to reduce the WEEE disposed of in waste bins and other inappropriate channels.

Recommendation 2.3: to reduce illegal exports of WEEE

In the EU, some WEEE is still being illegally exported. These exports need to be reduced via more enforcement by competent authorities and cooperation between all actors in the WEEE management chain.

Recommendation 2.4: to start monitoring used-EEE exports and create appropriate custom code

Distinct monitoring of used-EEE exports is essential in order to understand which parts of the EEE sold in the country are not becoming WEEE. All exported used-EEE must also be legal and not mixed with illegal WEEE exports, which is often happening currently. This monitoring must be accompanied by quality checks and certifications. Better monitoring will distinguish illegal WEEE from real used-EEE exports. We also recommend that the EU create a specific custom code for second-hand equipment in order to improve inspections by customs.

Recommendation 3: Facilitate cooperation between the various stakeholders in the country through a coordination body.

It is important that a country sets up a coordination body for monitoring WEEE. This coordination body may be public, private, or of a hybrid nature and should have representatives from all WEEE actors, such as producers, recyclers, retailers, public authorities, customs, environmental inspection agencies, and municipalities. The body should be tasked with managing data collection and monitoring WEEE flows (see recommendation 1).

Furthermore, one of the coordination body's essential responsibilities should be to serve as a forum to facilitate a multi-stakeholder discussion that assigns targets on reduction of unwanted WEEE flows. The effectiveness of the interventions of recommendation 2 must be monitored, guided, and carried out by the responsible agencies.

Recommendation 4: Improve target calculation methodology when targets are unrealistic

Article 7 of the WEEE Directive gives the Member State the option to calculate the collection target, with either 65% of the average weight of EEE POM in the three preceding years or 85% of WEEE Generated from 2019. Countries can change the methodology to calculate the target each year, if they so desire. This makes sense from a practical point of view as one of the other targets might not work out for a country. However, there might be also cases where both targets do not work out.

In general, the WEEE Generated target is, from a methodological perspective, more appropriate to measure the amount of WEEE that can be collected than the EEE POM methodology is. However, it is also more data-demanding, and is generally too high in times of recession. The main methodological constraint of the EEE POM target calculation is the volatility due to the PV panels and changes in the economy. The amount of WEEE that can be collected does not therefore keep pace with the growth of the EEE POM.

As such, countries may consider looking for improvements in the current target-setting approach as a way of coming up with smarter targets.

Recommendation 4.1: Choice of target calculation methodology per category
For some categories with long lifespans and where recent market penetration means that they are not replacing existing products (such as PV panels), it is better to use WEEE Generated (such as PV panels) and for others categories to have a target based on 65% of EEE POM. The recommendation of correcting for the volatility is that Member States can consider having a methodology that is based on a hybrid of both methods. This is also proposed in a forthcoming report of the Irish EPA. The country then decides to use either the EEE POM methodology or the WEEE Generated methodology, per category. For example, for temperature exchange equipment, large equipment (excl. PV), small equipment, small IT, and screens and lamps, the EEE POM methodology is used. For PV panels, a WEEE Generated target is used. Otherwise, any other combination that reflects market saturation within the country could be used.

Recommendation 4.2: correct for used-EEE exports for reuse
Used-EEE that are exported for reuse, will not become WEEE in the country where they were originally placed on the market. Therefore, it is recommended to correct for those in target methodology. One option could be to subtract those used-EEE exports from the EEE POM, which is undertaken in the Netherlands and is researched in Ireland.

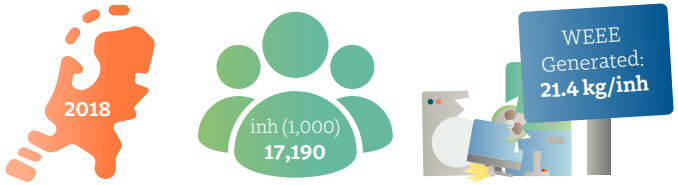
Chapter 5 illustrated that the main shortcoming of the WEEE Generated target methodology is the fluctuations in WEEE Generated, due to economic and business cycles as well as possible inaccuracies of EEE POM and lifespans.

Recommendation 4.3: Improve WEEE Generated methodology for economic fluctuations
The first recommendation is to improve the WEEE Generated methodology to reflect economic fluctuations when there is a strong economic recession, as is illustrated in chapter 5. This would lead to both a downward correction of WEEE Generated in years when the annual change of EEE POM is negative as well as to an increase of WEEE Generated in the years that follow. Such an improvement would necessitate an amendment to the definition of WEEE Generated in the common methodology, but would also require additional research to further test the methodology.

Recommendation 4.4: Member Sates produce national data to improve WEEE Generated
This recommendation is addressed to the Member States, particularly Hungary, Romania, Slovakia, Estonia, Denmark, Portugal, Greece, Spain and Cyprus that have discrepancies in the EEE POM data of apparent consumption methodology and national registers (Table 5) and Eastern European countries that might not have discrepancies of lifespan data – though the recommendation may be applicable in other regions as well. The Member States need to validate the EEE POM and lifespans used for the WEEE Generated calculations. It must be ensured that the EEE POM serving as the basis of WEEE Generated is not substantially under-counted due to free riders or used-EEE imports. The lifespans necessary for calculating WEEE Generated can be obtained if the EEE POM and lifespans match or are cross-checked with empirical data on the number of items in use and in hibernation. It must also be ensured that conceptually sound conversions of the national classifications into the UNU-KEYs are developed.

Chapter 7.
Country Profiles

The country profiles have been constructed from the underlying data outlined in previous chapters, input from the WEEE Forum members, and additional details in the reports that have been provided. Where possible, all data and information has been harmonised and synchronised, but doing so was not always possible. As such, minor inconsistencies with the previous chapters, country profiles, and underlying reports may exist.



7.1 The Netherlands

Overview

The Netherlands has increased the collection of WEEE from 7.7 kg/inh in 2010 to 10.8 kg/inh in 2018. In 2015, WEEELABEX certifications for treatment facilities became mandatory, the 'all actors' approach was implemented, and the National (W)EEE Register was set up. In 2018, the 'all actors' approach has increased the WEEE collection volumes by 1.7 kg/inh. However, this was insufficient for reaching both the 85% WEEE Generated and the 65% EEE POM targets, as the collection rate is 50% of WEEE Generated, or 49% of EEE POM in 2018.

The country perceives, as main hindrances to achieving the target, a limited availability of the administration in the inspection capacity, the competition on fees for producers and importers, and the considerable export of used-EEE. By contrast, the implementation of some attributes from the WEEE Directive and the actualisation of national collection campaigns have positively influenced the increased collection rate.

Figure 12 illustrates the WEEE flows, EEE POM, and WEEE Generated targets in the Netherlands for 2018.

Figure 12
WEEE flows, EEE POM, and WEEE Generated targets in the Netherlands

Analysis of key factors affecting collection rate

Target methodology

The methodology, which is mostly used in the Netherlands to calculate the collection target, is based on 65% of EEE POM, though the legislation allows both approaches. For 2019, the target has been set to 16 kg/inh, and there are not specific targets differentiated by category. Regarding the WEEE Generated approach, from 2010 to 2018, the share, which is formally and compliantly recycled, increased from 39% to 50%. From 2019 onwards, used-EEE exports can be subtracted from the EEE POM in the target calculation methodology.

Other WEEE flows

The WEEE flows have been quantified in the Netherlands and revealed that 5.8 kg/inh of WEEE was still found in mixed metal scrap dealers, recycled in the Netherlands, or exported. As well, 1.8 kg/inh of used-EEE is exported for reuse, and bad consumer habits indicate that 1.9 kg/inh of WEEE is disposed of in waste bins [17].

Efforts are currently being undertaken to use substantiated estimates to quantify the used-EEE exports, which are not closely controlled. In fact, the monitoring of the exports for used-EEE is currently in a pilot phase, and the National (W)EEE Register covers only voluntary reports of export for reuse, although reporting will become obligatory as of 2020. In the Dutch WEEE Flows 2020 study, the export for reuse has been estimated as 31 kt (1.8 kg/inh), with approximately 30% of the appliances not being functioning and thus equating to WEEE.

However, even considering the attempts to quantify exportation of used-EEE, the size of the other WEEE flows (i.e. metal scrap, waste bins) is quite significant and makes it rather difficult for PROs to achieve the collection target.

The informal sector is mainly comprised of scrap dealers, who recycle WEEE as metal scrap. Since 2019, a new 'motivational fee' is enforced to encourage scrap dealers to deliver WEEE to certified recyclers, and beginning in 2020, the legislation will render the fee obligatory.

PV Panels and open scope

The share of PV panels in the EEE POM is quite significant, and it has consistently risen since 2014 (1.38 kg/inh). In 2018, 6.1 kg/inh of PV were put on the market in the Netherlands, with a share of 11% (1.6 kg/inh) of the 65% EEE POM target. These PV panels are not yet found in waste streams, and as such, they are another impediment to reaching the collection target.

The impact of the open scope in the Netherlands corresponded in 2018 to 0.31 kg/inh EEE POM and 521 (0.03 kg/inh) tons of WEEE collected, which have been allocated to Cat. IV, Cat. V, and Cat.VI (EU-6).

Coverage of the WEEE collection data

Since the WEEELABEX certification has been mandatory by law since July 2015 in the Netherlands, the present registration of WEEE collection data in the National (W)EEE Register is based exclusively on WEEE treated in compliance with WEEELABEX. In 2018, the WEEE collected and compliantly registered was equal to 10.7 kg/inh, showing a 45% weight increase as compared to 2010.

All categories are reported in the Netherlands, and they are within the European averages. In the Netherlands, 0.8 kg/inh are collected through B2B, which is close to the European average of 10% for total WEEE collected. Based on the current share reported, it is not expected that B2B collection could significantly affect the collection rate.

In the Netherlands, producers only report their own WEEE (i.e. collected and treated), while imported WEEE is excluded, so there is no risk of double-counting. When reporting, the country differentiates among its collection between individual producers, PROs, and recyclers, and a total collection rate is subsequently calculated based on those three reporting groups.

WEEE Directive Implementation

In 2015, it became mandatory to have a WEEELABEX certification for treatment facilities, the 'all actors' approach was implemented, and the National (W)EEE Register was set up. Stakeholders are currently negotiating to have a mandatory handover of WEEE in 2020. Currently, there is a draft for legislation, with the expected date of implementation being in 2021. The mandatory handover will cover all WEEE, with all actors accepting it: municipalities, retailers, traders, brokers, etc. WEEE will have to be mandatorily handed over to WEEELABEX/CENELEC-certified recyclers.

The collection responsibility is allocated according to an 'all actors' approach, which entered into enaction in 2014 through an implementation law of the WEEE Directive enforced. This measure has been fully implemented, and all stakeholders active in the WEEE collection and recycling chain are involved. The organisational setting is defined in the Dutch implementation law (Regeling AEEA), and it delineates an entity, called the Monitoring Council, where all actors are involved and to which an Action Plan for reaching the 65% EEE POM target is committed by all actors involved. The reporting of POM, collection, and recycling is organized by the National (W)EEE Register, to which individual producers (with their own take-back scheme), PROs, and recyclers are reporting. The National (W)EEE Register then reports the data to the Minister.

As such, there is currently no clearing house in the Netherlands, only a partial system for clearing responsibilities and costs. Indeed, the clearing contracts in the Netherlands balance the collection, recycling, and waste management costs between various PROs.

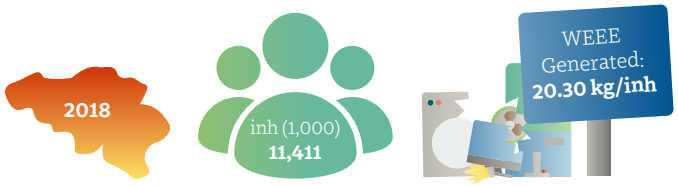
The Netherlands does not yet use substantiated estimates, but it is considering estimating and subtracting the exports for reuse and correcting the information in the statistics.

There is currently no visible fee in the Netherlands.

Key Statistics
The Netherlands

Indicator	Year	Value
Inhabitants (1,000)	2018	17,190
Sum of EEE POM apparent consumption method* (kt)	2012-2017	2,286
Sum of EEE POM Eurostat* (kt)	2012-2017	1.957
EEE POM Eurostat (kg/inh)	2017	24.35
WEEE Generated (kg/inh)	2018	21.43
WEEE Collection Eurostat (kg/inh)	2017	9.7
WEEE Collection Key Figures (kg/inh)	2018	10.76
Collection rate in % (compared to EEE POM for the three preceding years)	2018	49%
Collection rate in % (compared to WEEE Generated)	2018	50%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.



7.2 Belgium

Overview

Belgium achieved a collection rate of 53% of WEEE Generated in 2018 and 47% of EEE POM averaged across the three preceding years (2015-2017). The country could not achieve either of the two targets for that year. Belgium remains short of the target by 7.06 kg/inh for the 85% WEEE Generated target and 4.88 kg/inh for the 65% EEE POM.

Though the collection of WEEE in Belgium has been relatively high since 2013 (10.8 kg/inh), the country has faced difficulties in increasing it further in recent years. Apparently, the WEEE is channelled in other WEEE flows, and this practice increases with the price of metals in the market. Additionally, the presence of online free riders has become an issue in recent years and is expected to have a greater impact in the near future due to increased e-commerce.

Figure 13 illustrates the WEEE flows, EEE POM, and WEEE Generated targets in Belgium for 2018.

Figure 13
WEEE flows, EEE POM, and WEEE Generated targets in Belgium

Analysis of key factors affecting collection targets

Target methodology

Belgium adopted the official targets as defined in the WEEE Directive and, thus, do not have any specific target per collection category. The methodology used was based on the 65% EEE POM, though in the country's three regional legislations, both the EEE POM and the WEEE Generated options could feasibly be used.

Concerning the preparation for reuse of EEE, Belgium applies a collection target of 80% for both Cat. I of EU-10 (LHA) and Cat. X (automatic dispensers) and a 70% target for both Cat. III (IT equipment and telecommunications) and Cat. IV (consumer equipment). For all other categories, the preparation target for reuse differs, depending on region. However, a collection target of 55% should be reached in Brussels, and a 70% should be reached in Flanders and Wallonia.

Other WEEE flows

Though there are no official numbers, the share of WEEE collected by informal collectors in Belgium is considered to be quite significant. Metal scrap dealers offer more euro per ton of scrap and lead to improper disposal of WEEE. Meaning that the price of 'classic' scrap in weight is worth more than the price for an equivalent amount of WEEE, as such disposal does not require dismantling and treatment processes according to high standards. In addition to metal scrap dealers, amounts of WEEE may be unaccounted for, due to producers' or resellers' practices (i.e. big players in the market), which keep returned products and consequently dismantle them for spare parts in order to refurbish other equipment. According to a Recupel study, approximately 50% of the informally collected refrigerators eventually reach the correct destination for treatment, while the remaining parts end up being treated illegally or by the collector itself [36], [37]. Additionally, some parts may be collected in reuse centres or exported abroad. In general, metal prices play an important role in whether or not appliances are collected through the PROs network.

For 2018, WEEE flows were quantified using data provided by Recupel [33], [36], [37]. It was estimated that WEEE mixed in with metal scrap was equal to 2.1 kg/inh and that 0.3 kg/inh was disposed of in waste bins. As well, 0.7 kg/inh of WEEE is exported to be treated abroad, of which 0.27 kg/inh is declared and 0.39 kg/inh is not. Additionally, 7.5 kg/inh of WEEE has an unknown fate.

Monitoring exports of WEEE is normally performed by the country's enforcement authorities, but in practice, such monitoring is rarely done. IT and telecommunication equipment are the collection categories most-subjected to illegal exportation. A Recupel study estimated that in 2016, 1.5 kg/inh of IT equipment was exported as used-EEE [36]. Current market trends and interviews conducted with brokers and leasing companies indicate that the stream of second-hand IT devices currently represents a significant amount of the total figure for exported WEEE, but more detailed information is difficult to obtain. The export of WEEE from Belgium should be noted in an information file, which is usually not filled out, due to exporters' unawareness of the requirement. A prominent channel in the country is exportation of cars. In fact, there is a large market for cars transported abroad, mainly to Africa and which are often filled with WEEE. Those quantities leave Belgium as undocumented and are typically sold in the destination countries.

Moreover, depending on the geographical location (especially in big cities), it has been noticed that WEEE is also likely to end up discarded in streets, so valuable components may be scavenged.

PV Panels and open scope

The sector of PV panels in Belgium has a share over the total EEE POM, which is in line with the European average (5%). The amount of PV POM has consistently been increasing since 2016 (1.12 kg/inh), and in 2018, Belgium registered 2.11 kg/inh of PV panels as POM, which is considerably above the European average (0.79 kg/inh). So, the influence of this sector on the EEE POM flow is relevant and accounts for 5% of the collection rate achieved by the country. Treatment of PV panels began in July 2016, and currently, the entire amount of PV panels collected is also treated afterward, though no audit of treatment facilities has yet been performed to confirm recycling rates and obtain treatment data for the sector. All the selenium-based solar panels are treated in Belgium (241.3 tons in 2016 and 22.2 tons in 2017), while the CIGS-based panels are treated in Germany (26.2 tons in 2016 and 89.3 tons in 2017). Data on PV panels in Belgium is managed by PV Cycle.

With the open scope having been enacted, Belgium began reporting data for several new products, particularly: atmospheric, signage, and safety lighting, which has been accommodated to Cat. V of EU-10 (consumer and lighting equipment); professional electric and electronic machines and tools, which have been allocated

to Cat. VI (electrical and electronic tools); and small electrical installation material, such as cable or energy management systems, power supplies, controls for lighting, and protective devices, allocated to Cat. IX (monitoring instruments and controls). Separate data for new products included is not available, except for small electrical installation material (0.15 kg/inh), so, as of this writing, it has not been possible to quantify their specific impacts on the market.

Coverage of the WEEE collection data

Data on WEEE collected are obtained from Recupel (85% of the total), which is the only PRO active in Belgium, and BeWEEE (the remaining 15%), a national reporting tool which is used by producers with an individual waste collection agreement. BeWEEE has assumed the connotations of a proper association since 2018 and has also led follow-up and sensitization activities.

The official reporting system in Belgium does not completely cover the sector. Indeed, until 2017, only Flanders was obliged to report data from all actors outside the compliance schemes, while Brussels and the Walloon region had only enforced the obligation on data-reporting starting in 2018.

Belgium's data includes B2B collection since 2007, and for 2017 it shows 1.14 kg/inh of WEEE being collected through B2B channels, with a share of the total amount of WEEE collected being within the European average (10%). For what concerns the different sources of household collection, Recupel calculated that in 2018, 24% (2.3 kg/inh) of WEEE has been collected by distributors, 14% (1.3 kg/inh) by operators cooperating with Recupel, 54% (5.3 kg/inh) by municipal parks, and 8% (0.8 kg/inh) through reuse centres.

Recupel takes into account WEEE exported to be treated abroad (i.e. fridges to Germany), while BeWEEE data does not include WEEE exported for treatment. In order to have representative estimates in the WEEE management, Recupel performs audits on each of their members at least every +/- 3 years to verify whether or not the POM quantities that were declared were correct. If inconsistencies with POM quantities are observed from their members, Recupel practices more targeted 'audits' and performs enquiries to determine the reasons for the inconsistencies. The strict controls lead to higher amounts of EEE POM registered.

WEEE Generated methodology

Currently, the WEEE Generated methodology is not considered to be an option for Belgium, due to the unreliability of the underlying data available according to the PRO. The EEE POM data obtained from the apparent consumption method, which was used as the basis for the WEEE Generated calculation, shows a moderate match with the EEE POM data reported to Eurostat. The EEE POM from the apparent consumption methodology is 12% lower than the EEE POM from Eurostat.

WEEE Directive Implementation

In Belgium, the mandatory handover of WEEE has not been fully implemented and applied to all actors. For instance, consumers do not have the obligation to hand over their WEEE to a specific partner, while professionals in partnership with Recupel are supposed to hand over WEEE only to authorised locations. Nonetheless, scrap dealers who are not provided with a proper license to stock and treat WEEE are prohibited from accepting it.

The 'all actors' approach has mostly been implemented in the country since the upgrade of BeWEEE from tool to proper association took place. Regarding POM, the majority of producers have a membership with Recupel, while the few not affiliated with the PRO have to declare directly to BeWEEE. In 2019, BeWEEE managed actors reporting in the tool for the reporting of the year 2018, which resulted in a sizable difference between what was declared in 2017 (around 6.662 t) and what was declared in 2018 to BeWEEE (20.835 t). In 2019, BeWEEE expects to have reporting also of approximately 20 kt.

As for WEEE, household and professional appliances often end up in the Recupel stream via recognised channels. Information on quantities that has not been directly declared to Recupel must be reported by actors to BeWEEE. The extra amount of WEEE collected through the application of the 'all actors' approach is difficult to estimate, as BeWEEE was only created in December 2018. The effects of BeWEEE implementation will likely be noticeable only beginning with 2019 data. Since Belgium has only one active PRO, a clearing house has not yet been implemented.

A visible fee has been applied since 2008 only for the sales of household appliances, while sales to end users and professional appliances do not require a visible fee. Considering that the measure has only partially been introduced, the impact of the attribute on PROs could not be quantified.

Substantiated estimates are not currently used in the country, and they are not expected to be implemented in the near future. Only reported data are included in the official figures. One of the obstacles that the PRO regards as threatening to the efforts that can be made to increase the collection target for the upcoming years is online commerce, especially for small consumer devices. Another item to be considered is that every member of the PRO is audited, which frequently results in a growth of the POM data – which, in turn, helps reflect the country's real situation. Furthermore, the level of enforcement measures by the government and at the international level against undocumented export and non-compliant collection and treatment flows is deemed to be inadequate.

Key Statistics

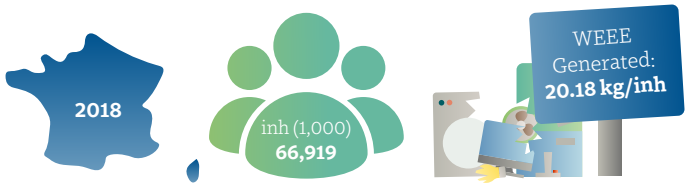
Belgium

Indicator	Year	Value
Inhabitants (1,000)	2018	11,411
Sum of EEE POM apparent consumption method* (kt)	2008-2017	2,314
Sum of EEE POM Eurostat* (kt)	2008-2017	2,821
EEE POM Eurostat (kg/inh)	2017	24.57
WEEE Generated (kg/inh)	2018	20.41
WEEE Collection Eurostat (kg/inh)	2017	10.92
WEEE Collection Key Figures (kg/inh)	2018	10.29
Collection rate in % (compared to EEE POM for the three preceding years)	2018	47%**
Collection rate in % (compared to WEEE Generated)	2018	53%***

* Excluding UNU-KEY 0001 and UNU-KEY 0002.

** The original value for the WEEE Forum Key Figures data was 44%, but this has been adjusted to 47%, as the WEEE Forum Key Figures data was under-reported compared to official Eurostat data.

*** The original value for the WEEE Forum Key Figures data was 50%, but this has been adjusted to 53%, as the WEEE Forum Key Figures data was under-reported compared to official Eurostat data.



7.3 France

Overview

In 2018, France achieved a collection rate of 58% of WEEE Generated and a 45% collection rate on the average EEE POM for the three preceding years (2015-2017), equivalent to 11.9 kg/inh collected. The WEEE collected per inhabitant consistently increased over the past years, from 6.5 kg/inh in 2010 to 11.9 kg/inh in 2018.

The WEEE Directive implementation models, such as mandatory handover and the visible fee, are deemed by PROs as essential in guaranteeing a high collection rate in the country. One key factor that has been identified for improving the collection rate is the limitation of uncontrolled WEEE exportation for reuse and treatment. Additionally, municipalities should guarantee a sufficient number and effective distribution of collection points, as well as improve the enforcement actions, as a means for reducing informal channels.

Figure 14 illustrates WEEE flows, EEE POM, and WEEE Generated targets in France for 2018.

Figure 14
WEEE flows, EEE POM, and WEEE Generated targets in France

Analysis of key factors affecting collection targets

Target methodology

Until 2019, the approach chosen to calculate the collection target was 65% of the average EEE POM over the three preceding years. In particular, the target has been set to 14.6 kg/inh for WEEE collected from households and 1 kg/inh from B2B WEEE for 2019. Specific and increasing overtime targets for B2B differ from category to category, increasing over time, and will be reviewed in 2022. Beginning in 2019, French regulation foresees the possibility to choose the target methodology between EEE POM and WEEE Generated, and the approach still has to be selected for 2021 on.

Other WEEE flows

Other WEEE flows are present in the country and part of the informal sector. The informal sector is comprised mainly of informal collectors acting prior to kerbside collection or committing theft at municipal collection points and shops, as well as distributor delivery employees and equipment installers, who do not always bring the WEEE back to shops or PROs. Most often, informally collected WEEE is exported as WEEE or used-EEE, or, alternatively, is sold to scrap dealers and shredded along with metal scrap. Notably, exportation to other EU Member States occurs, and such exports may then be shredded along with metal scrap, or re-exported by these EU countries to locations outside the EU (e.g. Africa or Asia), whereas, to a lesser extent, part of the WEEE is directly exported outside the EU. Many informal collectors are well-organized, some are equipped with vans and patrol areas the same days as municipalities in order to collect large equipment before the municipalities do. Some informal collectors belong to minority groups in the country, which collect and/or purchase used-EEE in order to export them to Africa. The informal collection and scavenging practices in recycling centres or shops result in a reduction of the amount of WEEE collected by PROs and municipalities.

The different WEEE flows in France have been quantified for 2017-2019 via French Environmental Agency (ADEME) data, showing that, apart from the WEEE collected, 1.8 kg/inh of WEEE is disposed of in residual waste [38]. The quantities of WEEE in metal scrap is 4.9 kg/inh [38].

It has been indicatively estimated by PROs that roughly 0.5-1 kg/inh of B2B used-EEE were exported for reuse from France in 2017 by producers, brokers, facility managers, and NGOs, whereas no data is available for B2C EEE. Some quantities of B2B used-EEE exported are monitored and reported (e.g. IT equipment, medical devices, etc.), but the monitoring system is not extensive: only B2B EEE exported directly by member producers after taking second-hand EEE back from their customers and by medical NGOs in contract with PROs can be reported to the PROs on a voluntarily basis In 2018, 0.13 kg/inh of IT equipment and 0.015 kg/inh of medical devices were exported for reuse and reported to the PROs. However, a large part of the exports of used-EEE is not reported, as it is carried out by other actors than producers. As such, it does not necessarily comply with present regulations and may be illegal. A French study [38] has detected that B2B EEE exported for reuse mostly entails professional equipment – primarily IT, medical devices, automatic dispensers, industrial equipment, and power generation groups. Brokers are the main actors involved in the B2B used-EEE export for reuse. The primary concerns that have been identified in the flow of export for reuse are a lack of transparency by the players in the sector, a lack of knowledge of regulations regarding cross-border transfers of EEE, and the common loss of traceability, which are at the origin of the potential illegal transfer of WEEE. France did not establish a reporting method for B2C used-EEE exported for reuse. Random controls are performed by customs, but this type of information is unfortunately not available.

With regard to scavenging practices, the equipment most affected are refrigerators, computers, central processing units, and CRT TVs. The locations where these activities most commonly occur include municipal collection points and treatment centres. Components most frequently missing from the aforementioned appliances are compressors, hard drives, and deflection parts.

PV Panels and open scope

The amount of PV panels POM per inhabitant in France for 2018 corresponded to 0.97 kg/inh, and increased significantly as compared to 2016 (0.55 kg/inh). The share of PV panels in 2018's collection target was 3% (0.58 kg/inh).

With the introduction of the open scope, the new products added include ink cartridges; household luminaires; energy production, storage, and conversion equipment; and installation equipment for low-voltage electrical power networks and communication networks. As a result, three additional categories were introduced in the French system: category 12 (which includes professional, installation equipment for low-voltage electrical power networks and

communication networks), category 13 (energy production, storage, and conversion equipment), and category 14 (which focuses on B2C printer cartridges). For 2019, these three new categories constituted 20,000 tons of EEE POM, and in the case of luminaries was more than 30,000 tons, equivalent to 0.77 kg/inh. In 2019, it could be estimated that the contribution of products belonging to the open scope on the total WEEE collected in France was equal to 0.09 kg/inh.

Coverage of the WEEE collection data

France reports the WEEE collection data in the National Register in 6 categories and is run by ADEME (French Environment and Energy Management Agency). ADEME is the authority in charge of performing quality checks on the National Register data and tasked with liaising with the PROs. Collection data is provided only by PROs and B2B producers with individual systems. WEEE collection data is available by type of collection points : municipalities (6.2 kg/inh), distributors of EEE sold in France, SSE (social and solidarity economy) organisations (0.4 kg/inh), and others (incl. waste operators or scrap metal dealers in contract with PROs). SSE collects used-EEE that may or may not be functional, repair them (as needed), and sell them to customers. The SSE then provides the unrepairable WEEE to the PROs, thus contributing to the WEEE collection.

France gathers data on WEEE collected for five categories, which, as defined in the WEEE Directive, are then converted through sampling campaigns performed by the collective systems. The procedural rules are set by ADEME (French Environment and Energy Management Agency) and the Ministry of Environment (Eurostat Quality Report, 2017). ADEME is the authority in charge of performing quality checks on the National Register data and tasked with liaising with the collective organisations of approved producers. Data is provided by producers with individual systems and professionally certified eco-organisations. Other sources of data on WEEE collected are municipalities (6.2 kg/inh), distributors of EEE sold in France, SSE (social and solidarity economy) organisations (0.4 kg/inh), and waste operators or scrap metal dealers. The aforementioned actors do not provide data to the National Register. They are part of the collection network managed by PROs. Only PROs report data to ADEME. SSE collects used-EEE that may or may not be functional, repair them (as needed), and sell them to customers. According to Ecosystem's data, there were 439,878 household appliances reused through SSE in 2018. The SSE then provides the unrepairable WEEE to the PROs, thus contributing to the WEEE collection.

Since 2016, waste operators and scrap dealers collecting WEEE have to be in contract with PROs and supposedly report the WEEE collected to the PROs. However, reporting is still not complete (see *WEEE Directive implementation*).

Other actors that play a role in the management of WEEE are the take-back shops – representing more than 5,000 collection points – which collected 1.8 kg/inh (120 kt) of WEEE in 2018. Since 2006, data from retailers is also included in the country's collection-reporting, as they hand the WEEE over to PROs.

The distinction between B2B and B2C was introduced in 2006, when the EPR principle was enacted. However, PROs agreed on B2B only starting in 2012, and since then they have separate designations for B2C and B2B collection. In 2016 and 2017, France showed a share of the B2B collection of 8%, which is close to the European one for those years (10%) and corresponded to 0.97 kg/inh of WEEE, from the total collected. B2B EEE in France includes all appliances in the professional stream, which are not similar to B2C ones, meaning that products such as laptops, small printers, and phones, even when used in professional contexts, are all considered as B2C equipment.

The volume of WEEE not collected in France but imported for treatment is not included as part of the collection rate registered in the country. On the contrary, when no treatment technology capacity is available in France, the amount of WEEE collected but exported and recovered in other Member States or outside the EU is reflected in the national figures. In this regard, individual systems and waste operators must provide a certificate to ensure adequate standards of collection and treatment.

WEEE Generated

In the upcoming French study, the amount of household WEEE Generated is 21.3 kg/inh, whereas the amount of household and business WEEE is 20.2 kg/inh in this study. The EEE POM from the apparent consumption methodology, which served as the basis for the WEEE Generated calculations in this study, was, on average, 11% lower than the EEE POM data reported to Eurostat, which indicates that the WEEE Generated is underestimated for France.

WEEE Directive Implementation

In France, two PROs manage household and professional WEEE (Ecosystem and Ecologic), whereas one PRO manages PV panels, specifically (PV Cycle). In particular, the category of lamps is entirely handled by ecosystem. In the future, penalties for PROs are expected to be imposed when the annual action plan for the management of WEEE is not reached.

The two PROs compete commercially to obtain memberships with producers and sign contracts with waste treatment operators (i.e. scrap dealers and shredders). However, there is no competition for the access to collection points, as this is managed by France's clearing house. In 2006, France introduced a clearing house (OCAD3E) for household WEEE, a subsidiary of the PROs. The clearing house provides financial support to municipalities (e.g. fees, dedicated staff and enforcement measures, security, etc.) and allocates collection points based on the POM share in order to balance obligations. In addition, it monitors obligations for the two PROs and establishes and manages the contractual and financial relations with local authorities and shareholders and the payment of financial compensation for collection. OCAD3E implementation methodology is based on the allocation of collection points and the allocation of the weight of WEEE to be collected.

The country has implemented mandatory handover of WEEE since 2016, so every company or actor managing WEEE (i.e. metal scrap dealers, car shredders, transit operators, and waste brokers) must be in contract either with a PRO or with an individual system. All actors should report, directly to the PROs, the WEEE they receive and treat themselves, as well as the WEEE received that cannot be properly treated and which has to be handed over to the PROs. The scope of mandatory handover in France is not only for metal scrap dealers and shredders but also for WEEE operators that are already in contract with PROs but who have their own WEEE collection. It is estimated that roughly 50% of the metal scrap dealers and all shredders are in contact with a PRO. The mandatory handover, when effectively enforced, has been identified as an important tool for setting the obligations for all operators managing WEEE to be in contract with a PRO. According to national data, the extra amount collected through implementation of the mandatory handover in 2018 was equivalent to 2.52 kg/inh of B2C WEEE and 0.48 kg/inh of B2B WEEE. The amount included WEEE from metal scrap dealers, shredders, WEEE treatment operators from their own WEE collection, and transit operators that do not process WEEE, such as package-sorting centres, business waste-sorting centres, B2B, or private collection points. However, the reporting from scrap dealers is not complete, as not all the scrap dealers are in contract with PROs, due to insufficient law enforcement. Furthermore, the reporting is done step-by-step, with a focus on large household appliances, whereas it is particularly lacking for some flows, such as small household appliances, screens, and B2B equipment.

France adopted a visible fee for B2C equipment in 2006, and the fee must clearly appear on the EEE labels. There is no visible fee for B2B equipment. Though the effect of the visible fee on the collection rate is difficult to estimate, it is recognised by PROs as a fundamental tool for guaranteeing the efficiency of their activity. In fact, if the fee were not visible, manufacturers would not be able to negotiate with distributors to keep it as low as possible. The contributions received by the PROs would thus be lower, and they would not have the same means to communicate, provide distributors with financial incentives to give back their WEEE, support the reuse sector, and incentivize R&D activities. Moreover, the visible fee plays an important role to the consumers, as it increases their awareness of WEEE management.

Substantiated estimates are not in use in France because they are not deemed to fulfil the obligations of traceability and recovery targets, set by the WEEE Directive.

Based on the opinion of the PROs, the key factors that have supported the country in the achievement of a high collection rate are the implementation of models from the WEEE Directive, such as the visible fee for household WEEE; the allocation of the municipal collection points through the clearing house; retailers' obligations from the start (1 for 1 and 1 for 0); and mandatory handover, which obliges all operators managing WEEE to be in contract with a PRO. In 2013, one action taken to secure WEEE prior to its collection was the development of local temporary collection points. These aforementioned measures led to an increase in the WEEE collected from 7.77 kg/inh in 2013 to 11.9 kg/inh in 2018. By contrast, the limitation of uncontrolled WEEE exported channelling into the informal sector via strong enforcement actions and monitoring by authorities should be improved.

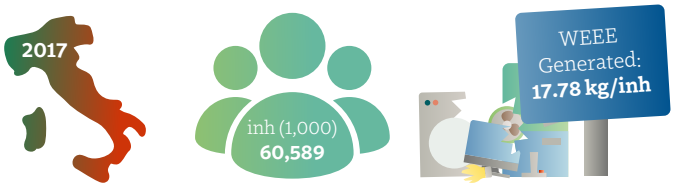
Additionally, according to the PROs, the challenge of increasing the collection rate partially lies in POM declarations, which are historically consistent and complete. Only infrequent shortages and the presence of free riders are considered marginal. The high denominator makes it a challenge to increase the EEE POM target, given how it has been defined.

Key Statistics

France

Indicator	Year	Value
Inhabitants (1,000)	2018	66,919
Sum of EEE POM apparent consumption method* (kt)	2008-2017	14,714
Sum of EEE POM Eurostat* (kt)	2008-2017	16,359
EEE POM Eurostat (kg/inh)	2017	26.89
WEEE Generated** (kg/inh)	2018	20.18
WEEE Collection Eurostat (kg/inh)	2017	11.11
WEEE Collection Key Figures (kg/inh)	2018	11.9
Collection rate in % (compared to EEE POM for the three preceding years)	2018	45%
Collection rate in % (compared to WEEE Generated)	2018	58%***

*Excluding UNU-KEY 0001 and UNU-KEY 0002.
**The WEEE generation presented in this table for both professional and household WEEE appears to be underestimated according to the ongoing French study on household WEEE generation, in which the household WEEE Generated is 21.3 kg/inh.
***The original value for the WEEE Forum Key Figures data was 59%, but this has been adjusted to 58%, as the WEEE Forum Key Figures data was over-reported compared to official Eurostat data.



7.4 Italy

Overview

In 2017, Italy reached a collection rate of 35% of WEEE Generated and a 42% of the average of EEE POM for the three preceding years, which is equivalent to 6.3 kg/inh of WEEE. Italy is currently 8.81 kg/inh away of reaching the 85% WEEE Generated target and 3.52 kg/inh away of reaching the 65% EEE POM target.

The main challenge for reaching a higher collection in Italy is the lack of a control system, which enables the development of unofficial flows when WEEE is collected by informal actors or even by authorised collectors (i.e. municipal collection points and retailers). Moreover, the collection infrastructure system could be improved to fully suit the needs of the citizens. Still, a positive trend in WEEE collection is observed, due to both the low value of raw materials, which discourages the WEEE market of the informal system, and the awareness raising campaigns coordinated by the WEEE Coordination Centre (CdC RAEE).

Figure 15 illustrates WEEE flows, EEE POM, and WEEE Generated targets in Italy for 2018.

Figure 15
WEEE flows, EEE POM, and WEEE Generated targets in Italy

Analysis of key factors affecting collection targets

Target methodology

In Italy, the target is calculated based on the 65% EEE POM approach (9.5 kg/inh for 2019), whereas no further specific targets per category have been implemented, as stated in article no. 14 of the legislative decree n. 49, 2014. The possibility of choosing the preferred methodology to express the collection target between the EEE POM and the WEEE Generated approaches is feasible.

Other WEEE flows

The presence of other WEEE flows in Italy is mainly due to insufficient WEEE management infrastructure and an insufficient control system. In fact, a portion of the WEEE goes to unauthorised treatment plants, car shredders and scrap dealers. Unfortunately, there are also cases in which WEEE is handled by formal collectors (i.e. municipal collection points and retailers) before later entering the informal sector. Indeed, some formal collectors and treatment operators sell the WEEE to informal treatment operators for economic convenience, as they do not process it adequately, usually treating it as iron and shredding it to obtain valuable metals. In other cases, the WEEE is destined to second-hand markets, both in Italy and abroad, without any preparation for reuse.

In Italy, 35% of the WEEE Generated never arrives to authorised treatment plants and, instead, generates multiple side flows. In 2019, members of the Ecodom Consortium and Altroconsumo (Italian Consumers Association) collaborated and presented an investigation of the diverse WEEE routes of the country [34], based on satellite technology. Over 200 GPS trackers were hidden in appliances such as refrigerators, freezers, washing machines, dishwashers, ready to be disposed of, with the purpose of understanding the final destination of the products after leaving residences. After 4,700 hours, 67 of the 174 valid samples ended up in unexpected places. Some 36 cases arrived in non-authorised facilities (4 appliances ended up in Slovenia), 4 WEEE appliances ended up in anonymous warehouses (or the GPS interrupted the transmission), 24 appliances ended up in parking lots, private houses or collection stations, and 3 ended up in used-EEE markets. In this specific event, the WEEE is reintroduced into the market without prior reconditioning and legal authorization, bringing potential harm to the consumers. Considering that the analysis's sample was not representative of the entire country and that the appliances selected were mostly located in Northern Italy, it can be anticipated that the WEEE actually managed by the informal sector is more than the 39% of total WEEE as identified by the investigation.

A UNU study financed by Ecodom in 2012 notes that approximately two-thirds of the total flow of WEEE being managed by the informal sector would be more representative of the national picture [34].

For 2018, the WEEE flows have been quantified by primarily extrapolating data from the ProSUM project and revealed that 2.6 kg/inh of WEEE is still found in mixed metal scraps, whereas bad consumer habits indicate that 0.4 kg/inh of WEEE is disposed of in waste bins (Eurostat Quality Report, ISPRA 2017). As well, the majority of WEEE flows, corresponding to 8.6 kg/inh, have an unknown fate. A total of 11.6 kg/inh of WEEE were discarded in waste bins or metal scraps, or otherwise having an unknown fate and approximately two-thirds of WEEE being managed by the informal sector.

A portion of the unknown is likely to be exported for reuse, but data is unavailable, as controls are very limited and there is no report from the authorities. However, customs checks should in theory guarantee that the EEE exported is functioning. Similarly, a fraction of used-EEE and WEEE is also sold for reuse within the country, likely through the internet, or sent to second-hand markets. Used-EEE shops exist in Italy and are used partly for equipment legally acquired from citizens, but in some cases, the shops acquire illegal WEEE from retailers that is then recirculated without any repair or preparation for reuse practices. A study conducted in 2012 indicated an amount of 2.1 kg/inh of WEEE being sold or given away for reuse and 0.7 kg/inh exported abroad as used-EEE or sent elsewhere to be treated as WEEE [39]. However, more recent figures on reuse and export channels are unavailable.
Regarding hoarding practices in Italy, a survey conducted in 2011 by Ipsos of the country's citizens revealed that 13% of the EEE stocks in households is made up of equipment that is no longer in use, including both functional but disused and non-functional equipment [39]. The stream for which the phenomenon has been evaluated as being most prominent is IT equipment, and causes include lack of awareness of how to properly dispose of WEEE, the perception of residual product value, emotional attachment, and possible logistical obstacles linked to the WEEE disposal.

In Italy, there are practices of scavenging valuable parts of WEEE in the streets,

kerbside (prior to collection), and in municipal and retailers' facilities. The analysis for 2019 conducted by Ecodom revealed that from a sample taken of 26 kt (equivalent to 0.42 kg/inh), 27.52% of appliances, on average, or 0.12 kg/inh, were affected by scavenging practices. Products most affected by these practices included temperature exchange equipment (e.g. fridges) and large household appliances, whose missing components are commonly compressors and engines.

PV Panels and open scope

By analysing the Eurostat renewable energy statistics, it is clear that the PV panels have maintained a constant share of 3% of the total EEE POM in 2016 and 2017, with 0.42 kg/inh, whereas in 2018, Italy reached 0.5 kg/inh of PV panels POM. The national figures currently remain below the European average of PV panels POM (0.97 kg/inh in 2018). The sector contributed moderately to the country's EEE POM target, with 0.3 kg/inh, having an impact of 2%. However, due to the long lifespan of PV Panels, they do not become part of the WEEE stream at the same rate that conventional products would. In addition, PV panels are handled by installers, so they are difficult for municipal collection points to control.

With the introduction of the open scope, various products – such as temperature exchange equipment using fluid other than water, gas boilers, and gas heaters – have been included in the reporting system. Equipment using heat pumps have been allocated to the temperature exchange equipment (Cat. I of the EU-6), while gas boilers and heaters have been allocated to the small equipment category (Cat. V of the EU-6). The impact of the amount of appliances put on the market that are related to the open scope has been calculated by Ecodom, considering the increase of the Italian EEE POM, as being equal to 1.47 kg/inh in 2019.

Coverage of the WEEE collection data

Data on WEEE collected follows the categories defined in the WEEE Directive and is gathered via annual reports to the database Environmental Compulsory Declarations, which constitutes a sort of mass balance of the waste that is transferred annually to the authorities, and via questionnaires conducted by ISPRA for public and private entities. Analyses to check the presence of eventual inconsistencies are performed for each European Waste Code by comparing historical data and performing targeted surveys and mass balances.

The collection within the country is planned, regulated, and organized according to the following streams: R1 (temperature exchange equipment with fluids), R2 (large appliances), R3 (TVs and monitors), R4 (IT and consumer electronics, lightning equipment, PV panels, and more), and R5 (light sources).

The share of B2B collection for Italy can be evaluated from Eurostat data on WEEE collected from other sources than from private households and through the quality report submitted by ISPRA in 2017. The figures show a constant trend from 2015 to 2017 of 28% of the total WEEE collected (1.76 kg/inh), which is significantly higher than the European average (10%). The categories with the greatest margins above the European average are IT and telecommunication (46%), consumer equipment (22%), and electrical and electronic tools (91%). Before the WEEE Directive was enacted, management of professional WEEE was commonly left to companies. By contrast, following transposition of Directive 2002/96/EC, producers are now responsible for the financing of collection, transportation, and treatment of professional WEEE when they supply a new and equivalent product.

For Italy, it is possible to categorize the data on WEEE collected into two sources: according to Ecodom, approximately 84% of the total WEEE collected comes from municipal centres, while the remaining 16% comes from retailers. In particular, municipal collection points collect all of the WEEE categories in almost homogeneous fractions, while retailers mainly collect large appliances – picked up at consumers' homes during the delivery of new products. Information from retailers has been included in the national data since 2009, when the PROs began collecting WEEE from retailers' facilities.

There are geographical incongruities in Italy that lead to inconsistent regional results: whereas some Regions manage to collect 7-10 kg/inh of WEEE, others, mainly located in the Southern part of the country, collect less than 3 kg/inh.

WEEE treated in other Member States or outside the EU is included in the collection and recycling rates reported by the country, following a check on the suitability of the final recovery operation and destination facility.

WEEE Generated

The EEE POM from the apparent consumption methodology, which served as the basis for the WEEE Generated methodology, closely matches the EEE POM data reported to Eurostat, on average. In fact, EEE POM from the apparent consumption

methodology is only 6% higher than the EEE POM from Eurostat, so the impact on the WEEE Generated can be considered minor, and the quantification of the flow can be considered accurate overall.

WEEE Directive Implementation

The European WEEE Directive was transposed into Italian law by the Legislative Decree n.151 of 25 July 2005, followed by a series of other implementing decrees, whereas the Legislative Decree n.49 of 14 March 2014 subsequently transposed the Recast of the WEEE Directive 2012/19/EU.

Italy adopts an 'all actors' approach with a clearing house, the WEEE Coordination Centre (CdC RAEE), a coordinating body constituted by all PROs which is in charge of optimizing the management of the WEEE over the entire national territory [40]. It also divides responsibilities among the PROs in a competing market. Every year, by assigning collection points, the clearing house assigns to each PRO a fraction of the total WEEE, equal to the market share of the producers belonging to that PRO.

There is a total of 15 PROs in Italy, and, among them, 10 operate with all WEEE categories, whereas the remaining ones deal only with selected categories. This is because each PRO must manage an amount of WEEE proportional to the number of EEE sold each year by the producers who joined the collective system [41]. PROs compete for producers and operative partners (i.e. logistical and treatment), but there is no competition for accessing the collection points, as they are assigned by the clearing house. Nonetheless, the legislation does not regard the producers and PROs as being responsible for achieving the national targets, and there are not currently any penalties for failure in doing so. Facilities handling WEEE (i.e. WEEE treatment operators) must be accredited by the CdC RAEE in order to work with the PROs, and to obtain accreditation, they must meet several defined treatment requirements and assessment procedures conducted by suitably trained auditors of third-party certifiers [42].

The network of WEEE collection facilities in Italy is constituted by Designated Collection Facilities, run by local authorities or authorised management companies that represent the main sites for WEEE collection, Distributors' Collection Sites, where the waste is accepted from the take-back schemes 'One to One' and 'One to Zero' enacted in 2016, and from Individual Collection Sites, that are set up by producers through the PROs and which mainly collect lighting equipment-related waste. However, ongoing investments are needed to provide new collection sites, as there are areas where the number of facilities is still far from fulfilling the need of the population, thus negatively the collection results [41].

The 'all actors' approach has been implemented since 2005. The collection operators can contact the clearing house to organize transport of the collected WEEE to the designated treatment plant. One drawback of the 'all actors' approach is that the collection operators may also decide to deliver the WEEE to treatment facilities that are not accredited by the clearing house and which deliver 'payment' directly to the collection operators. However, all the recycling operators, including the scrap metal dealers, should declare both the quantities of WEEE they manage to the clearing house as well as the normative requirements to the authority via the annual environmental declaration, but these declarations rarely happen, due to lack of enforcement. According to the data reported to the CdC RAEE, only 6.2 kt (0.10 kg/inh) of the 316.8 kt (5.2 kg/inh) of household WEEE treated in 2018, or 2%, has been handled by facilities that are not working with the PROs and are not accredited by the clearing house [43]. Considering the collection rate of 35%, it is evident that the informal system often does not declare to the clearing house.

In November 2007, Italy introduced the possibility of using a visible fee, but the producers are not currently required to include the fee on their invoices to the retailers, and the retailers are similarly not required to present the fee to the consumers. The approach that the compliance schemes use for the fee is not homogeneous. In fact, Ecodom foresees a visible fee for all categories based on the type of appliance and its weight, while other consortia use a visible fee for some categories and an internalised one for others. The mandatory handover of WEEE has not been adopted in Italy.

With respect to the reporting methodology, Italy has not considered using substantiated estimates, and only official declarations via the environmental declaration model are accepted as a means for defining data on the WEEE managed. In particular, the data is taken using the sum of the existing records in the National Register of Waste.

One of Italy's best practices is the establishment of the CdC RAEE, which has been instrumental in ensuring a consistent service for collection and treatment of WEEE throughout the country. An item that has increased the quantities of WEEE

collected in recent years considerably is the EPR system, introduced in 2008. The figures reported by all PROs show a collection rate that nearly tripled from 1.1 kg/inh in 2008 to 3.2 kg/inh in 2009, due to the fact that before 2008, the local authorities did not monitor the WEEE collected. Additionally, the EPR scheme has been vital in assisting authorities in financing waste management and has also contributed to citizens' awareness through targeted campaigns. The Italian Minister of Environment, Land, and Sea noted that the introduction of the two legislative decrees – n.65 of March 2010 and n.121 of May 2016 – concerning the simplification of collection mechanisms from distributors and installers and the free withdrawal in 'One-to-One' model allowed Italy to achieve a greater collection of WEEE and also reduced the amount of waste ending up in residual waste bins, which decreased from 1.6 kg/inh in 2011 to 0.6 in 2018. Another important factor that contributed to an increase in waste collection per capita in recent years is the number of waste recycling centres available across the country: 4,883 as of 2018 [41]. Italy introduced a system of financial incentives through Efficiency Rewards, which equate to monetary amounts that producers pay to the collection sites and vary according to the receiver, categories of WEEE involved, amount collected, and method of collection used [41]. As such, PROs provide the financial resources for updating and improving infrastructure and equipment available at a waste centre and promote efficient management by all stakeholders.

One of the main obstacles undermining the proper management of the WEEE sector concerns price competition with other actors from the informal sector, leading to fewer WEEE operators respecting the standards and a higher risk that formal collectors and operators might sell their WEEE to the informal sector. Furthermore, in the WEEE system, there are several leakage points. It is essential to ensure full traceability of all complementary flows as well as timely and consistent monitoring of all those involved in the collection and treatment chain as a way of improving the overall performance of the WEEE system. Other needs that PROs consider most urgent for increasing the collection rate of the country include: the improvement of the collection infrastructure, security of the WEEE at collection points and more consistent inspections in the treatment plants to ensure environmental efficiency of the processes involved.

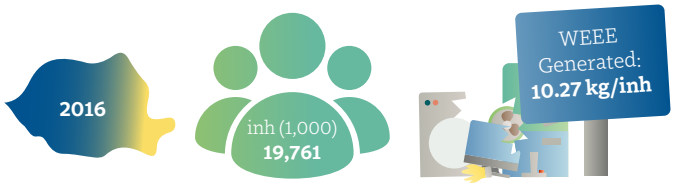
Key Statistics

Italy

Indicator	Year	Value
Inhabitants (1,000)	2017	60,589
Sum of EEE POM apparent consumption method* (kt)	2008-2017	10,350
Sum of EEE POM Eurostat* (kt)	2008-2017	9,989
EEE POM Eurostat (kg/inh)	2017	16.95
WEEE Generated (kg/inh)	2017	17.78
WEEE Collection Eurostat (kg/inh)	2017	6.3
WEEE Collection Key Figures (kg/inh)	2018	5.1
Collection rate in % (compared to EEE POM for the three preceding years)	2017	42%**
Collection rate in % (compared to WEEE Generated)	2017	35%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.

** Rounded up from 41.7%. Data on EEE POM taken from Eurostat (updated to 2020): 883,883 t (2014), 912,349 t (2015), 949,649 t (2016), for an average value of 915,293 t. Data on WEEE collected has been taken from the Quality Report submitted by Eurostat (2017): 381,656 t.



7.5 Romania

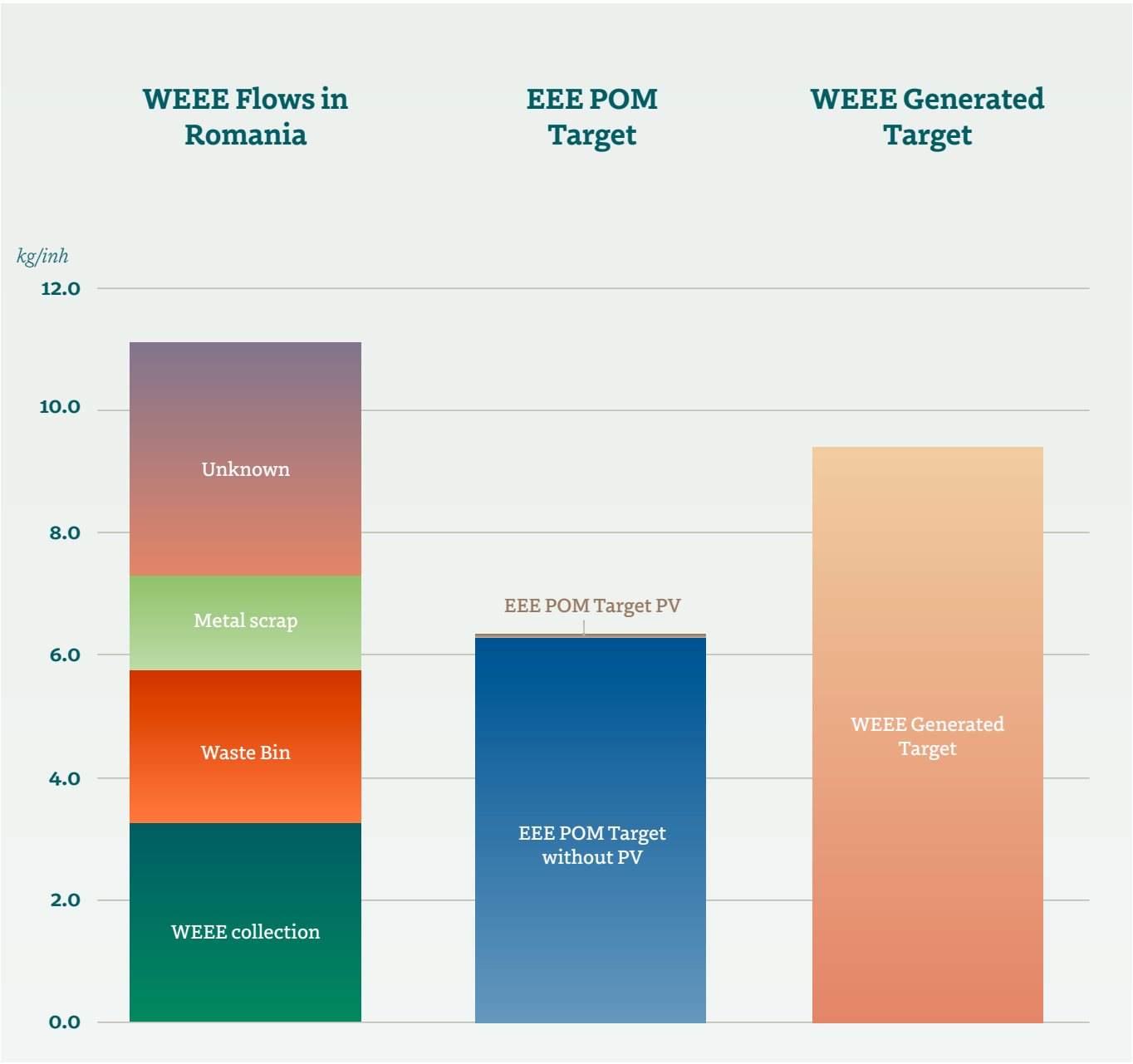
Overview

In recent years, the amount of WEEE collected in Romania has increased from 1.61 kg/inh in 2014 to 2.36 kg/inh in 2016. The collection rate compared to the WEEE Generated is 23% for 2016, or 31% using the EEE POM methodology. In 2016, Romania was short of the target by 2.51 kg/inh for 65% EEE POM target and 6.37 kg/inh for the WEEE Generated target.

In comparison to other Member States, Romania's collection rate is among the lowest in Europe. This can be attributed to many factors, such as the inadequacy of the collection infrastructure, and the lack of awareness of proper disposal of e-waste, and which facilitates large quantities of WEEE collected and managed by metal scrap dealers or being disposed of in waste bins. But also the country's reuse culture being more prominent than in other European countries, hoarding practices.

Figure 16 illustrates a conservative estimate of the aforementioned flows in Romania for 2018

Figure 16
WEEE flows, EEE POM, and WEEE Generated targets in Romania



Analysis of key factors affecting collection targets

Target methodology

Romania adopted the Government Emergency Ordinance no. 5/2015, introducing new annual targets for collection and recycling of WEEE, and it transposed the WEEE Directive 2012/19/EU and revoked Governmental Decision 1037/2010[44]–[47]. In doing so, the annual targets for collection and recycling of 4 kg/inh were replaced with a formal collection and recycling rate of 45% of the average weight of products put on the market by Romanian producers in the three preceding years [47]. It is anticipated that, through a Government Emergency Ordinance, collection targets will increase to 65% of the amount put on the market (i.e. the annual average of the three preceding years), starting in 2021.

In the case of Cat. III (lamps), a category-specific target is currently applied and is defined as 45% of the amount put on the market, but it will also be set to 65% starting in 2021, as with the other WEEE Directive Categories. Apart from lamps, Romania does not have other targets at the category level.

Other WEEE flows

Other WEEE flows are very significant in Romania. It is estimated that 50% of WEEE being discarded is managed by the informal sector, of which half might eventually reach the formal system. Approximately 40% of the country's WEEE collected is done by either the informal sector or iron-scrap dealers and is sold for high prices to the WEEE treatment facilities or to PRO schemes (which constitutes 30 kt and is equivalent to 1.54 kg/inh) [48]. Therefore, this amount is already reported in the country figures. Additionally, another 30 kt of WEEE, approximately, are estimated to end up mixed in metal scrap and are currently not reported. This assumption is based on the fact that 25% of all WEEE Generated, or roughly 60 kt tons, is discarded through channels apart from compliance schemes or end up receiving substandard treatments [17].

Romania has few official municipal collection points, which, in turn, contributes to large quantities of WEEE being collected and managed by metal scrap dealers. Furthermore, both the lack of public awareness regarding proper disposal of WEEE and frail collection infrastructure have made non-compliant collection difficult to eradicate (approximately 2.1 kg/inh).

More than 60 treatment operators are authorised and registered in the National Environmental Protection Agency for Romania, but not all of them fully comply with the regulations regarding management of pollutants and reporting obligations. The number of unauthorised facilities is unknown, but they are mostly small entities that dismantle WEEE to extract iron and copper.

With regard to scavenging, temperature exchange equipment and screens are the items most affected. For temperature exchange equipment, it is estimated that 5% of all refrigerators entering treatment facilities are missing their compressors, and many are missing their cables as well, though the percentage could not be estimated. As well, it is estimated that 15% of all CRT screens are broken, with cables and batteries missing.

PV Panels and open scope

The share of PV panels POM in Romania was quite significant between 2013 and 2015, as they had an average of 1.72 kg/inh of PV panels POM. The WEEE Directive 2012/19/EU was transposed in the country's legislation in April 2015, so PV panels were considered as EEE in Romania beginning then. Because of PV Panels' long lifespans, they are not part of the WEEE stream at the same rate that conventional products would be, so they cannot be collected by authorised PROs. When excluding PV panels, the collection rate in 2016 would have increased from 32%, as previously indicated, to 41%.

Nonetheless, for 2018, the influence of PV panels is much more moderate, with only 0.04 kg/inh POM and a share of 1% of the collection rate. The popularity of PV panels began 10 years ago, halting in 2014, due to green certification policy. Nonetheless, it is expected that the trend will increase again soon, as a government program with financial incentive for households to install PV panels has been implemented as of 2020.

With respect to the open scope, new products have been added to the scope of the WEEE Directive as of August 2018, and the ones that have consequently been introduced in Romania are: toner cartridges (0.03 kg/inh in 2019), plugs, switches, and other electrical installation products (0.16 kg/inh in 2019). In total, 0.5% of the total WEEE collected in Romania in 2019 relates to the open scope, which mainly consists of cables and toners [17].

Coverage of the WEEE collection data

WEEE collection data are reported for all categories as in the WEEE Directive, and companies treating WEEE report only WEEE collected in Romania. According to the quality report submitted by the Member State to Eurostat, the coverage of the WEEE sector by the reporting system is estimated to be roughly 100%, with no major flows excluded from what is officially reported. In distinguishing the WEEE collected data by source, ECOTIC estimated that 40% is collected by retailers, 15% is collected the Business to Business (B2B) sector, 5% is officially collected by the different municipalities, 10% is collected as a result of PRO collection campaigns, and 30% is collected by scrap dealers.

WEEE Generated methodology

The EEE POM from the apparent consumption methodology from 2008-2016, which served as the basis for the WEEE Generated methodology, was, on average, 35% higher than the EEE POM data reported to Eurostat for the same period. It needs further analysis to investigate the differences.

A core element to be considered is the reuse culture, which is more widespread in Romania than in other European countries. It is estimated that 34% of POM products (2.8 kg/inh) are reused, extending their lifespan. Since the concept of lifespan includes reuse and hoarding and influences the calculation of the WEEE Generated, developing national lifespans for the different products is recommended as a way of properly reflecting, mathematically, the country's behaviours.

WEEE Directive Implementation

Romania began implementing a visible fee in 2007 and made it mandatory in 2015, which had a positive impact on the overall WEEE management performance [49]. On one hand, authorities were able to identify free riders by noticing that the visible fee was missing. On the other hand, a significant number of producers has emerged that should register as producers once a visible fee for recycling has been imposed, thus reducing the burden of take-back schemes that partake in the EPR system. In particular, more than 100 new producers were registered after the visible fee was imposed in 2015, by only one PRO (out of 7). The fee is calculated by all PROs, and it mostly consists of a flat rate that differs, depending on appliance, within a weight interval.

Neither clearing houses nor the 'all actors' approach have yet been set up in Romania. In theory, all actors should report the entire amount of WEEE managed to the National Environmental Agency, but this has not yet been fully enforced.

With respect to mandatory handover, all WEEE should be collected and treated by authorised collectors and treatment operators that have contracts with registered PROs. Therefore, all municipalities, retailers, and companies should provide the WEEE only to authorised collectors and treatment facilities. Unfortunately, this is not always implemented, so a significant amount of WEEE is collected by scrap dealers and diverted into the metal scrap flow.

The B2B quantities have been included in Romania's collection and reporting system since 2005. According to official reporting, the B2B share of the total WEEE collected corresponded to 7% in 2016 and was centred on strictly professional equipment. As previously noted, data from ECOTIC, which includes also dual products, estimate a share of B2B equal to the 15% of the total collected.

Besides poor collection infrastructure and the impact of informal WEEE flows, studies performed by collective schemes indicate that the main two reasons behind the low collection rate are the country's current market and consumer behaviours. In fact, Romania is still an expanding market, and the majority of EEE stock in households is less than five years old. Furthermore, a lot of newly purchased equipment is not replacing older equipment. On the contrary, some equipment is kept in household even when it is no longer used or functional. In some cases, upon purchasing new equipment, the consumer gives the older equipment to a friend or relative or, alternatively, sells it as a second-hand product.

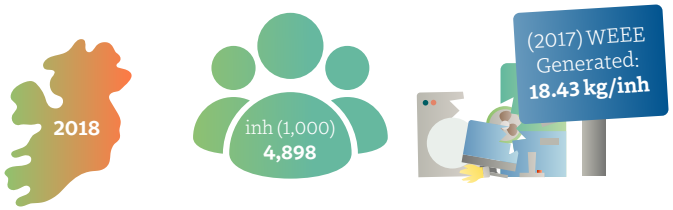
In addition, Romania does not use substantiated estimates when reporting to the EC, but PROs have developed a proposal for sampling the metal scrap flow, as most WEEE is diverted into it. The intention is to quantify and report the amount of WEEE that is diverted to this flow, as that material is following a recycling path, though without the same management standards of PROs. This would allow for regulating the iron scrap flow and tackling the problem.

Key Statistics

Romania

Indicator	Year	Value
Inhabitants (1,000)	2016	19,761
Sum of EEE POM apparent consumption method* (kt)	2008-2016	2,205
Sum of EEE POM Eurostat* (kt)	2008-2016	1,423
EEE POM Eurostat (kg/inh)	2016	10.15
WEEE Generated (kg/inh)	2016	10.27
WEEE Collection Eurostat (kg/inh)	2016	2.36
WEEE Collection Key Figures (kg/inh)	2016	/
Collection rate in % (compared to EEE POM for the three preceding years)	2016	31%
Collection rate in % (compared to WEEE Generated)	2016	23%

*Excluding UNU-KEY 0001 and UNU-KEY 0002.



7.6 Ireland

Overview

Ireland reached a collection rate of 59% of WEEE Generated in 2017, being one of the highest collection rates in Europe. This rate corresponds to 10.84 kg/inh of WEEE collected, missing the target by 4.8 kg/inh. With regard to the 65% EEE POM target, Ireland registered a collection rate of 54% in 2018, missing the target by 3.22 kg/inh.

The high collection rate achieved in Ireland can be attributed to the nationally implemented measures, such as: mandatory handover for collection points and takeback by retailers, the implementation of a visible fee, and the strong engagement of stakeholders with authorities. In particular, the visible fee provides visibility of the WEEE system for consumers, ensures a stable and sustainable financing program, and enables contributions for effective enforcement.

Ireland only reports collection of sorted waste, so WEEE in residual waste is not measured or reported to national authorities. Additionally, metal scrap collectors may, from time to time, receive WEEE mixed in metal loads and not reported. Moreover, WEEE exported from business end users cannot be monitored, as they are independent.

Figure 17
WEEE flows, EEE POM, and WEEE Generated targets in Ireland

Analysis of key factors affecting collection targets

Target methodology
Ireland calculates its collection target using 65% of EEE POM over the average of the three previous year, as defined in the Directive. However, an ongoing study by EEE2WEEE intends to provide policy makers with relevant recommendations, based on its findings, which could influence the choice of the target system in the years to come [50].

Though EEE exported for reuse should be subtracted from the total quantity of EEE POM, Ireland does not yet systematically collect this data and as such they remain on their national registry. As a result, this affects their collection target when calculated using 65% of EEE POM, per the WEEE Directive. The topic is currently being researched

Other WEEE flows
Ireland considers most of the WEEE sector to be covered by the reporting system, but it has still identified several unreported flows. In fact, metal scrap collectors receive WEEE as mixed-metal loads, and in some cases, these materials are not recognised as WEEE. As well, there is still an unknown amount of WEEE that is exported directly by business end users.

Using ProSUM estimates, Ireland's WEEE flows have been quantified for 2020, illustrating that 4.2 kg/inh of WEEE can be found in mixed-metal scrap and that 1.4 kg/inh of WEEE is disposed of in waste bins. Given that WEEE in residual waste is not collected separately, quantities of the flow are not reflected in the country figures. It is also estimated that 2 kg/inh of WEEE have an unknown fate.

Unauthorised collection appears to be one of the main challenges in Ireland, especially when prices of metal goods are high. To counteract this, PROs have worked, since 2014, on a contribution program intended to reduce outflows, improve the collection rate, and improve the quality of the takeback system.

PV Panels and open scope
The PV panel sector in Ireland plays a minor role of the total EEE POM, with a share of 0.3%, which is considerably below the European average of 5%. Though the amount of PV POM has consistently increased since 2014 (0.01 kg/inh), Ireland registered only 0.11 kg/inh of PV panels POM in 2018.

Since the open scope was enforced in 2018, Ireland has included household lighting in their reporting and allocated them in Cat. IV and Cat. V of EU-10 (consumer and lighting equipment). Even though the country registered an increase in the amount of EEE POM in 2019, the amount is not considered to be linked to the introduction of the open scope. However, its impact for 2019-2020 is currently being researched.

Coverage of the WEEE collection data
The data on WEEE collected is gathered from several sources in the country, which are the results from surveys performed by the Environmental Protection Agency in waste treatment facilities and which are supplied by B2C compliance schemes and B2B producers.

Ireland reported that 1.3 kg/inh of WEEE are to be collected through B2B, which is 12% of the total WEEE collected. This is slightly above the European average of 10%. Nonetheless, the B2B sector has no scheme in Ireland, and the self-compliance was not actively enforced until recently, so it is still partially lagging in terms of take-back and reporting.

In 2019, Ireland identified that 55% of the total WEEE collected comes from retailers, 28% comes from civic amenity sites (CA), and the remaining 17% comes from direct collection points, which are related to public collection events in schools or in waste industries.

The amount of WEEE that is not directly collected by the producers normally ends up at waste recovery operators and can therefore be reported in national registries. The same is true for WEEE mixed with in metal scrap. Metal recovery operators estimate this flow, which is then included in the WEEE collected figures, though these quantities could be underestimated. WEEE in residual waste is not measured, so it is not reflected in the reported figures. This is because Ireland only reports WEEE in sorted waste collections.

WEEE Generated methodology
The EEE POM resulting from the apparent consumption methodology, which served as the basis for the WEEE Generated methodology, closely matches, on average, the EEE POM data reported to Eurostat. The results from the apparent

consumption methodology are only 7% higher than the EEE POM from Eurostat. Therefore, the impact on the WEEE Generated can be regarded as minor.

WEEE Implementation

Ireland adopted an 'all actors' approach, so the responsibility is shared among PROs, B2B producers, and waste operators. There are two PRO schemes for B2C WEEE. They have been allocated a geographical area for collection, based on market share, in order to avoid competition and to guarantee efficient collection practices. B2B producers must organize and finance their own take-back systems and information flows from customers. They must also report autonomously to the Environmental Protection Agency on their annual WEEE management (i.e. take-back, recycling, and recovery). Finally, waste operators have to be appropriately licensed and allowed to collect and/or recycle WEEE, and they must report to the relevant authority on an annual basis.

Irish WEEE regulation has anticipated elements of mandatory handover since the transposition of the WEEE Directive in 2005, but the regulations were specified further, in 2014, via the implementation of the Recast WEEE Directive [51]. Currently, mandatory handover is applied for retail and local authority collection points to the PROs or producers. Quantification of the extra amounts collected through mandatory handover is difficult to achieve, since the attribute has already been in place, to some extent, since 2005. Nonetheless, it is considered by the compliance schemes to be an undoubtedly key element for the success of the WEEE management system in Ireland.

Ireland also implemented a visible fee in 2005, which proved to be a successful tool for awareness, enforcement, and finance within the system. The current Visible Environmental Management Costs (VEMCs) has been in place since the transposition of the Recast WEEE Directive into the Irish WEEE Regulation in 2014. The VEMCs do not apply to all equipment, but do specifically apply to some 'flagship' appliances, such as refrigerators (10-5€/kg), large white goods (5€/kg), large TVs (5€/kg), and gas discharge lamps and LEDs (0.15-0.05€/kg). All categories of EEE are subjected to non-Visible Recycling Management Costs, which are invoiced by the PROs to their producer members and to the VEMCs. These costs are mainly charged per kg of the EEE POM and vary by type of EEE, taking into account the cost of the environmental management of that EEE sector. The introduction of the visible fee is considered a fundamental practice for sustaining marketing campaigns, enforcement, and research projects in the WEEE sector. It has also helped to decrease the amount of outflows in the system.

Ireland does not have a national clearing house, but they have created the Producer Register Limited (PRL) [51]. The PRL assists producers in meeting their obligations for the responsible management of WEEE and, since September 2008, producer obligations for waste batteries and accumulators as well. The PRL was established with approval from the (now titled) Department of Communications, Climate Action and Environment under the WEEE Regulations as the National Registration Body. To be sure, though, the PRL is not a clearing house. Its primary activity relates to the administration of the National Producer Registration system (currently for WEEE, batteries, and recently tires), visible fee levels, and the management of the online reporting tool named 'Blackbox reporting system'. Producers in Ireland report monthly, in confidence, to Blackbox for the products they have supplied by weight/and or unit volume onto the Irish market.

Regarding the country's export and import flows, a fraction of WEEE is shipped from Ireland to treatment facilities in other countries by undergoing inspections in the ports. However, the WEEE is also collected within the country from foreign businesses and handed over to Irish recovery operators. Moreover, this flow is identified and subtracted from the total WEEE accepted by recovery operators and reported as treated.

Substantiated estimates are not currently used in Ireland, but a national study is underway to quantify some specific flows – in particular, WEEE flows sent to recovery operators by business end users (and not directly collected by producers) as well as the amount of WEEE that arrives at waste metal scrap locations in mixed-metal loads, which are not recognised as WEEE.

Some obstacles perceived by the PROs in Ireland in increasing their collection rate include the density of the collection points and hoarding practices, which mostly affect small WEEE. Attention must also be placed on what heavily determines consumer convenience. Specifically, online sales and take-back delivery may become the more prevalent sale route in the future, especially for small consumer devices, and could provide room for free riders' activities.

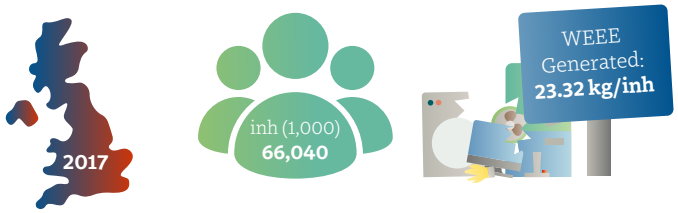
Key Statistics

Ireland

Indicator	Year	Value
Inhabitants (1,000)	2018	4,898
Sum of EEE POM apparent consumption method* (kt)	2008-2017	979
Sum of EEE POM Eurostat* (kt)	2008-2017	961
EEE POM Eurostat (kg/inh)	2017	22.48
WEEE Generated (kg/inh)	2017	18.43
WEEE Collection Eurostat (kg/inh)	2017	10.84
WEEE Collection Key Figures (kg/inh)	2018	9.67
Collection rate in % (compared to EEE POM for the three preceding years)	2018	54%**
Collection rate in % (compared to WEEE Generated)	2017	59%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.

** The original value for the WEEE Forum Key Figures data was 49%, but this has been adjusted to 54%, as the WEEE Forum Key Figures data was under-reported as compared to official Eurostat data.



7.7 The United Kingdom

Overview

In 2017, according to the latest available Eurostat data, the United Kingdom (UK) achieved a collection rate of 57% of WEEE Generated and 50% calculated on the average of the EEE POM for the three previous years (2014, 2015, and 2016), equivalent to 13.19 kg/inh, or 871 kt of WEEE[13]. Using this data, the UK remains short of the target by 6.64 kg/inh (438 kt), based on the 85% WEEE Generated target, and 3.8 kg/inh (251 kt), based on the 65% POM target. Published 2019 data is available for the UK, the data had not been reported to Eurostat at the time of this writing.

When reporting WEEE collection to Eurostat, the United Kingdom uses substantiated estimates to quantify the fraction of WEEE in metal scrap light iron streams, which corresponded to 4.1 kg/inh, (273 kt), based on a 2016 study [27]. The PV panels sector in the United Kingdom is more prominent than in most EU countries, contributing significantly – by 9% – to their EEE POM target (as shown in Figure 18).

Figure 18

WEEE flows, EEE POM, and WEEE Generated targets in the United Kingdom

[13] The 2019 data were public, but not officially reported at Eurostat as of the writing of this report.

Until 2019, the United Kingdom reported having reached its Member State collection targets to Eurostat. However, it now faces challenges similar to other EU countries for the higher targets from 2019. The UK has a high number of PROs in operation and has no central allocation system. All retailers are currently permitted to opt out of in-store take back, which means that the principle options available to consumers to dispose of WEEE are either at local authority-run, household waste recycling centres or collections of WEEE picked up by producers or retailers on home delivery of new products. Until very recently, there has been no national household communication approach. In common with other Member States fluctuations in light iron value impact the flows of large household appliances (LHA), which leads to a reduction in LHA collected by PROs at times when the commodity value is high. Commodity prices also lead to thefts of compressors from fridges, which, in turn, leads to a negative impact on the amount of WEEE collected by PROs when not properly addressed or enforced by authorities. Furthermore, there is a growing presence of free riders on the EEE POM market.

Figure 18 shows a conservative estimate of the WEEE flows, PV Panel influence, and WG target in the UK for 2018, the study's reference year. The metal scrap data has been estimated at the EU average, but the amounts of the category large equipment (UK category 1) have been subtracted to prevent double-counting for LHA reported in the substantiated estimate of 0.9 kg/inh, (61 kt). Note that, UK category 1 excludes appliances with refrigerants.

Analysis of key factors affecting collection targets

Target methodology

The United Kingdom currently calculates its collection target using the 65% EEE POM methodology, which, for 2019, corresponded to 15.88 kg/inh. The target includes WEEE both from households and other sources, and there is no specific collection target for B2B. The WEEE that was collected on behalf of PROs, substantiated estimates, and non-obligated WEEE recycling – which is the amount recorded as recycled by Approved Authorised Treatment Facilities (AATFs) – not on behalf of PROs, is used to demonstrate target attainment.

Household collection targets for PROs are set by the government and are assigned to each PRO, based on their household EEE POM market share. Until 2019, the target for each category was set by calculating the average change in WEEE collections for a specific category over the previous five years and applying that percentage to the amount of WEEE collected in the previous year, after making adjustments, where appropriate, for particular circumstances in each category. For instance, the principle was applied when the government wanted to target a higher amount of WEEE collected, such as small household appliances (SHA), or when the historical growth trend was not relevant to the present circumstances (i.e. CRTs and flat-screen TVs). The targets are set for each UK category (1-14) using the same approach, but for categories 2-10, they can be met with any category from 2 to 10 WEEE.

Overall, to calculate achievement of the collection target, the United Kingdom takes into account B2C WEEE collected by PROs, B2B WEEE reported by PROs, substantiated estimates for large household appliances (excluding cooling and freezing equipment, thus the UK Cat. 1 in the old WEEE Directive) in the light iron stream, and non-obligated WEEE reported by AATFs [52].

Other WEEE flows

Over the years, PROs have reported a significant presence of informal actors involved in the WEEE collection, including through the scrap route. There is an inverse correlation (-0.75) between LHA scrap price and the quantity of LHA collected, and around 42% of LHA are lost through leakage [15]. PROs have noted that the quantity of LHA formally collected decreases when light iron prices are high in the market. According to a 2018 study conducted by Anthesis based on 2015 data, 6% (1.47 kg/inh, 96 kt) of the 23.47 kg/inh (1,528 kt) of WEEE Generated is stolen from the formal system, and 9% (2.13 kg/inh, 139 kt) goes to unreported channels or is likely treated as scrap, landfilled, or exported for reuse [53]. However, note that there are also scrap metal treatment facilities in the country that are permitted and licensed to handle WEEE and that do so according to the standards required by the national legislation.

The WEEE flows in the United Kingdom were quantified in an Anthesis report in 2019 [15]. Analysis of the report and further consultations with Eurostat illustrated that the 9.2 kg/inh (887 kt) reported to Eurostat consisted of 4.1 kg/inh (273 kt), using a substantiated estimate of large equipment in metal scrap; 2.3 kg/inh of WEEE could be found in waste bins (155 kt); 0.2 kg/inh is exported for reuse (16 kt); and 0.5 kg/inh is illegally exported (32 kt). The metal scrap data has been estimated to be the EU average but is corrected for the category of large household equipment (UK category 1) that is already included in the reporting of the substantiated estimate of 0.9 kg/inh (61 kt).

Data on exports for reuse is not captured by the UK Environment Agencies, so more representative figures are difficult to obtain. Based on the HM Revenue and Customs (HMRC) code analysis for items recognised as EEE, we can estimate that the export of electrical and electronic products accounts for 12% (by value) of all national exports [54]. Per the analysis, physically smaller products with a higher value, such as mobile phones, are likely to be exported. As a result, mostly IT, consumer, and specialist equipment feature more prominently in this flow. National studies indicate that there is a significant quantity of used-EEE items sold for reuse by the third sector and commercial operators within the country. That flow is not always monitored or reported in the system, so it does not appear in the recycling figures. It is estimated that 7% of the UK exports are second-hand electrical items, which is equivalent to 16 kt exported in 2017 [55]. Still, its quantification would help in better understanding the overall amount of unreported flows [56].

REPIC and BEKO commissioned two separate consumer surveys. The BEKO survey revealed that 25% of the surveyed consumers purchasing a cooling appliance did not discard an old one at the time of purchase. Products still functional may have been kept for additional refrigerated storage used elsewhere, e.g. the garage. The REPIC survey identified that 16% of consumers hoarded broken or no-longer-working appliances at home when buying a new appliance and noted that the percentage increased to 22% when referring to unwanted products that are still in good, working condition [55].

A report on theft of WEEE from local authority-designated collection facilities in the United Kingdom estimated that this type of practice corresponded to 114 kt [15]. Using information from 2015, it was estimated that, with the exception of 9 kt of components (mainly compressors) that were illegally treated, the majority of WEEE being stolen was later treated through legitimate routes [57]. These practices are considered to be minor and are not part of a large-scale, organized sector [56].

PV Panels and open scope

The United Kingdom uses a 14-category EEE classification system, in which PV panels are separately represented. It is observable from analysing the Eurostat renewable energy statistics that PV panels have permeated the market, which yields a higher EEE POM than the average for Europe. Indeed, in 2016 and 2017, the United Kingdom registered 2.31 kg/inh (151 kt) and 0.84 kg/inh (55 kt) of PV panel POM, as compared to European averages equal to 0.66 kg/inh and 0.79 kg/inh. Due to the long lifespan of PV Panels, they do not enter the WEEE stream at the same rate as conventional products, but they already show a considerable impact on the collection rate achieved. For the 2018 EEE POM collection target, we calculate that PV panels contributed 9% to the EEE POM target registered to Eurostat, corresponding to 1.6 kg/inh (106 kt). Therefore, the UK is one country where PV panels show the highest impact on the EEE POM target, along with Cyprus (9%), Malta (10%), and the Netherlands (11%).

Since the introduction of open scope in January 2019, reported data on both POM lighting and luminaires and large-scale fixed installations show an increased tonnage. These have been allocated respectively to Cat. V and VI of the EU-10. It is not possible to quantify national impact of open scope, based on the data available. However, it has been observed that household lighting Cat. V POM has increased in 2019 published data, and according to PROs' know-how of the sector, it is safe to assume that the majority of the change (53 kt) is a result of the open scope [58]. There is also a 30 kt increase from 2018 to 2019 for the B2B Category UK 1, which may have been due to open scope. The switch between the UK and EU categories also makes the impact of the open scope difficult to follow. Because of that, as of this study, the impact of the open scope on the EEE POM for 2018 is estimated to be 0.8 kg/inh, which is close to the European average, based on the countries that could quantify it. It is therefore clear that the influence of the open scope on the EEE POM target for the United Kingdom corresponded to 3%.

Coverage of the WEEE collection data

Data on WEEE collected are provided to the Environment Agency by PROs and AATFs. Recycling and recovery rates are obtained through treatment operator (AATF) reporting that is based on input and output of WEEE-recycled material. The United Kingdom uses a reporting system based on the ten categories already set by the WEEE Directive, plus four additional subcategories. These subcategories are for appliances containing refrigerants, display equipment, gas discharge lamps, and photovoltaic panels (Eurostat Quality Report, 2017). The UK Environment Agencies are responsible for monitoring compliance of the data reported as well as for addressing eventual inaccuracies through inspections and audits. WEEE imported for treatment is accepted in the country, e.g. from Ireland, but is not included in the national data, which only contains UK-sourced and -treated WEEE. Trans-frontier shipment of waste notifications are used to identify which operators are accepting imported WEEE. As for exports, the data reported to the Environment Agencies indicates that there is no exportation of WEEE. However, used EEE is known to be exported, but it is not reported, as it has not yet become (or has ceased to be) WEEE.

As for what concerns the different sources of collection, PRO data reported to the Environment Agencies for 2019 shows that 4.62 kg/inh (309 kt) of WEEE was collected by PROs from Designated Collection Facilities (DCFs), 1.94 kg/inh (130 kt) came from retailers, and 0.83 kg/inh (56 kt) came from other sources of collection, e.g. producers' own collections. Additionally, 0.13 kg/inh (9 kt) of WEEE are linked to B2B and correspond to 1.8% of the total collected, which is considerably lower than the European average (10%). A possible cause for the variance could be that Art.13 of the WEEE Directive (Reg. 12 in the UK 2013 WEEE Regulations) allows for alternative financial arrangements to be made, and this has been used in the contractual terms of suppliers of B2B WEEE. According to the Directive, they can insert a clause into the contract made with the end-user (usually the purchaser) that states that they are not responsible for the end-of-life disposal of the products. There is also thought to be a lack of awareness from purchasers that the suppliers are, by law and by default, responsible for the WEEE. The small amount reported in proportion to the equivalent product sold is an indication of the frequency of the process [59].

With respect to the data on EEE POM, PROs have reported data gathered from their producer members to the Environment Agency on a quarterly basis.

A Valpak report performed on EEE POM for 2017 showed that the registered POM accounted for 88% of the total POM, whereas the unregistered POM was equal to 4%, and the missing 8% remained unaccounted for/exempt (i.e. luminaires that have been included from the open scope in 2019) [56]. For the purposes of their report, Valpak attributed unregistered quantities of POM to the categories of consumer equipment (cat.4), electric and electronic tools (cat.6), and PV panels (cat.14) of the UK system [56]. The Anthesis report estimated that 46 kt of POM are not reported and are, thus, free riders [15].

WEEE Generated

The EEE POM resulting from the apparent consumption methodology, which is the basis for the WEEE Generated calculation, closely matches the EEE POM data reported to Eurostat for 2017. The results from the consumption methodology are only 9% higher than the EEE POM from Eurostat. Therefore, the impact on the WEEE Generated can be considered minor, and the quantification of the WEEE Generated can be considered accurate. In the Anthesis report, the WEEE Generated (though referred to differently) is 1665 kt, which closely matches the WEEE Generated from our study 1,568 kt (23.32 kg/inh) [15].

WEEE Directive Implementation

WEEE management in the UK is regulated by the Waste Electrical and Electronic Equipment Regulations 2013, which was enacted on 1 January 2014 and which transposed the EU WEEE Directive (2012/19/EU) into national law. This legislation replaced the original Directive and all previously associated UK Regulations.

The United Kingdom has 28 PROs active on the territory, and most deal with all WEEE categories. They are required to register their members and finance their household WEEE collection target (as distinct from the overall household and non-household target for the member state). PROs must finance their individual scheme member non-household WEEE obligations, but there is no target set for the requirement. PROs must obtain sufficient evidence notes to show that the household WEEE targets and any non-household WEEE obligations have been met; an online platform (https://www.weee-sc.org.uk/) is used for this.

The WEEE Settlement Centre is an online tool for PROs to gather evidence of WEEE treatment. PROs and AATFs must report the weight of WEEE they receive quarterly by category, noting the distinction between households and non-households [59].

However, PROs can discharge their obligations without physically collecting WEEE. In the event that a PRO does not secure enough direct collection contracts for meeting the target, it can contract with another PRO, and the evidence notes can be transferred between the PROs.

The recent changes to the WEEE Regulations introduced the new requirement that PROs must join the PRO Balancing System (PBS). The function of the PBS is to guarantee a free-of-charge collection service to local authorities for some or all WEEE streams in the event that they cannot obtain a service from a PRO. This can happen when, for instance, a PRO has already collected sufficient WEEE to meet its target or if the local authority is too expensive to collect from, e.g. if it has low levels of waste arising in remote areas. The PROs share both the cost and evidence notes generated from any collections facilitated through the PBS.

PROs in the United Kingdom have highlighted the issue of competition for access to household WEEE. Indeed, for many WEEE streams, there are large organisations, retailers, waste management companies, and collective purchasing arrangements from local authorities that control the access to significant quantities of WEEE.

The national regulations foresee the possibility of PROs paying a compliance fee as a means of meeting the collection target – either for part or all of it [60]. According to the law, the fee should be defined to reflect the costs of collecting and treating WEEE and should encourage compliance through direct collection and disincentivise over-collection [53], [60]. Therefore, the fee complements the national targets by creating an additional financial incentive to collect WEEE [60]. The current fund manager for the compliance fee is the Joint Trade Associations.

Whereas the PROs can only include collected WEEE in the reported figures, the UK government makes use of substantiated estimates to report additional data regarding large household appliances (i.e. cookers, washing machines, etc.), excluding cooling equipment, which is treated as metal scrap and within the light iron stream apart from the WEEE system. The use of substantiated estimates is allowed, since the recycling process used on most light iron in the United Kingdom has the same requirements set by the WEEE Directive, in terms of both treatment standards and recycling and recovery targets. A study conducted in 2013 and 2014 estimated the amount of LHA treated within the light iron stream as accounting for 11% of the flow, or 273 kt [27]. As such, considering that estimation as valid

for subsequent years as well, one can infer that 28% (4.1 kg/inh, 273 kt) of the WEEE collected reported by the country in 2016 is linked to the application of the substantiated estimates. In 2017, figures indicate that the UK managed to comply with the Directive target (45% of EEE POM) by including the amount of LHA in light iron as substantiated estimates, which allowed them to not only cover the missing 1.91 kg/inh (126 kt) to meet the target, but exceed it, with 2.18 kg/inh (144 kt) [56]. The use of substantiated estimates while reporting data on WEEE collected to Eurostat is also confirmed by the quality report submitted by the country for 2017. In order to have confidence in the use of substantiated estimates used to demonstrate the achievement of the target, the developed methodology ensured the choice of representative samples for the UK and then scaled up the outcomes for the nation as a whole, since it is not feasible to routinely measure the amount of WEEE in the light iron stream. The samples for analysing the light iron stream must be selected from large and small facilities, which are managed by different companies and located in various regions of the country. The information to be captured must include the average tonnage of large household appliances within the light iron stream as well as the frequency of the different appliances. It has been proven that the size of the treatment site impacts neither the light iron content of WEEE nor the variability of appliances delivered [61].

In addition, the amount of WEEE delivered to AATFs – where it is correctly processed, recycled, and reported, but not categorized as WEEE, since it has not been sent for treatment under arrangement with a PROs – is also relevant. The aforementioned flow is defined as non-obligated WEEE, and the MS includes it when achieving the target. Recent studies have highlighted the importance of assessing how non-obligated WEEE is identified and reported by the AATFs, as the classification of obligated/non-obligated may happen incorrectly. This analysis could help tackle issues such as double-counting or incomplete reporting [56].

Among the main obstacles for PROs increasing their collection performance in the country is the correlation between the scrap prices and the large household appliances going out of the official WEEE system, which represents a relevant amount of leakage. Furthermore, PROs in the UK perceive the short-term nature of the system (i.e. targets set annually and one-year compliance periods) as contributing to a lack of investment and long-term arrangements and commitments. Also, the competition between PROs and other collection actors that have no obligations and can manage the WEEE as they wish – or other organisations, such as retailers, who have the direct relationship with consumers and can charge to pick up the WEEE from households – strongly impacts the ability of PROs to meet their targets via their own collection arrangements. Additionally, improvements in the collection rate in the past appear to have been driven by POM growth, which has been static or even dropped more recently. The increasing evidence of online sales represents another issue for producer responsibility, as the enforcement agencies are not sufficiently resourced for tackling the increase in free-riding activities. Moreover, consistent public national awareness-raising of the importance of WEEE recycling was lacking until 2020.

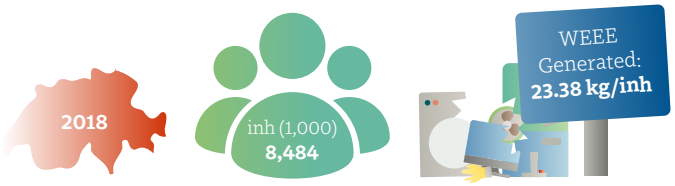
The United Kingdom has not implemented other components of the WEEE Directive, such as mandatory handover, the visible fee, the 'all actors' approach, or clearing houses.

Key Statistics

The United Kingdom

Indicator	Year	Value
Inhabitants (1,000)	2017	66,040
Sum of EEE POM apparent consumption method* (kt)	2008-2017	16,559
Sum of EEE POM Eurostat* (kt)	2008-2017	15,451
EEE POM Eurostat (kg/inh)	2017	23.93
WEEE Generated (kg/inh)	2017	23.32
WEEE Collection Eurostat (kg/inh)	2017	13.19
WEEE Collection Key Figures (kg/inh)	2018	7.54
Collection rate in % (EEE POM and WEEE Generated)	2017	50% and 57%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.



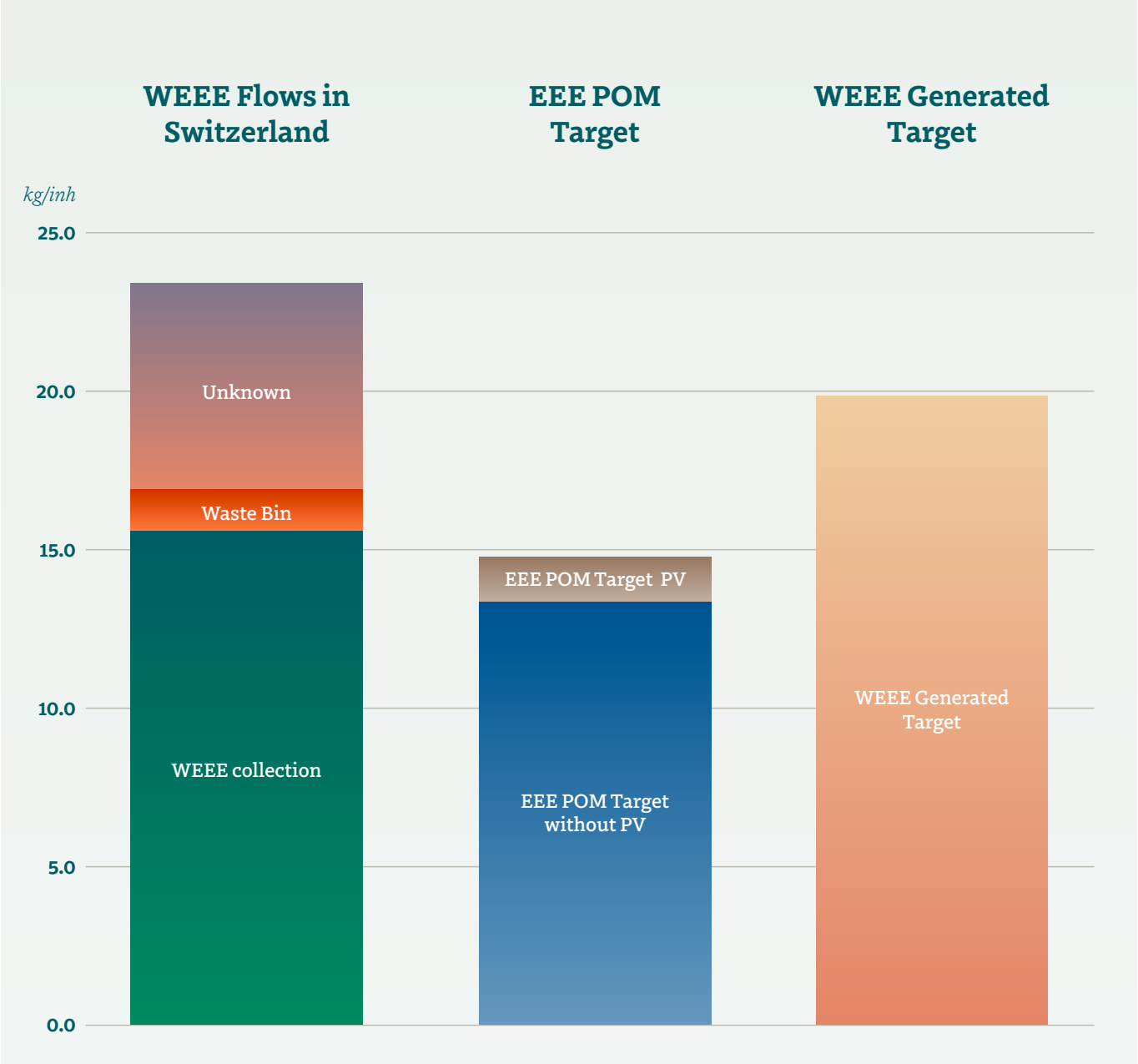
7.8 Switzerland

Overview

Switzerland has a collection rate of 68% (in 2018) and is one of the few countries that exceed the collection rate of 65% of the EEE POM, despite not being an EU Member State. Their high collection rate is a result of fundamental measures that have been regulated and implemented, such as the employment of an EPR system that employs take-back obligations without limitation, a dense network of collection points and retailers, consumer awareness, defined retailer obligations, and a reasonable collection fee for all WEEE that has been taken back. WEEE collection has remained more or less constant at 16 kg/inh over the past five years, as the country's return rate is possibly at its limit.

Figure 19 illustrates the WEEE flows, as well as the EEE POM and WEEE Generated targets, in Switzerland for 2018. It should be reiterated, though, that Switzerland is not a member of the EU, so the targets are not applicable.

Figure 19
WEEE flows, EEE POM, and WEEE Generated targets in Switzerland



Analysis of key factors affecting collection targets

Target methodology

Since Switzerland is not a member of the EU, it has no obligation to follow EU policies or comply with the WEEE Directive. However, the implemented methodology for calculating the collection rate at the national level is 65% of EEE POM. Specific collection targets – e.g. items for reuse, B2B collection, or other categories – have not been introduced.

The producer responsibility take-back scheme for EEE in Switzerland is covered by the Ordinance on the Return, take-back, and Disposal of Electrical and Electronic Equipment (ORDEE). The Ordinance came into force in 1998 and was amended in 2005. The amendment increased the scope of the Ordinance from the number of categories of EEE[14] and the inclusion of components containing capacitors in lighting [62].

Other WEEE flows

In Switzerland, other WEEE flows are not monitored, as WEEE collection operated by the informal sector has not been registered. Traders/retailers are an important element in the management of WEEE, since they are obliged to accept all discarded products, irrespective of whether they were bought in their establishment or not and whether the customers replace the discarded product by buying new EEE or not. Having no significant informal flows is also associated with the fair collection fees that are set in the Swiss system. As a result of the fees, the system can guarantee a high collection rate and ensures that all products and materials have sound management. Most metal scrap collectors are thus part of the formal system and have partnerships with the country's various PROs.

Switzerland's various WEEE Flows have been estimated for 2018 through ProSUM estimates, showing that 1.3 kg/inh of WEEE is disposed of in residual waste and 6.4 kg/inh of WEEE have an unknown fate. The quantities of WEEE in metal scrap are unknown, but PROs consider them to be very limited, due to the financial incentive that authorities provide for the sorted collection of WEEE.

It is estimated that 2% of the WEEE collected for Cat. I (Temperature exchange equipment) is affected by scavenging practices, especially scavenging for components, such as compressors.

PV Panels and open scope

The share of PV panels over the total EEE POM in Switzerland is 1.4 kg/inh, which is within range of the European average (5.9% for 2018). The collection of PV panels for 2018 is equivalent to 0.9 kg/inh, contributing 6% to the 65% EEE POM target achieved by the country. Due to economic reasons, SENS eRecycling exports PV modules and other flat glass to Germany so they can be processed [63].
Open scope has not been implemented in the country, nor are there any plans for it to be implemented.

Coverage of the WEEE collection data

Switzerland has a voluntary system in place whereby the producers are responsible for managing their WEEE (concerning collection, recycling etc.). Through ORDEE, customers bear the responsibility of bringing their discarded products back into selected collection points or retailers. The discarded products are then sent to waste treatment and processing plants for treatment and for valuable material to be soundly recovered. Consumers are required to pay into an Advance Recycling Fund (ARF) when purchasing new EEE products, which finances the operation of the system (i.e. collection, transport, recycling, and disposal). The fee on new equipment finances the take-back of old equipment purchased at a time when the fee had not yet been implemented as well as new equipment. The ARF reflects the gap between the total cost of the WEEE management system and total value recovered from the waste.

Batch tests are put into place in order to standardize the recycling and recovery rate (RVQ) per treatment stream of a single recycling plant. The RVQ aims to assess the recovery performance of the recycling products. Specific minimum RVQ requirements for material and energy recovery are defined, based on the WEEE Directive. The recycling rate is the proportion of materials of the equipment recycled. In 2018, the minimum requirement for RVQ for household equipment was a 75% recycling rate [64].

WEEE in Switzerland is managed by two PROs that are financed by the ARF (and its collection stream is product-dependent): the Swiss Association for Information, Communication and Organisational Technology (SWICO) and the Swiss Foundation

[14] Collection categories in the ORDEE amendment include: consumer electronics equipment; office, IT, and communication technology equipment; household appliances; lighting equipment; lamps (without incandescent lamps); tools (except large-scale stationary industrial tools); and sport and leisure appliances (and toys).

for WEEE Management (SENS). SWICO manages Information Communication technology and telecommunication equipment. SENS focuses on the management and disposal of equipment coming from households, such as large and small household appliances, leisure appliances and toys, and PV panels. Additionally, the Swiss Association for Illumination (SLRS) comprises a third take-back system, which is solely responsible for lamps and lighting fixtures, though the processing of the material after collection falls to SENS. The PROs maintain close cooperation with each other and with specialized networks and partners involved in the EEE's lifespan.

Switzerland's data-reporting happens through SENS and SWICO, which do not distinguish between WEEE collected through B2C or B2B channels. Moreover, as the country has not implemented the open scope, a large portion of professional WEEE from B2B is not reported.

WEEE Directive Implementation

The EPR principle is used as the basis for their WEEE management, and manufacturers/producers, retailers, and distributors are thus solely responsible for the environmentally sound management of their products. The visible fee has been implemented since 1998, which has had a positive impact on the overall WEEE management performance, as can be reflected by the decrease in littering. The visible recycling fee of WEEE is based on the type of appliance and its specific weight [65]. Every collection partner (e.g. community collection, private collection, producers, importers, etc.) and recycler is charged a reasonable fee for taking back WEEE, which facilitates transparency and avoids competition.

SENS regularly publishes the differentiated values of collection fees for large and small household appliances and PV modules. For instance, for large household appliances, the fee can reach up to 74 CHF/ton, depending on the weight of the product for cooling and freezing equipment. Depending on the item's weight, the fees can reach up to 222 CHF/t; for power tools and garden equipment (including batteries), it can be as much as 692 CHF/ton; and for PV modules, including components (e.g. inverted rectifiers, circuit elements, controllers, etc.) the fee is 40 CHF/ton [65]. All fees exclude the 7.7% sales tax, and recyclers retain the profits of recyclable fraction sales.

Neither the clearing house nor the 'all actors' approach have been implemented in Switzerland. However, the 'all actors' approach is effectively applied through the ORDEE, as all stakeholders are involved in the life cycle of EEE (i.e. consumers, retailers, collection partners, PROs, and recyclers of WEEE). Switzerland does not use substantiated estimates for its data when reporting.

Handover is voluntary in Switzerland, as the majority of the producers and importers have close partnerships with the various PROs, and retailers and metal scrap dealers are obliged to take back defective appliances and return them to recycling centres. In addition, a take-back obligation without limitations has been implemented by law, meaning that it is also possible to take back more than one product, irrespective of the brand or where the product was bought or replaced.

In the case of reuse and exportation of used-EEE, they do not currently undergo reporting procedures at the national level. They are not currently communicated to the various PROs. As used-EEE do not fall under the country's waste legislation, the exporter does not need authorisation by the waste authorities and does not provide data, so this type of flow has not yet been quantified in Switzerland. The number of thrift shops and repair cafees has increased lately, but unfortunately, they do not report this practice to PROs or authorities. However, they do have the obligation to accept all discarded products and hand them over to the PROs.

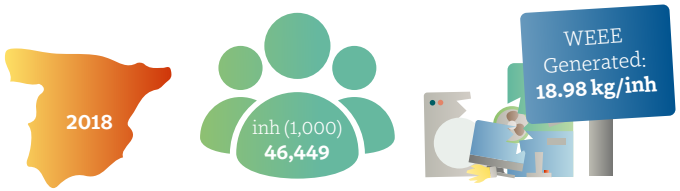
With regard to the WEEE management infrastructure, collection points are very widespread within Switzerland, and all active recycling facilities in the territory must meet the required recycling quality standards (EN 50625).

Key Statistics

Switzerland

Indicator	Year	Value
Inhabitants (1,000)	2018	8,484
Sum of EEE POM apparent consumption method* (kt)	2008-2017	2,108
Sum of EEE POM Eurostat* (kt)	/	n/a
EEE POM Eurostat (kg/inh)	2018	24.2
WEEE Generated (kg/inh)	2018	23.38
WEEE Collection Eurostat (kg/inh)	-	-
WEEE Collection Key Figures (kg/inh)	2018	15.58
Collection rate in % (compared to EEE POM for the three preceding years)	2018	68%
Collection rate in % (compared to WEEE Generated)	2018	67%

*Excluding UNU-KEY 0001 and UNU-KEY 0002.



7.9 Spain

Overview

Spain registered a collection rate of WEEE Generated of 34% with 5.8 kg/inh and a collection rate on EEE POM of 48% in 2018, with 6.2 kg/inh of EEE POM collected in 2017. Spain remains 10.3 kg/inh short of reaching the 85% WEEE Generated target, corresponding to 16.1 kg/inh, and remains 2.2 kg/inh short of the 65% POM target, corresponding to 8.4 kg/inh.

One of the main factors keeping Spain from reaching a higher collection target so far has been the fact that large quantities of WEEE are managed by the scrap dealers (0.9 kg/inh), as well as the common lack of disposal awareness among citizens (equivalent to 1 kg/inh of WEEE found in waste bins). Overall, WEEE flows disposed of in waste bins and managed as scrap is estimated to be an additional 30% of the total reported WEEE collected.

Figure 20 illustrates the WEEE flows, EEE POM, and WEEE Generated targets in Spain for 2018.

Figure 20
WEEE flows, EEE POM, and WEEE Generated targets in Spain

Analysis of key factors affecting collection targets

Target methodology

The method chosen for calculating the collection target is the 65% EEE POM, which corresponds to 9.35 kg/inh for 2018. Spain has also set targets for preparation for reuse that have been implemented since 2018, according to which producers should achieve a target of 3% for collected WEEE of large equipment and 4% of collected WEEE for small IT. The collection objectives for 2020 have recently been published and are based on the 65% EEE POM approach. The Ministry for the Ecological Transition in Spain has not yet announced the intention to calculate the collection target based on the WEEE Generated approach, due to the current absence of consistent information about the methodology.

Other WEEE flows

Other WEEE flows in Spain are mostly managed by metal scrap dealers and unofficial recyclers that collect and treat their own WEEE without reporting it to the PROs or to corresponding authorities. In most cases, some of the output fraction managed by metal scrap dealers is sent to treatment facilities, while other parts can be exported, legally or illegally, as either scrap or used-EEE. Lack of enforcement has been identified as one of the leading causes of other WEEE flows and as an obstacle for Spain in achieving higher collection rates by the PRO. Non-compliant actors, such as metal scrap dealers and the informal sector, manage most of the non-official flows, mostly because of the financial and administrative incentives. Indeed, by operating outside of the official system, they do not face licensing of reporting obligations, making the work very attractive to them.

Using data from ProSUM, it was estimated that 0.9 kg/inh of WEEE was managed by metal scrap dealers, and 1 kg/inh was disposed of in waste bins as a result of inappropriate consumer behaviour [66]. Based on the know-how of the sector and discussions with stakeholders, PROs have evaluated that an additional 30% of the total WEEE collected is managed by non-compliant collectors.

Two more problems at the country level that have been highlighted by PROs include the theft taking place at municipal collection points and scavenging practices. These activities happen mainly for temperature exchange equipment and some large household appliances because of their high content in valuable parts. While these valuable parts are suspected to end up in the scrap flow, no estimations about volumes robbed or scavenged are available, unfortunately, and the impact of the practices could not be quantified.

The majority of WEEE flows have an unknown fate (equivalent to 10.7 kg/inh) and could not be quantified, due to lack of information.

In Spain, PROs are responsible for meeting targets defined by the European Commission, but they lack the necessary competence to monitor and penalise the informal sector. The informal sector mostly manages products such as air-conditioning systems, large household appliances, and products with the highest economic value.

As with many European countries, exports of used-EEE, such as medical devices, happen in Spain as well. Nonetheless, no estimations of volumes exported were available at the moment of this writing, nor was evidence available that specific controls to monitor this type of flow had been implemented.

PV Panels and open scope

As seen in Figure 20, the market of PV panels in Spain has not yet permeated the EEE sector in any relevant way. In 2017, PV panels POM was equivalent to 0.01 kg/inh, which is considerably below the European average (0.8 kg/inh). In 2018, this figure slightly increased to 0.06 kg/inh of PV panels POM, illustrating that the effect of the sector on the overall collection rate achieved by the country can be considered minor. However, the introduction of the open scope led to a relevant increase, up to 1.7 kg/inh of PV panels POM in 2019.

With respect to the open scope, the main products that have been included in the reporting system, once enforced, included cables, motors, ink cardridges (toners), domestic luminaires and switches, and other electrical devices. Most of these new EEE have been allocated into the categories of large and small household appliances (Cat. IV and Cat. V of the EU-6). PV panels have been established as a separate category (Cat. VII). The effect of the introduction of the open scope is expected to be relevant to the collection target, as it has increased the amount of POM by 3 kg/inh for 2019, including both B2B and B2C, as well as the sector of PV panels.

Coverage of the WEEE collection data

The Spanish Ministry for the Ecological Transition has reported that there is a

portion of unaccounted flows. By examining reported WEEE collected and treated from 2009-2016, it is possible to notice a difference of 60,209 tons, meaning that 4.1% of the WEEE collected over these years were not treated. According to the Ministry for the Ecological Transition, this discrepancy can be explained by the fact that WEEE data are processed at the regional level (Autonomous Communities in Spain), then centrally forwarded to the Ministry. Therefore, uncertainty remains with respect to collected data, due to the territorial and administrative organisation. For instance, WEEE collected in one Autonomous Community, which is then transferred to another Autonomous Community to be treated there, could lead to double-counting or inconsistent reporting. The competent authority is then in charge of checking the eventual duplication in the data and discounting the WEEE whose origins are not clear. Furthermore, uncertainty in the WEEE collected data is also due to the fact that scales for this type of waste are frequently unavailable at municipal and distributors' collection facilities.

Despite the abovementioned difficulties, the Ministry for the Ecological Transition notes that 2016 data have improved, as result of the introduction of the Royal Decree 110/2015 that sets out the gradual adaptation and improvement of the municipal collection waste facilities in order to make them compliant with the new specifications of the WEEE Directive. In addition to the introduction of electronic tools for facilitating reporting and traceability of WEEE, this enhancement should help information about collection be more accurate in the next several years.

Given that Spain uses a different classification system at the national level to collect and report WEEE flows (LER codes), it uses estimates when reporting to the European Commission in order to create a link between the Spanish WEEE classification and the Collection Category defined by the WEEE Directive. The aforementioned estimates are made by treatment facilities for the list of waste codes they treat and are based on previous experience and studies conducted using sampling methods and sorting surveys. The wide variety of EEE products that do not fall within the scope of the WEEE Directive, as well as the use of different types of classifications, can lead to misreporting that affects Spain's collection rate for a category.

The B2B collection for the country is within range of the European average (9% in 2017, 0.56 kg/inh), and the percentage has remained nearly constant from 2015 to 2017.

The overall WEEE collection in Spain has consistently increased in recent years, from 4.0 kg/inh in 2014 to 6.2 kg/inh in 2017. A contributing factor was the end of the economic crisis in 2013, which led to an increase of yearly POM quantities and to a higher equipment substitution rate, which also influenced the generation and collection of WEEE. Another factor was the publication of the WEEE Directive in 2012, when PROs began anticipating efforts to achieve targets by widening collection networks and conducting more awareness campaigns.

WEEE Generated methodology

Available information indicates that the Ministry of Environment of Spain is currently not considering the use of the WEEE Generated methodology for calculating the collection target, until more consistent information about the functioning of the methodology is available [67]. (Resolución y objetivos mínimos de recogida separada de RAEE estatales y autonómicos para el año 2020).
The EEE POM from the apparent consumption methodology, which served as the basis for the WEEE Generated methodology, was, on average, 33% higher than the EEE POM data reported to Eurostat. It needs further analysis to investigate the differences.

WEEE Directive Implementation

The WEEE Directive was transposed into Spanish legislation in 2015. An 'all actors' approach was implemented, meaning that all-natural or legal persons or entities involved in the life cycle of WEEE had certain obligations pursuant to the WEEE Royal Decree (i.e. producers, distributors, PRO, treatment facilities, Small and Medium Enterprises, etc.), mostly with regard to reporting. According to the Royal Decree of 10/2015, the Ministry should establish an online platform partially financed by PROs for all actors handling WEEE to report WEEE collected quantities and their traceability in a centralised manner [68]. Once properly implemented, the approach is expected to have a positive impact on collected quantities. Nonetheless, the electronic reporting platform has yet not been implemented via a legislative act. As a result, the Ministry does not currently have means available for quantifying all WEEE collected or cross-checking the information provided by the Autonomous Communities (CCAA).

For the time being, the responsibility of achieving targets relies on the collective and the individual PROs, and the responsibility is allocated proportionally to their market share in the previous year (i.e. the target for a PRO for 2019 is allocated based

on the market share of POM quantities of year 2018). Since the responsibility relies only on PROs and not on other actors, such as the recyclers, to the best-available knowledge, the WEEE managed apart from PROs is not accounted for, which is likely a key factor hindering the country's potential for reaching the collection target.

In Spain, the Oficina de Coordinación de Residuos de Aparatos Eléctricos y Electrónicos (OfiRAEE) is a private entity that functions much like a clearing house. It was developed and appointed by several PROs in Spain, though not by all of them. OfiRAEEis a platform that coordinates the municipal management of WEEE and collection points and provides technical assistance to users and PROs. The Ministry is currently working on implementing a clearing house in the coming months, which should involve all PROs, both individual and collective. Since the implementation of OfiRAEE, the collection rate has noticeably increased, from 41% in 2015 to 48% in 2017.

Currently, there is no mandatory handover in Spain, and a visible fee to the end consumer is not allowed.

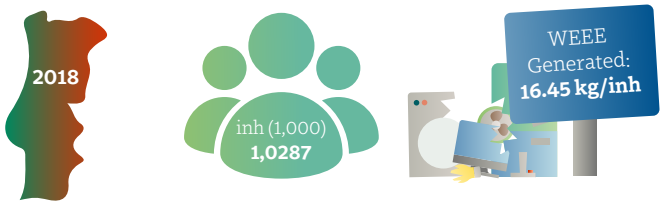
Key Statistics

Spain

Indicator	Year	Value
Inhabitants (1,000)	2018	46,449
Sum of EEE POM apparent consumption method* (kt)	2008-2017	9,105
Sum of EEE POM Eurostat* (kt)	2008-2017	6,447
EEE POM Eurostat (kg/inh)	2017	14.35
WEEE Generated (kg/inh)	2018	18.98
WEEE Collection Eurostat (kg/inh)	2017	6.19
WEEE Collection Key Figures (kg/inh)	2018	5.76
Collection rate in % (compared to EEE POM for the three preceding years)	2017	48%
Collection rate in % (compared to WEEE Generated)	2018	34%**

*Excluding UNU-KEY 0001 and UNU-KEY 0002.

**The original value for the WEEE Forum Key Figures data was 30%, but this has been adjusted to 34%, as the WEEE Forum Key Figures data was under-reported in comparison to official Eurostat data.



7.10 Portugal

Overview

Portugal has increased its collection rate in recent years, from 41% of WEEE Generated in 2016 to 44% in 2018. Using the 65% EEE POM target methodology, the collection rate achieved was equal to 54% in 2017, with an equivalent WEEE collection of 6.8 kg/inh. Portugal remains short of the target by 1.4 kg/inh, using the 65% EEE POM target, and 7.4 kg/inh, using the 85% WEEE Generated target.

Some of the main challenges Portugal has encountered in attempting to reach its collection target include the lack of distinction between collection sources and the absence of models within the country that encourage collaboration between others actors. Implementation models such as the 'all actors' approach and mandatory handover have not been introduced in Portugal. Additionally, the lack of commitment to proper disposal practices results in WEEE mixed in with other waste streams and being disposed of on streets and in waste bins. Despite that, Portugal has one of the eight highest collection rates in Europe. This could be due to the substantiated estimates reported by its environmental authorities, which were enforced until 2018. The substantiated estimates quantified WEEE flows found in metal scrap or mixed with unsorted waste and accounted for more than 50% of the total reported WEEE collected.

Figure 21

WEEE flows, EEE POM, and WEEE Generated targets in Portugal

Analysis of key factors affecting collection targets

Target methodology

Portugal transposed the WEEE Directives 2002/96/EC and 2002/95/EC by implementing Decree 230/2004 of December 2004, and it transposed Directive 2012/19/EU by implementing Decree 67/2014 of May 2014 [69], [70]. The target methodology adopted by Portugal is the same that has been established in the WEEE Directive. Starting in 2019, the collection target to be achieved annually will be either 65% of the average weight of the EEE POM in the three preceding years or 85% of the WEEE Generated in Portugal [69]. In addition to the target methodologies defined for all the Member States by the WEEE Directive, Portugal introduced additional regulations for the PROs, stating that beginning in 2019, they must ensure at least a 50% of the total WEEE collected and reported coming from their own collection network. Until the end of the license period (2021), PROs are also asked to guarantee a collection rate of 70% of the EEE POM averaged over the three preceding years for the categories of temperature exchange equipment (Cat. I of the EU-6) and lamps (Cat. III of the EU-6). Additionally, they must maximize the preparation for reuse until 2021, achieving a minimum of 5% of the total WEEE collected.

Other WEEE flows

Portugal has a significant amount of WEEE that is collected by the informal sector and treated by facilities applying substandard treatments at the municipal level. These entities mainly consist of small- and medium-size collectors who scavenge appliances for components to sell, with the remaining portion ending up in car shredders. A share of the WEEE collected by the informal collectors is shipped abroad. Unfortunately, Portugal does not have a systematic monitoring framework in place to quantify this type of flow.

Other WEEE flows have been quantified for 2018 by using the ProSUM project estimates and illustrated that apart from the 4 kg/inh collected, 2 kg/inh of WEEE is still found in mixed metal scrap, and 1.5 kg/inh of WEEE is disposed of in waste bins. Moreover, the majority of WEEE flows, 5.6 kg/inh, have an unknown fate. An additional 3.3 kg/inh was obtained via substantiated estimates.

PV Panels and open scope

The share of PV panels on the total EEE POM flow is moderate in relation to other European countries. The amount of PV panels POM per capita remained almost stable from 2016-2017 at 0.41 kg/inh, which is below the European average of 0.79 kg/inh. In 2018, Portugal reached 0.56 kg/inh of PV panels POM, meaning that the sector contributes 2% of Portugal's collection rate.

The open scope is expected to impact all WEEE categories, and Portugal has not yet allocated products to specific categories. For all categories, the Portuguese reporting system provides subcategories that allow declaration of products. The National Environmental Agency (APA) produced a document containing several examples of the open scope, including toners, sockets, hand dryers, and smoke detectors, among others [71]. Differentiated information of products included in the open scope are not available, as they are difficult to isolate. However, the PRO Electrão - Associação de Gestão de Resíduos estimated an overall impact that will be visible in 2019 data, as there would be at least an 8% increase of EEE POM quantities as compared to 2018.

Coverage of the WEEE collection data

The data on WEEE collected is gathered from national collective schemes, waste treatment operators (including foreign operators for exports), and EEE producers. Extra controls are applied on the system to assure that all the info concerning WEEE collected and treated is reported. Data on WEEE collected does not distinguish between collections operated from households and other sources. Since 2016, Portugal has not provided official information that separates WEEE collected 'from private households' from WEEE collected from places 'other than private households', which results in an aggregation of data collected from both sources. This is because the collection target is set based on the total amount of WEEE collected (Art.7 of the WEEE Directive), and the need to track separate data for the two sources is not perceived as significant. Portugal does not distinguish between B2B and B2C flows, but given Electrão's network, it can catalogue collection points that are B2B or B2C.

Portugal registered an increase in the amount of WEEE collected per inhabitant from 2012 (4.1 kg/inh) to 2018 (7.2 kg/inh). This trend is correlated to an expansion of the collection network at the national level, which has occurred gradually in recent years. For instance, Electrão's network grew from 600 to 4,500 collection points from 2014 to 2019. As well, the investment of PROs in consumer awareness, communication, and education campaigns might have had an important impact on the increase of collection and proper disposal of WEEE.

Information on the rates of WEEE officially collected and reuse/recycling is reported to Portugal's environmental authorities, using several channels, including: WEEE collected from the PROs' own network, WEEE collected and recycled in treatment facilities (including treatment facilities financed by PROs), and reuse programs supported by PROs. Electrão estimated that WEEE collected from treatment operators that are not PRO-financed account for less than 10% of the total reported. Approximately 0.08% of the total WEEE collected is exported for treatment outside the European Union, either directly by its producers or by waste treatment operators [72].

With respect to the reportage of EEE POM, the Portuguese Environment Agency (APA) noted that the amount registered had dropped remarkably, from 16.46 kg/inh in 2008 to 11.13 kg/inh per inhabitant in 2012, which has been explained as a result of the economic crisis that Portugal has faced since early 2008. Indeed, the decrease has not been attributed to a reporting problem because the majority of the producers comply with the deadlines when reporting to the national registry. According to Electrão, the online market represents a significant amount of EEE sales, and studies (e.g. the OECD's European Ecommerce report, among others) have estimated that 45% of EEE POM correspond to free riders [73], [74].

WEEE Generated methodology

The EEE POM from the apparent consumption methodology that was used as a basis for the WEEE Generated calculation for 2009-2019 was, on average, 18% higher than the EEE POM data reported to Eurostat. It needs further analysis to investigate the differences.

WEEE Directive Implementation

Portugal has three PROs, Electrão, ERP Portugal, and WEEECYCLE) which manage all categories defined by the WEEE Directive [75], [76]. PROs are subject to the management principles and objectives established in Decree-Law no. 152-D of 11 December 2017: namely, the structuring of a collection network selective; the financing of costs for sorting, storage, transport, treatment, recovery, and disposal of WEEE deposited into the selective collection network; and the fulfilment of collection targets and minimum recovery objectives. Portugal's national regulation defined a waste management fee (expressed in €/ton) as a penalty for the infringement of the PROs collection target [77].

Portugal established a private national register, which, in the past two years, has been integrated into the Portuguese Environment Agency (APA) under Decree-law No. 306/2016, from 7 December 2016. Portugal stablished the structure, configuration, and operation of the Commission for the Monitoring of Waste Management (CAGER) [78]. CAGER is Portugal's clearing house, and it focuses on supporting the monitoring and evaluation of sustainable waste management. CAGER is in its initial stages in 2018, when allocation and compensation mechanisms for WEEE flows were initially defined [78]. In 2019, a discussion was held in conjunction with the Battery and Accumulator representatives for future allocations and compensation mechanisms of the flows, and an analysis of the application of rules was evaluated and further discussed in February 2020 [78].

Portugal implemented a mandatory visible fee for all B2B economic transactions, starting 1 January 2020, and its effect will be quantifiable in the months to come. With regard to B2C, companies selling EEE products directly to final consumers are not obliged to apply a visible fee [79]. In the past, a mandatory fee was applied to end consumers, but Portugal did not experience any influence either on the collection rate or on consumer behaviour with respect to EEE alternatives. Consequently, the country currently has a voluntary approach to the visible fee when it comes to B2C [80].

Portugal's national legislation has adopted neither mandatory handover of WEEE nor the 'all actors' approach. Nonetheless, the PROs openly support these principles and have been advocating for them as necessary measures to be implemented in a future revision of the law.

Until 2018, Electrão used substantiated estimates for collection figures concerning large household appliances (Cat. I of EU-10), small household appliances (Cat. II), and IT equipment (Cat. III). Substantiated estimates were used to quantify and report systematically and in a statistically representative way the portion of WEEE found in metal scraps or receiving substandard treatments among unsorted waste. The methodology developed was based on the characterisation of representative samples that were performed through technical verification of waste management plants. The Portuguese Environment Agency specified that aspects evaluated by the methodology used for the substantiated estimates include: how periodically the characterisation (i.e. selection of load and identification of products) is performed, duration and sample size, and calibration used. While in use, substantiated estimates

accounted for roughly 50% of the total reported WEEE collected by the PROs. Nonetheless, starting in 2019, the license provided to PROs no longer accounts for the possibility of using substantiated estimates, as requirements defined by the National Authorities indicate that the PROs network should be structured in order to prioritise the selective collection of WEEE. It is also noted in the legislation that the PROs should take measures to ensure the integrity of WEEE sent for treatment. Consequently, WEEE in metal scrap or found in unsorted waste can no longer be integrated with the total collected. However, Electrão developed a study on substantiated estimates using all information gathered in recent years and shared it with the authorities, but it is still unclear whether the National Environmental Agency will adopt the methodology nationally, going forward.

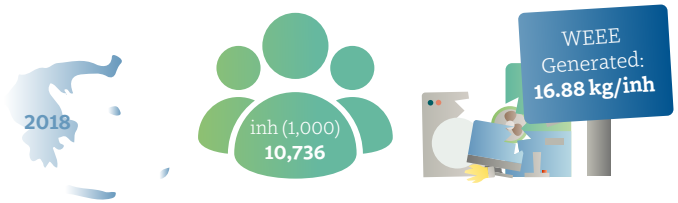
Key Statistics

Portugal

Indicator	Year	Value
Inhabitants (1,000)	2018	1,0287
Sum of EEE POM apparent consumption method* (kt)	2008-2017	1,667
Sum of EEE POM Eurostat* (kt)	2008-2017	1,417
EEE POM Eurostat (kg/inh)	2017	15.34
WEEE Generated (kg/inh)	2018	16.45
WEEE Collection Eurostat (kg/inh)	2017	6.80
WEEE Collection Key Figures (kg/inh)	2018	6.58
Collection rate in % (compared to EEE POM for the three preceding years)	2017	54%
Collection rate in % (compared to WEEE Generated)	2018	44%**

*Excluding UNU-KEY 0001 and UNU-KEY 0002.

** The original value for the WEEE Forum Key Figures data was 40%, but this has been adjusted to 44%, as the WEEE Forum Key Figures data was under-reported as compared to official Eurostat data.



7.11 Greece

Overview

The amount of WEEE collected in Greece has increased from 4.5 kg/inh in 2015 to 5.4 kg/inh in 2018. Greece's collection rate for WEEE Generated was 32% in 2018 and was 45% for the EEE POM methodology.

The low collection rate, compared to WEEE Generated, can be attributed to such factors as the specific characteristics of the Greek market, resulting in fluctuating and unstable levels of POM, as well as hoarding practices. The result is that large quantities of WEEE are collected and managed by metal scrap dealers or are disposed of in waste bins.

The main hindrances to achieving the target include the limited engagement of authorities and municipalities and lack of implementation of useful measures for limiting the activities of the illegal sector.

Figure 22 illustrates the WEEE flows, EEE POM, and WEEE Generated targets in Greece for 2018.

Figure 22
WEEE flows, EEE POM, and WEEE Generated targets in Greece

Analysis of key factors affecting collection targets

Target methodology

Greece has chosen the methodology based on 65% of EEE POM for calculating the collection target. The risk of this approach is that it is highly influenced by fluctuations on the amounts of EEE POM from year to year, due to the country's unstable economic situation, which can lead to low consumption behaviour.

Other WEEE flows

The WEEE flows have been estimated for 2018. They show that besides the 5.4 kg/inh collected, 1.5 kg/inh of WEEE is still found with mixed metal scrap dealers, and bad consumer habits indicate that 1.3 kg/inh of WEEE is disposed of in waste bins. Additionally, the majority of WEEE flows, corresponding to 8.7 kg/inh, have an unknown fate.

As with other countries, Greece exports an unknown amount of used-EEE. Information on quantifying this flow is not available, but customs authorities perform audits to regulate it, though the audits are not established at regular intervals.

The informal sector mainly consists of scrap dealers and backyard collectors. The informally collected WEEE is likely to be exported to other Member States or even outside of the EU, or may be sent to car shredders and reuse channels in Greece. No studies on these quantities currently exist.

In Greece, there are scavenging practices of valuable parts of WEEE, and the analysis conducted by Electrocycle for 2018 revealed that, from a sample taken of 34.7 kt (equivalent to 3.2 kg/inh), an average of 6.5% of appliances, or 2.6 kt (0.2 kg/inh), were affected by scavenging practices. The sample was taken from WEEE at a treatment facility that was collected by mixed municipalities, retailers, and scrap dealers. Products mostly involved by these practices included air-conditioning units, fridges, and large household appliances, as well as CRT and flat panel display screens, whose missing components are most commonly compressors and engines.

PV Panels and open scope

Currently, Greece does not account for PV panels in the reporting system because it is not part of the scope of the PROs. Data on PV panels are provided by HELAPCO, a non-profit organisation representing the major PV companies active in the production, trading, installation, and maintenance of PV systems in Greece. More detailed data is expected in the future, as the Hellenic Recycling Agency (HRA), a competent authority in the Ministry of Environment and Energy, is expected to approve one of the existing PROs' request to include PV panels in their scope.

Calculations made using Eurostat's Renewable Energy Statistics (Figure 22) show that Greece's market for PV panels has not permeated the EEE sector in a relevant way. The calculation of the EEE POM collection target between 2015 and 2017 shows that PV panels contributed to a mere 0.17% of the total EEE POM, with only 0.02 kg/inh of PV panels POM. In 2018, the share of the sector showed an increase to 0.27 kg/inh of PV panels POM, which, nonetheless, is still considerably below the European average of 0.79 kg/inh. These figures illustrate that the effect of this sector on the overall collection rate achieved by the country at this stage can be considered minor.

As for the open scope, the new products added into the scope of the WEEE regulation in Greece beginning August 2018 include large, fixed installations; large, fixed tools; PV panels; and domestic luminaries. Allocation of these new products to the various categories has been made according to the function performed by the appliances.

Coverage of the WEEE collection data

The reporting system covers all categories of WEEE (I-VI) managed by the formal sector, excluding only PV panels, as they are not in the scope of the PROs. Data is communicated by collectors and transporters to the respective PROs, then to the Hellenic Recycling Agency.

PROs in Greece estimate that approximately 70% of the total amount of WEEE is collected by scrap dealers affiliated with the formal sector. However, there are likely some unreported quantities that are not delivered by the aforementioned scrap dealers or which are collected by other scrap dealers who are not cooperating with the PROs.

In 2017, B2B collection represented only 2% (0.11 kg/inh) of the total WEEE collected, which is considerably below the European average of 10% of the total amount of WEEE collected. Specifically, the collection by B2B channels is only reported for large household appliances (3% or 0.09 kg/inh) and lighting equipment (8% or 0.01 kg/inh).

The WEEE collected can be categorized by different sources: municipalities (1.53%), retailers (22.13%), scrap dealers (69.28%), and other companies (7%), which can belong both to the public and private sectors. WEEE imported from abroad and collected (i.e. from Cyprus) are not included in PRO-reported data.

WEEE Generated

The EEE POM resulting from the consumption methodology, which has been used as the basis for the WEEE Generated methodology, averages 16% higher than the EEE POM data reported to Eurostat. It needs further analysis to investigate the differences.

WEEE Directive Implementation

PROs are responsible for the collection of WEEE in Greece according to an 'all actors' approach, which is based on the respective share on EEE POM. In addition, fines and penalties between 10,000 € to 5,000,000 € are applied to PROs who do not meet the target.

Mandatory handover, as described in the WEEE Directive, was successfully implemented in the country, and it has been recognised by PROs as a useful tool for positively influencing the WEEE collection rate.

Greece does not yet use substantiated estimates for reporting official data, and neither a visible fee nor a clearing house have yet been adopted.

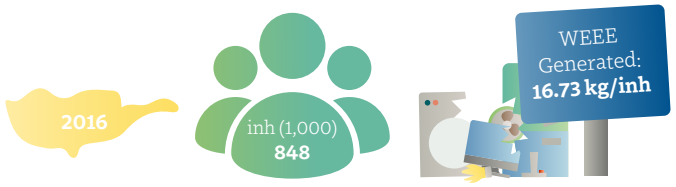
According to the PRO, the key factors hindering the increase of the country's collection rate are the absence of measures and penalties for dealing with the illegal sector and the very poor participation of local authorities and municipalities in establishing networks and infrastructures for managing WEEE collection. In fact, only 1.5% of the total WEEE collection is performed by municipalities.

Key Statistics

Greece

Indicator	Year	Value
Inhabitants (1,000)	2018	10,736
Sum of EEE POM apparent consumption method* (kt)	2008-2017	1,737
Sum of EEE POM Eurostat* (kt)	2008-2017	1,544
EEE POM Eurostat (kg/inh)	2017	12.4
WEEE Generated (kg/inh)	2018	16.88
WEEE Collection Eurostat (kg/inh)	2017	5.18
WEEE Collection Key Figures (kg/inh)	2018	5.41
Collection rate in % (compared to EEE POM for the three preceding years)	2018	45%
Collection rate in % (compared to WEEE Generated)	2018	32%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.



7.12 Cyprus

Overview

The collection of WEEE in Cyprus declined from 3.5 kg/inh in 2015 to 2.9 kg/inh in 2016, equating to a collection rate in 2016 of 26%, which is three percentage points lower than in 2015. Cyprus has one of the lowest collection rates in Europe.

As result of the economic recession that began in early 2010, the WEEE Generated methodology for Cyprus is flawed, so, with the current data, it is not a good reference for target-setting. The share of PV panels in the country's EEE POM is substantially above the European average and contributes to 0.8 kg/inh for the EEE POM target in 2018. The presence of street pickers and informal collectors that export WEEE or treat it as metal scrap is considered to be a major cause for the large volume loss of WEEE in Cyprus. Another reason for Cyprus's low collection rate, according to the PRO, is the lack of governmental implementation and enforcing measures, such as specific penalties and inspections.

Figure 23 illustrates the WEEE flows, EEE POM, and WEEE Generated targets in Cyprus for 2018.

Figure 23
WEEE flows, EEE POM, and WEEE Generated targets in Cyprus

Analysis of key factors affecting collection targets

Target methodology

The methodology used in Cyprus for defining the collection target is 65% on EEE POM over the three preceding years. According to the PRO, Cyprus's target is set to 4 kg/inh in 2019. Because of the economic recession, Cyprus's EEE POM decreased from 23 kg/inh in 2010 to 11 kg/inh in 2013 (WEEE clarification requests – Eurostat 2019). Nonetheless, the WEEE Generated is still high as result of the presence of historic POM in the country, which makes the current WEEE Generated data unrealistic for target setting in Cyprus.

Other WEEE flows

The presence of informal collectors that export WEEE is considered a major cause of the large volume loss of WEEE inside the country for the compliant systems. Actors involved in other WEEE flows in Cyprus are scrap dealers and scavengers. In most cases, WEEE that is informally collected is illegally dismantled by metal scrap collectors as a way of obtaining their metallic parts and is further sold to metal scrap dealers or car shredders. Scavengers and street pickers disassemble and sell valuable WEEE parts to the scrap metal dealers.

Cyprus's WEEE flows have been quantified using information from the ProSUM project, and it was estimated that 0.5 kg/inh of WEEE was still found in mixed metal scraps and that 1.3 kg/inh of WEEE were disposed of in waste bins. Additionally, 11.9 kg/inh of WEEE have an unknown fate.

Moreover, collection of waste products such as tools, lamps, toys, medical devices, and automated dispensers are almost absent in Cyprus's collection system, as they do not end up in the PRO collection network, retail shops, or municipal collection points. This is because small appliances, due to their small size, are generally discarded with mixed municipal waste and can easily be subsequently stolen by street pickers.

Controls on the exports of used-EEE are not conducted in Cyprus. The presence of used-EEE shops that manage small volumes of equipment are expanding in the country. Additionally, Cyprus shops offer take-back, and the majority (80%) are cooperating with PROs. Unfortunately, official indications on the quantities of reused-EEE are not available.

PV Panels and open scope

The share of PV panels in Cyprus's total EEE POM is significant and registered a relevant increase from 2016 (0.6 kg/inh) to 2017 (2.0 kg/inh), whereas the European average for 2016 is considerably lower, at 0.79 kg/inh POM. In 2018, the sector of PV panels in Cyprus contributed 0.8 kg/inh to the EEE POM target (9%). This substantial amount has not yet become part of the WEEE stream, due to its long lifespan.
Cyprus has not yet implemented the open scope, as the compliance scheme active on the territory is still operating with the 2008 license. Ink cartridges and PV Panels are among the new products expected to be added in the WEEE regulation's new scope in upcoming licenses.

Coverage of the WEEE collection data

WEEE officially collected is reported in the 10 categories as defined in the WEEE Directive [4]. It has been estimated by WEEE CYPRUS LTD that 27% of WEEE collected is collected by retailers, 5% is officially collected by recycling centres, and 68% is collected by scrap dealers. From 2010 to 2015, it was estimated that 2% of all WEEE collected was linked to B2B channels as opposed to private households. Unfortunately, the reportage of WEEE collected from B2B for 2016-2017 was not available at the time of this writing.

WEEE Generated

The EEE POM using the apparent consumption methodology (which served as the basis for the WEEE Generated methodology) averaged 28% higher than the EEE POM data reported to Eurostat. It needs further analysis to investigate the differences.

WEEE Directive Implementation

Cyprus does not use substantiated estimates to report WEEE collected from unofficial flows to the European Commission. Nonetheless, until 2019, Cyprus's PRO was allowed to account for second-hand reuse to demonstrate collection performance, but this is no longer allowed, since the final cost was much higher than the one of normal recycling.

The collection responsibility in Cyprus has been allocated exclusively to PROs, though there is only one PRO active in the country. Additionally, there are 15-20 companies licensed to collect and 3-5 companies licensed to recycle that are not in contract with PROs, so large quantities of WEEE are not likely to end up in the

collective system, especially for large household appliances and air-conditioning units. WEEE CYPRUS LTD has estimated that this flow could represent approximately 35-40% of the total amount of WEEE.

The 'all actors' approach has been implemented in Cyprus since the Directive was transposed into national legislation. As a result, all actors involved in the WEEE management chain must report directly to Cyprus's Department of the Environment.

Cyprus introduced a visible fee only for B2B collection, whereas other tools of the Directive, such as mandatory handover of WEEE and clearing houses, have not yet been implemented.

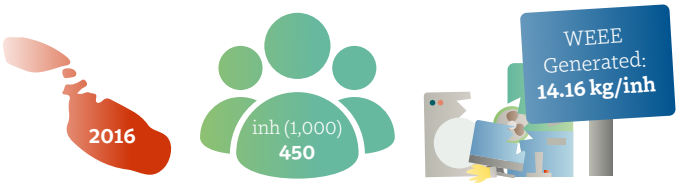
According to the PRO, main obstacles in increasing WEEE collection in Cyprus include the lack of government enforcement with regard to terms of penalties, specific policies, and inspections.

Key Statistics

Cyprus

Indicator	Year	Value
Inhabitants (1,000)	2016	848
Sum of EEE POM apparent consumption method* (kt)	2008-2016	134
Sum of EEE POM Eurostat* (kt)	2008-2016	123
EEE POM Eurostat (kg/inh)	2016	12.61
WEEE Generated (kg/inh)	2016	16.73
WEEE Collection Eurostat (kg/inh)	2016	2.9
WEEE Collection Key Figures (kg/inh)	-	-
Collection rate in % (compared to EEE POM for the three preceding years)	2016	26%
Collection rate in % (compared to WEEE Generated)	2016	17%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.



7.13 Malta

Overview

Malta's collection rate of WEEE Generated decreased by four per cent from 2015 to 2016, from 31.2% to 27%. As well, the amount of WEEE collected per inhabitant decreased from 4.46 kg/inh in 2015 to 3.85 kg/inh in 2016. With regard to the 65% POM target, Malta has the lowest collection rate in Europe (12% in 2016), and it is short of the target by 17.8 kg/inh.

Many factors are inhibiting Malta from achieving a higher collection rate. The absence of a state-of-the-art WEEE collection infrastructure, strong presence of metal scrap collectors that compete with WEEE collection, and lack of strong competition between the formal and informal sector limit efficiency of WEEE collection in Malta. Measures such as the visible fee, mere partial implementation of mandatory handover, and the lack of enforcement from the government are absent, among other factors.

Figure 24 illustrates the various flows of WEEE in Malta, as well as the influence of PV panels with regard to the EEE POM collection target and WEEE Generated target.

Figure 24
WEEE flows, EEE POM, and WEEE Generated targets in Malta

Analysis of key factors affecting collection targets

Target methodology

Malta currently uses the EEE POM methodology to calculate its collection target, based on information provided by producers or by their authorised representatives, under the Directive 2012/19/EU. The collection target for 2019 was set to 55% of EEE POM of the three previous years, which equates to 13.86 kg/inh.

Other WEEE flows

The lack of enforcement measures, the presence of metal scrap dealers, and competition between the formal and informal sectors are key drivers for WEEE volumes to follow unofficial flows in Malta. The informal collectors and metal scrap dealers manage a significant amount of WEEE, especially products such as washing machines, fridges, and IT equipment. This is mainly because other WEEE flows, often non-compliant systems, are low-cost to manage and more economically convenient, so actors (i.e. metals scrap dealers) offer financial incentives to unregulated collectors. The aforementioned process creates competition between the formal and informal sectors; as result, it becomes challenging for PROs to reach their collection targets.

The WEEE flows for 2018 show that 1 kg/inh of WEEE is still with mixed metal scrap dealers, and bad consumer habits indicate that 1.3 kg/inh of WEEE is disposed of in waste bins. As well, the majority of WEEE flows (8.1 kg/inh) have an unknown fate and could not be quantified.

There are different types of informal actors in Malta, which vary from kerbside collectors to service technicians who install new products (i.e. air-conditioning units) and trade the old units or valuable parts to metal scrap dealers. Scavenging practices in collection points is also an issue, as scavengers remove selected components (for example refrigerator compressors) from products and export them to countries within or outside of Europe.

Reuse of EEE in Malta is mainly realized in the presence of used-EEE shops and is still unregulated in terms of documentation, though reuse does not involve significant quantities, according to PROs. There are also shops offering take-back, and they are usually members of the PRO (WEEE Malta) and hand the material over to the formal system.

PV Panels and open scope

The amount of PV panels that were POM from 2016 to 2018 equates to 2.66 kg/inh. The share of PV panels in 2016 resulted in 10% of the total EEE POM, which is considerably above the European average (5%). As such, PV panels can be evaluated as a key factor in achieving the 65% POM collection target for Malta. Indeed, the influence of PV panels on the overall potential collection for 2018 was equivalent to 10%, or 2.64 kg/inh, of EEE POM.

Specific information on products that have been added to the country's reporting system as result of the open scope could not be retrieved.

Coverage of the WEEE collection data

Malta distinguishes only between WEEE directly collected by official PROs and WEEE collected from publicly owned collection sites. Additionally, all figures concerning WEEE officially collected are totalled and reported, as defined in the WEEE Directive (2002/96/EC).

From 2010 to 2015, WEEE collected from sources other than private households average 19% of the total amount, which is significantly above the European average of 10%. However, figures of WEEE collected by B2B and officially reported have not been produced since 2016. If the flow was not quantified for 2016, it reduced the amount of WEEE collected by 0.73 kg/inh.

WEEE Generated methodology

The EEE POM from the apparent consumption methodology that was used as the basis for the WEEE Generated calculation. For 2009-2019 the EEE POM from the apparent consumption methodology was 80% lower than the EEE POM data reported to Eurostat. This difference requires further investigation. The Competent Authority in Malta is currently conducting a study on EEE lifespans to determine the country's total WEEE Generated. The results of this study are expected to be available in autumn 2020.

WEEE Directive Implementation

Given that Malta is an island that lacks state-of-the-art treatment facilities, a large portion of hazardous waste is exported to other Member States, according to (and monitored by) the regulation of the Environment and Resources Authority. Based on implementation of the Council Regulation (EC) No. 1013/2006 of the European Parliament and of the Council of 14 June 2006 on waste shipments, Malta is allowed to export waste for disposal only to EU Member States. With regard to exporting for recovery purposes, shipment of hazardous waste is permitted only to EU and OECD countries [81]. According to the competent authority, 312 waste shipments were carried out between 2016 and 2018 and involved primarily mercury-containing waste (European Waste Code [EWC] 20 01 21) and discarded equipment containing chlorofluorocarbons (EWC 20 01 23) [82].

There are two PROs that manage all WEEE categories in Malta. They are competing mostly for seeking producers as opposed to accessing collection points or for WEEE. According to the national regulation, PROs have the responsibility of ensuring that final holders can return the WEEE free of charge and that distributors can guarantee return of the waste on a one-to-one basis when supplying new and equivalent used products. PROs must also provide financial support for the collection, treatment, and environmentally sound disposal of WEEE left at collection facilities that are operated either by local councils or other local agencies. The competent authority applied fines to the PROs for not reaching the collection targets of 42% in 2016 and 45% in 2017.

Neither a clearing house nor a visible fee among the PROs have yet been implemented in Malta, both of which are factors that may contribute to the country's low collection rate. Some of the clearing house's functions are conducted by the Environment and Resources Authority, through a monthly meeting with stakeholders for allocating the WEEE deposited at civic amenity (CA) sites according to the PROs' market ratios.

Mandatory handover to PROs has been partially implemented, but it only involves WEEE disposed of in public collection points that are managed by the National Waste Agency, meaning that the rest of WEEE is not subjected to mandatory handover.

Malta does not use substantiated estimates to report WEEE collected, but PROs intend to consider the possible solution for future years.

The estimated collection rate for 2018 is 24% (provisional data from WEEE Malta), which is expected to increase in the years to come as result of a one-to-one outreach program that has been started with the island's main importers. This outreach program supports awareness of the importance of take-back systems and of keeping products and materials within official and authorised loops to promote sustainability and circularity resources.

Key Statistics

Malta

Indicator	Year	Value
Inhabitants (1,000)	2016	450
Sum of EEE POM apparent consumption method* (kt)	2008-2016	67
Sum of EEE POM Eurostat* (kt)	2008-2016	124
EEE POM Eurostat (kg/inh)	2016	31.23
WEEE Generated (kg/inh)	2016	14.16
WEEE Collection Eurostat (kg/inh)	2016	3.85
WEEE Collection Key Figures (kg/inh)	-	-
Collection rate in % (compared to EEE POM for the three preceding years)	2016	12%
Collection rate in % (compared to WEEE Generated)	2016	27%

* Excluding UNU-KEY 0001 and UNU-KEY 0002.

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Annex 1.
Correlation tables

UNU Keys, EU (WEEE Directive) categories

UNU	Full name	EU-6	EU-6PV	EU-10
0001	Central Heating (household installed)	4	4a	1
0002	Photovoltaic Panels (incl. inverters)	4	4b	4
0101	Professional Heating & Ventilation (excl. cooling equipment)	4	4a	1
0102	Dishwashers	4	4a	1
0103	Kitchen equipment (e.g. large furnaces, ovens, cooking equipment)	4	4a	1
0104	Washing Machines (incl. combined dryers)	4	4a	1
0105	Dryers (wash dryers, centrifuges)	4	4a	1
0106	Household Heating & Ventilation (e.g. hoods, ventilators, space heaters)	4	4a	1
0108	Fridges (incl. combi-fridges)	1	1	1
0109	Freezers	1	1	1
0111	Air Conditioners (household installed and portable)	1	1	1
0112	Other Cooling equipment (e.g. dehumidifiers, heat pump dryers)	1	1	1

UNU	Full name	EU-6	EU-6PV	EU-10
0113	Professional Cooling equipment (e.g. large air conditioners, cooling displays)	1	1	1
0114	Microwaves (incl. combined, excl. grills)	5	5	1
0201	Other small household equipment (e.g. small ventilators, irons, clocks, adapters)	5	5	2
0202	Equipment for food preparation (e.g. toaster, grills, food processing, frying pans)	5	5	2
0203	Small household equipment for hot water preparation (e.g. coffee, tea, water cookers)	5	5	2
0204	Vacuum Cleaners (excl. professional)	5	5	2
0205	Personal Care equipment(e.g. tooth brushes, hair dryers, razors)	5	5	2
0301	Small IT equipment (e.g. routers, mice, keyboards, external drives & accessories)	6	6	3
0302	Desktop PCs (excl. monitors, accessoires)	6	6	3
0303	Laptops (incl. tablets)	2	2	3
0304	Printers (e.g. scanners, multi functionals, faxes)	6	6	3

UNU	Full name	EU-6	EU-6PV	EU-10
0305	Telecommunication equipment (e.g. (cordless) phones, an-swering machines)	6	6	3
0306	Mobile Phones (incl. smartphones, pagers)	6	6	3
0307	Professional IT equipment (e.g. servers, routers, data stor-age, copiers)	4	4a	3
0308	Cathode Ray Tube Monitors	2	2	3
0309	Flat Display Panel Monitors (LCD, LED)	2	2	3
0401	Small Consumer Electronics (e.g. headphones, remote controls)	5	5	4
0402	Portable Audio & Video (e.g. MP3, e-readers, car navigation)	5	5	4
0403	Music Instruments, Radio, Hi-Fi (incl. audio sets)	5	5	4
0404	Video (e.g. Video recorders, DVD, Blue Ray, set-top box-es) and projectors	5	5	4
0405	Speakers	5	5	4
0406	Cameras (e.g. camcorders, photo & digital still cameras)	5	5	4
0407	Cathode Ray Tube TVs	2	2	4
0408	Flat Display Panel TVs (LCD, LED, Plasma)	2	2	4
0501	Small lighting equipment (excl. LED & incandescent)	3	3	5
0502	Compact Fluorescent Lamps (incl. retrofit & non-retrofit)	3	3	5
0503	Straight Tube Fluorescent Lamps	3	3	5
0504	Special Lamps (e.g. professional mercury, high & low pres-sure sodium)	3	3	5

UNU	Full name	EU-6	EU-6PV	EU-10
0505	LED Lamps (incl. retrofit LED lamps)	3	3	5
0506	Household Luminaires (incl. household incandescent fit-tings & household LED luminaires)	5	5	5
0507	Professional Luminaires (offices, public space, industry)	5	5	5
0601	Household Tools (e.g. drills, saws, high pressure cleaners, lawn mowers)	5	5	6
0602	Professional Tools (e.g. for welding, soldering, milling)	4	4a	6
0701	Toys (e.g. car racing sets, electric trains, music toys, biking computers, drones)	5	5	7
0702	Game Consoles	6	6	7
0703	Leisure equipment (e.g. sports equipment, electric bikes, juke boxes)	4	4a	7
0801	Household Medical equipment (e.g. thermometers, blood pressure meters)	5	5	8
0802	Professional Medical equipment (e.g. hospital, dentist, diag-nostics)	4	4a	8
0901	Household Monitoring & Control equipment (alarm, heat, smoke, excl. screens)	5	5	9
0902	Professional Monitoring & Control equip-ment (e.g. labora-tory, control panels)	4	4a	9
1001	Non- cooled Dispensers (e.g. for vending, hot drinks, tick-ets, money)	4	4a	10
1002	Cooled Dispensers (e.g. for vending, cold drinks)	1	1	10

10 Categories in WEEE Directive	Description
1	Large household appliances
2	Small household appliances
3	IT and telecom equipment
4	Consumer equipment
5	Lighting equipment
6	Electrical and electronic tools
7	Toys, leisure, and sports equipment
8	Medical equipment
9	Monitoring and control instruments
10	Automatic dispensers

6 Categories in WEEE Directive[15]	Description
1	Temperature exchange equipment (TEE)
2	Screens and monitors
3	Lamps
4	Large equipment
5	Small equipment
6	Small IT

[15] European Commission (2018). Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE). https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32012L0019 (accessed January 2020).

Annex 2.
Mathematical description of WEEE Generated

The mathematical description of WEEE Generated is described in the common methodology Implementing Regulation (EU) 2017/699 and is a function of the lifespans and EEE POM of the previous years. As such, WEEE Generated *(n)* is the quantity of WEEE Generated in evolution year *n*, *POM (t)* is the product sales (POM) in any historical years *t* prior to year *n*; t_0 is the initial year that a product was sold; L *(p)* and (t, n) is the discard-based, lifetime profile for the batch of products sold in historical year *t*.

[1]

$$\text{WEEE Generated (n)} = \sum_{t=t_0}^{n} \text{POM (t)} * L^{(p)}(t, n)$$

The lifespan, *L(p) (t, n)*, is the lifespan profile of an EEE sold in year *t*, which reflects its probable obsolescence rate in evaluation year *n*. The discarded-based lifespan profile for a product could be modelled using several probability functions. The Weibull distribution function is considered most suitable for describing discard behaviour for EEE and has been applied in the European Union and in scientific literature [83], [84].

Due to social and technical developments, a product's lifespan could be time-dependent. For instance, the Cathode Ray Tube Monitor became outdated rapidly, due to the technological developments of flat-screen monitors. In that case, lifespan distributions should ideally be modelled for each historical sales year. The Weibull function is defined by a time-varying shape parameter *(t)* and *(t)* a scale parameter as described in Eq. [2]:

[2]

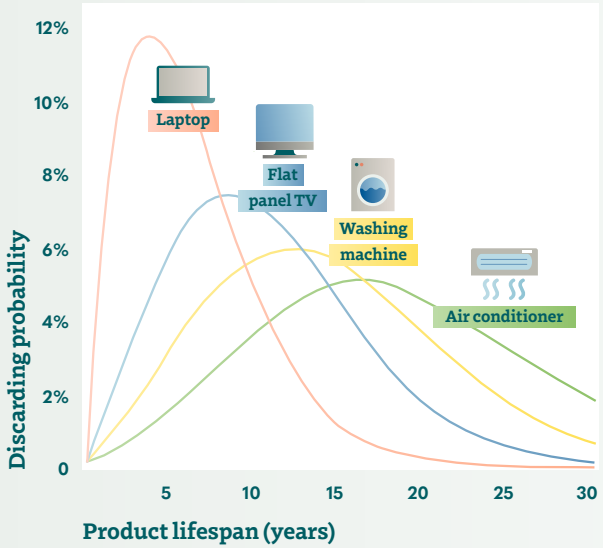
$$L^{(p)}(t, n) = \frac{\alpha(t)}{\beta(t)^{\alpha(t)}} (n - t)^{\alpha(t)-1} e^{-[(n-t)/\beta(t)]^{\alpha(t)}}$$

For other, more stable products, time-independent lifespan sufficiently describe actual behaviour. In those cases, the variations of the shape and scale parameter over time are minor, and variations can be disregarded. The distribution of product lifespans can then be simplified as follows in Eq. [3]:

[3]

$$L^{(p)}(t, n) = \frac{\alpha}{\beta^{\alpha}} (n - t)^{\alpha-1} e^{-[(n-t)/\beta]^{\alpha}}$$

Figure 25
Example of product lifespans in years



Annex 3.
WEEE Collection, EEE POM, and WEEE Generated data per country

Country	ISO code	Year	WEEE collected (kg/inh)	WEEE Generated (kg/inh)	Average EEE POM of three preceding years (kg/inh)
Austria	AUT	2018	13.10	18.94	22.73
Belgium	BEL	2018	10.29	20.41	23.34
Bulgaria	BGR	2017	7.73	11.05	9.73
Croatia	HRV	2017	8.83	11.25	10.83
Cyprus	CYP	2016	2.90	16.73	11.06
Czechia	CZE	2017	8.63	15.20	16.87
Denmark	DNK	2017	12.14	22.66	27.01
Estonia	EST	2018	7.59	12.82	12.09
Finland	FIN	2017	11.89	19.38	22.22
France	FRA	2018	11.90	20.18	26.42
Germany	DEU	2018	8.49*	19.50	23.87
Great Britain	GBR	2017	13.19	23.32	26.14
Greece	GRC	2018	5.41	16.88	12.11

* For the calculation of the WEEE Generated Target, WEEE Collected from 2017 has been used (DEU 10.13 kg/inh, IRL 10.84 kg/inh)

Country	ISO code	Year	WEEE collected (kg/inh)	WEEE Generated (kg/inh)	Average EEE POM of three preceding years (kg/inh)
Hungary	HUN	2017	6.45	12.68	10.64
Iceland	ISL	2018	14.08	21.62	31.59
Ireland	IRL	2018	9.66*	18.43	19.82
Italy	ITA	2017	6.30	17.78	15.11
Latvia	LVA	2017	4.79	10.38	9.61
Lithuania	LTU	2017	4.71	11.74	11.17
Luxembourg	LUX	2018	10.07	18.90	20.13
Malta	MLT	2016	3.85	14.16	33.28
Netherlands	NLD	2018	10.76	21.43	21.95
Norway	NOR	2017	18.68	25.77	34.18
Poland	POL	2018	8.68	11.21	15.07
Portugal	PRT	2018	6.58**	16.45	12.62
Romania	ROU	2016	2.36	10.27	7.50
Slovakia	SVK	2017	5.49	12.19	10.54
Slovenia	SVN	2018	6.49**	14.84	15.30
Spain	ESP	2018	5.76**	18.98	12.84
Sweden	SWE	2017	13.97	19.99	24.83
Switzerland	CHE	2018	15.58	23.38	22.77

* For the calculation of the WEEE Generated Target, WEEE Collected from 2017 has been used (DEU 10.13 kg/inh, IRL 10.84 kg/inh)
** For the calculation of the EEE POM Target, WEEE Collected from 2017 has been used (ESP 6.19 kg/inh, PRT 6.80 kg/inh, SVN 6.12 kg/inh)

In-depth review of the WEEE Collection Rates and Targets
in the EU-28, Norway, Switzerland, and Iceland

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United Nations Institute for Training and Research (UNITAR) –
co-hosting the SCYCLE Programme

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