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Project: [21115] – [WEEE-NET9]

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Acronyms

Art.	Article
EEE	Electrical and Electronic Equipment
EC	European Commission
EPR	Extended Producer Responsibility
EU	European Union
MS	Member States
POM	Put on the market
PRO	Producers Responsibility Organisation
RIS	Regional Innovation Scheme
TEE	Temperature Exchange Equipment
UNITAR	United Nations Institute for Training and Research
WG	WEEE Generation
WP	Work Package
WEEE	Waste Electrical and Electronic Equipment

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Executive Summary

This report provides an overview of the Waste Electrical and Electronic Equipment (WEEE) management market and value chain specificities on Regional Innovation Scheme (RIS) partnership countries in the scope of the WEEE-Net9 project (Czech Republic, Greece, Hungary, Poland, Romania and Slovenia), aims to provide the baseline information for the needs and actors in the WEEE recycling sector and to set the ground for a successful technology diffusion and matchmaking activity.

The methodology followed involved desk research and interviews with industry actors to complete missing information and to have a better overview of the national EEE/WEEE systems in place.

The report highlights the major findings, results, and recommendations, which are as follows:

- Stakeholders' participation: The roles and responsibilities of all the actors that have access to WEEE and can impact the collection rates, should be clearly defined and aligned with their competences. A coordination body and discussion roundtable gathering all the actors can facilitate cooperation.
- Environmental awareness: The poor environmental awareness of the population is a common factor behind the low collection rates. National authorities should participate in the awareness raising activities with clear messages on the necessity and importance of separate collection.
- Treatment standards and unfair competition: In most countries, treatment facilities are required to fulfil only minimum treatment standards set in the WEEE regulation, and inspections are rare. This creates unfair competition for certified treatment facilities and favours illegal actors. Mandatory standards or a voluntary incentivised implementation of standards should be adopted and enforced in all countries.
- Producer Responsibility Organizations (PROs): In many countries their roles and obligations are not well defined or controlled. There is a need to harmonise the roles and operations of the PROs, and to create a national coordination body or clearing house to foster cooperation among them.
- Illegal actors: The inadequate control of the illegal WEEE collection and unaccounted WEEE treatment quantities is a major problem in all countries. An extensive inspection plan with targeted inspections and well-trained inspectors could work towards alleviating the situation.
- Reporting: The WEEE reporting system is not providing accurate and reliable data in many countries, due to the failure of compliance, verification, and control of the reporting obligations. Digitalisation and online tools can allow for more transparent and fast reporting.

Eventual shortcomings and limitations should be considered, which are mainly related to the lack of data availability and reliability, the diversity and complexity of the WEEE regulatory frameworks, and the limited scope and representativeness of the survey and interviews.

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1. Introduction

1.1 Aim and scope of Deliverable

Work package (WP) 3 aims to locate opportunities, needs and actors in WEEE recycling value chain in the Regional Innovation Scheme (RIS) partnership countries in scope of the WEEE Net project. This Work Package– among other tasks - analyses the RIS market in WEEE value chain and sets the ground for a successful technology diffusion and matchmaking activity, tasks in other work packages. Furthermore, it plans the involvement of the most relevant stakeholders in the implementation of regulations and their decisive role in the WEEE collection process.

Deliverable 3.2.1 describes and analyses the WEEE recovery markets in the participating countries, with a focus on the existing collection networks and the WEEE technological solutions already implemented in those. The report includes information such as:

- a) sources, volume, and types of WEEE products collected, treated, and recovered officially, as well as WEEE circulation in unauthorised/illegal markets (estimation),
- b) collection systems (e.g., collective, and individual systems based on extended producer responsibility, municipal systems, door-to-door collection),
- c) existing WEEE treatment and recovery infrastructures and their performance,
- d) market distortions, barriers to expand and improve it, and
- e) regulatory considerations pertinent to WEEE recycling.

This deliverable comprises a roadmap on how to maximize the impact of the project, thus provides the directions for further WPs dealing with the capacity building (WP4), the technology transfer and networking (WP5), and the capitalization activities of the project (WP6).

1.2 Approach / Methodology

The main methodology to find information for this deliverable was to map and assess the available data and information sources via desk research. The kind of information required was to be found in European and national statistical reports on EEE and WEEE, country reports on EEE and WEEE systems, national EPR, and waste legislations, national waste management plans, scientific publications on EEE and WEEE flows, reports regarding the implementation of WEEE directive in EU members state countries. Additionally, surveys were prepared with the relevant questions, mainly those addressing information not found during desk research and sent to industry actors. The information provided by the interviewees was taken into consideration to have a better overview of the national EEE/WEEE systems in place.

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Each individual country section has been assigned to the participating task members of the given country, and if there was no representative another project partner carried out the research. The information collected on country level was reviewed by external organisations, mainly stakeholders active in the given country's EEE/WEEE industry.

Interviews were also carried out mainly for Action 3.3.2, in the frameworks of which outstanding questions have been added to the interview to cover topics relevant for the present deliverable.

1.3 General legislative environment

The WEEE environment in all EU countries is governed by the Directive 2012/19/EU (WEEE Directive).

The WEEE Directive aims to contribute to sustainable production and consumption by

- preventing the creation of WEEE as a first priority,
- contributing to the efficient use of resources and the retrieval of secondary raw materials through re-use, recycling, and other forms of recovery, and
- improving the environmental performance of everyone involved in the life cycle of EEE.

In order to achieve these objectives, the Directive:

- requires the separate collection and proper treatment of WEEE and sets targets for their collection as well as for their recovery and recycling,
- helps European countries fight illegal waste exports more effectively by making it harder for exporters to disguise illegal shipments of WEEE,
- reduces the administrative burden by calling for the harmonization of national EEE registers and of the reporting format [1]

The first EU WEEE Directive (Directive 2002/96/EC), which took effect in February 2003, mandated the treatment, recovery, and recycling of electric and electronic equipment. The recast of the WEEE Directive (Directive 2012/19/EU) took effect on February 14, 2014. Previously, WEEE only covered specific equipment. Starting August 15, 2018, the scope of the WEEE widened to include all EEE, which is classified within 6 categories.

WEEE Product Categories

Category 1. Temperature Exchange Equipment (TEE) - includes all EEE equipment that use substances other than water for heating and cooling. This includes refrigerators, air-conditioning equipment, and heat pumps.

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Category 2. Monitors and equipment with large screens - includes monitors, televisions, laptops, tablets, e-book readers with screens greater than 100 cm² and whose primary focus is displaying information. So would NOT include smartphones (too small) or smart fridges with screens (primary use is cooling, not displaying information).

Category 3. Lamp bulbs - includes fluorescent, LED, HID, and LPS lamp bulbs and tubes. Does NOT include luminaires and light fixtures (which are in Categories 4 and 5).

Category 4. Large equipment - includes any EEE not included in Categories 1, 2, or 3 that has at least one external dimension (L, W, H) greater than 50 cm. This typically includes washers, dryers, electric stoves, large medical equipment, photovoltaic panels, large light fixtures, etc.

Category 5. Small equipment - includes any EEE not included in other categories with all external dimensions (L, W, H) less than 50 cm and is not IT equipment (Category 6). This typically includes vacuum cleaners, microwaves, small kitchen appliances, and consumer electronic equipment.

Category 6. Small IT/computer/communications equipment - includes any EEE not included in other categories with all external dimensions (L, W, H) less than 50 cm that is used for IT, computing, or communications. This typically includes smartphones, desktop computers, GPS equipment, printers, routers, and fax machines. [2]

2. Czech Republic

The Czech Republic is dependent on imports for many strategic raw materials and commodities, effective waste and materials management policies are thus important to ensure secondary raw material for its industry. The country has fairly complete policy and legal frameworks, which have been further aligned with EU legislation. There is a dense collection network and variety of possibilities for consumers to give back WEEE. A project of stationary containers in the streets that allows collection of small WEEE received a European Business Award. However, despite progress in recovery and recycling, the Czech Republic's performance in waste management remains modest. There is a lack of coordination between different producers regarding collection targets, undefined roles and responsibilities of PROs regarding their duties as well as effective communication between the PROs and the treatment plants. Furthermore, given that the economy is considerably open, there is little state mediation among competing PROs [3].

Table 1 Summary dashboard of Czech Republic

Description	
Population of country (2021)	10 494 800 [4]
Surface of country	78 871 km ²
Extended Producers Responsibility (EPR)	Act No. 542/2020 Coll.
National standards	Mandatory CENELEC 50625 standards in force from 01/07/2023
E-waste collection target	65% (No. 184/2014 Coll) since 2021
Unreported flows [5] <i>data for Eastern Europe except where stated otherwise</i>	Waste bin: 1.2 ± 0.6 kg/inh
	Illegal WEEE Export in EU28: 0.5-1.4 kg/inh
	Metal scrap: 1.7 ± 1.0 kg/inh
	Informal recycling: no info.
	Unknown: no info.
Environmentally Sound e-waste management system in place	13 recycling companies with 18 plants [6] 15 PROs [7]
E-waste collection	Latest data (2020) 57% [8] as the percentage of POM average of the last 3 years

2.1 General legislative environment

E-waste Legislation-legal framework

According to community standards, all EU countries must adhere to the stipulations of the WEEE Directive. In the Czech Republic from January 1, 2021, Act No. 542/2020 Coll., on end-of-life products, is effective, which also regulates the area of take-back of electrical equipment. Reporting obligations for 2020 were still governed by the previous legislation, i.e. Act No. 185/2001 Coll., on waste and Decree No. 352/2005 Coll., on the details of handling electrical equipment and electrical waste.

- From 1/1/2021, or 1 February 2022, is the issue of handling waste electrical equipment legislatively regulated by the following legal regulations:
- Act No. 542/2020 Coll., on end-of-life products (hereinafter referred to as the "End-of-Life Act"),
- Decree No. 16/2022 Coll., on the details of handling certain products end of life [9]

Extended Producer Responsibility system

The Chamber of Deputies in the Czech Republic revised the extended producer responsibility (EPR) waste legislation and approved a new Act No. 542/2020 On End-of-Life Products, which repeals Act No. 185 of 14 June 2001 on Waste. The EPR provisions apply to EEE, batteries and vehicles. This system establishes a mandatory visible fee for all WEEE. In particular from 1st January 2021, the producer, the distributor and last seller (retailer) of any WEEE – including non-household EEE – must state the costs of takeback, processing, use and disposal of WEEE per unit or per kg of WEEE on a separate line before VAT on the tax document (invoice). Each collective scheme determines how visible fees are used.

Section 13 of the Decree No. 352/2005 Coll. paragraph 1 and 2:

Producers supplying electrical and electronic equipment by means of distance communication have the same obligations as other producers of electrical and electronic equipment. Internet retailers not established in the Czech Republic but who are selling EEE to the Czech Republic are required to appoint an authorised representative in the country. An authorised representative then carries out the obligations of those producers. Foreign online retailers who are not established in the Czech Republic shall fulfil their obligations through authorized representatives within a collective scheme [10].

There are also companies who fulfil their obligations individually, according to the Ministry of Environment in 2020 there were 45 such organisations.

Certification Schemes & National standards

The Czech Republic recently implemented the legal obligation to certify all WEEE Treatment facilities against CENELEC standards EN 50625. Based on Decree No. 16/2022 Coll., entering into force from 1/7/2023, the

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treatment operator has the legal obligation to ensure the verification of the fulfilment of the obligation to disassemble, store and treat WEEE in accordance with the technical requirements and selected technical standards of the Office for Technical Standardization, Metrology and Testing by a professionally qualified third party, which holds an accreditation issued by the Czech Accreditation Institute in accordance with the technical standards set by the Ministry's decree, and upon request submit a written report to the Ministry on this verification.

The WEEELABEX certification scheme, an accredited certification body, is based in the Czech Republic. WEEELABEX stands for 'Waste Electrical and Electronic Equipment LABEL of EXcellence'. It certifies auditors and treatment operators upon standards for the collection, storage, transport, processing (treatment), recycling and reuse of appliances (equipment). The organisation is an international non-profit legal entity, that qualifies auditors according to the WEEELABEX scheme and CENELEC standards and promotes the adoption of these standards by operators and member states to improve WEEE management practices in Europe.

In Act No 185/2001 Coll. On Waste, as amended, Section 37(i) imposes an obligation to facilitate dismantling, in particular for reuse and recycling of WEEE, its components and materials, in accordance with the protection of the environment and public health as one of the obligations on producers of EEE. In addition, a government bill (No 213, dated 14.5.2007) amended Act No 406/2000 Coll. on energy efficiency, based on Directive 2005/32/EC. The text of the bill contains paragraphs defining terms such as "environmental aspect", "product design" and "eco-design".

Financing mechanisms

Producers are fully responsible for all obligations related to take-back, transportation, recovery preparation & recovery, re-use, recycling and disposal.

1. If EEE is placed on the market after 13 August 2005, the producer of it shall finance the take-back, treatment, recovery and disposal of EEE collected from private households.
2. Before placing EEE on the market, the producer shall be obliged to provide a guarantee showing that the management of all WEEE will have financial support. This guarantee must be sufficient to cover the financing of the take-back, treatment, recovery and disposal of WEEE collected from private households.

Financing the Management of WEEE (B2B):

Producers of electrical equipment shall ensure the financing of the separate collection, treatment, recovery and disposal of electrical waste as follows:

- a) If the electrical equipment is placed on the market after 13 August 2005, the producers shall finance it themselves,

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- b) If the electrical equipment was placed on the market prior to 13 August 2005 and if it is replaced with products of the same type or products that perform the same function, financing shall be provided by the producer of such new product at the time it is supplied, but only up to the number of pieces of electrical equipment supplied,
- c) If the electrical equipment was placed on the market prior to 13 August 2005, but is not being replaced by products of the same type or products which perform the same function, financing shall be provided by the end-users who are not consumers.

Though the Czech Republic reported [10] that several operational programmes focusing on research and development for innovation (within the area of recovery, recycling and treatment of WEEE) had been approved and announced in line with the aims of the National Strategy Frame for the years 2007–2013, industry actors indicated that only producers invest in the infrastructure via PROs: Collecting network, collecting, containers, processing of WEEE, Promoting of WEEE and public awareness campaigns and collecting events.

National e-waste collection target

According to the WEEE Directive, member states are ought to be targeting the collection of 65% of the average of the three previous years put on the market amount or the 85% of the WEEE generated. The obligation to reach the 65% collection target entered into force from 2019 however according to the derogation set out in article 7 point 3 of the WEEE Directive some member states could postpone the achievement of the target until 2020. The Czech Republic was one of the countries that asked for a derogation, meaning the 65% target came into effect only from 2021.

In 2020 the Czech Republic was supposed reach the 13.7 kg/inhabitant of WEEE collected. The obligation to reach the collection target lies with the state, it has not been pushed onto other actors of the market.

Collection scheme (Take-Back)

Final holders and distributors of EEE consisting of products ordinarily used in households can return it free of charge to take-back points regardless of the age (when placed on the market) of the discarded EEE, and when buying new EEE they may use so called "one-to-one" exchange at the final seller. (see Article 37k(4) of Act No 185/2001 Coll.) i.e. handing in free of charge at the place of sale an item of EEE of the same type as a newly purchased product, on a "one to one" basis, for B2C-H- (Historical electric devices for private households) and B2B (business to business) transactions alike.

Collection of WEEE placed on the market later than 13 August 2005 is always free of charge. Only in the case of non-domestic (B2B) EEE produced before 13 August 2005 and not replaced by other products does a final non-consumer user incur a charge for the recovery and disposal of WEEE. Such WEEE is dealt with on a B2B basis. Operators of collective systems collect EEE from consumers, in some cases using take-back points such as municipality waste collection yards and municipality mobile pick-ups, but there are also collection points

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at offices. In smaller towns, established mobile hazardous waste collection systems are also used for take-back of EEE. There are web-tools developed to find the closest WEEE collection point.

2.2 National e-waste statistics

Table 2 Czech EEE/WEEE flows in 2020

Flow description [11]	2020
EEE products placed on the market	263 202 tons [8]
Production	1,4bn in US dollars
Imports	3,736bn in US dollars
Exports	3,737bn in US dollars
WEEE Generation	175.289 tones
WEEE Collected	118 316 tons [8]

In the table below WEEE flows for the previous years can be seen.

Table 3 Czech EEE/WEEE flows between 2015-2018 [8]

Flow description/Time	2015	2016	2017	2018
Products put on the market	182,025	187,487	203,572	196,918
WEEE collected	74,288	107,081	106,656	93,083
WEEE treatment	68,099	105,537	101,500	88,135
Recovery	62,693	97,961	95,011	80,882
Recycling and preparing for reuse	61,313	96,355	92,704	78,838

Market distortions, barriers to entry

Overall, Czech Republic has an open market with no significant barriers to entry. With regards to the purchase decisions, low prices are still often more important to consumers than ecologically sound design.

[10] When it comes to the EPR system, inefficient competition mediation among PROs has been observed [12].

There are also issues related to the distribution of WEEE among operators. Some collective schemes have established their own processing facilities, therefore limited the supply of WEEE to other existing facilities (many of these entities had to terminate their activity or they had to significantly reduce their activities) [10]

The Eunomia report evaluating the implementation of the Directive in the country [10] stated the difficulty to trace the total waste stream of WEEE generated until its actual use as a feedstock in other manufacturing processes is known.

There is still lack of consumer awareness. Despite the fact that manufacturers have to inform end-users about take-back systems, the Waste Act does not include provisions regarding

the methods and frequency of information campaigns. Some of collective schemes focus

on ‘showcasing’ and organise major information campaigns. Other collective schemes

organise smaller campaigns or have no campaigns at all [10]. Campaigns tend to be local and focused because PROs large national media campaigns may be very costly [12].

2.3 E-waste management

E-waste sources, volume, and types of WEEE products collected, treated, and recovered officially

In 2020 the Czech Republic collected 118 316 tons of WEEE. With this amount the country has reached 56% collection rate according to the 65% POM method, meaning they collected a little bit more than two-thirds of the average amount of EEE put on the market in the three previous years. In comparison to the 12.9 kg/inhabitant target, 56% shows a 11.1 kg/inhabitant collection, leaving 1.8 kg/inhabitant as a distance to target [13]. In the table below the exact collection amounts per categories can be seen including their breakdown by sources of WEEE and the amount of WEEE treated and recovered.

Table 4 Czech WEEE collection, treatment and recovery in 2020 by category [8]

Waste Type	Total collection (t)	Waste collected from households (t)	Waste collected from other sources (t)	Waste Treated (t)	Waste Recovered (t)
Lamps	1.019	805	214	1028	971

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Screens, monitors, and equipment containing screens having a surface greater than 100 cm ²	17.119	16.657	462	17.354	16.351
Temperature exchange equipment	23.387	20.519	2.868	23.269	21.548
Large equipment excluding photovoltaic panels	47.722	36.605	11.117	48.399	41.805
Photovoltaic panels	53	31	37	40	40
Small equipment (no external dimension more than 50 cm)	20.038	17.098	2.939	19.638	17.919
Small IT and telecommunication s equipment (no external dimension more than 50 cm)	8.977	6.797	2.181	8.720	8.030
Total WEEE from separate collection	118.316	99.498	19.817	118.448	106.704

In the Czech Republic some PROs organise individual activities related to reuse. There are for instance, projects in which PROs encourage consumers to offer a used mobile phone, computer or home appliances. Then the PRO would arrange the repair of the EEE (to ensure its ready to use and safe) and send it to the partner charity organisation.

Table 5 List of Producer Responsibility Organizations in the Czech Republic [7]

Organization	Contacts

ASEKOL a.s.	http://www.asekol.cz	
ASEKOL Solar s.r.o.	http://www.asekolsolar.cz	
Bren, s.r.o.	http://www.bren-zlin.cz/	
ČEZ Recyklace, s.r.o.	https://www.cez.cz/cs/o-cez/skupina-cez/vyznamne-spolecnosti-skupiny-cez/cez-recyklace	
ECOPARTNER s.r.o.	brunclik@isofen.net	
EKOLAMP s.r.o.	https://www.ekolamp.cz/	
ELEKTROWIN a.s.	https://www.elektrowin.cz/	
FitCraft Recyklace s.r.o.	http://www.fitcraftrecyklace.cz/	
MINTES Solutions s.r.o.	http://www.mintesolutions.cz/	
PV Recovery, s.r.o.	http://www.pvrecovery.cz/	
Recycling Systems, s.r.o.	https://www.recycling.gr/en	
REMA PV Systém, a.s.	http://www.rema.cloud	
REMA Systém, a.s.	http://www.rema.cloud	
REsolar s.r.o.	https://www.resolar.cz/cs	
RETELA, s.r.o.	https://www.retela.cz/en/	

Collection systems

The network is primarily based on existing collection yards. Collection yards are usually managed by municipalities or waste companies [12]. PROs have an agreement with the collection yards to place collection containers for WEEE. One collection yard may have agreement with several PROs. Other collection points include retailers, services, and administration buildings. One of the PROs has a network of outdoor containers developed for small WEEE and batteries. Red containers are placed in the streets next to containers for plastics, paper, glass, and metal. These are deployed in cooperation with municipalities. Mobile collection is also organised periodically by PROs. Producers are required to put in place a collection point in municipalities or districts with more than 2,000 inhabitants. It is up to each PRO how to fulfil this requirement. Therefore, there is more than one point per 2,000 inhabitants. However, municipalities are not obliged to conclude agreements in this regard [12].

Furthermore, there is a [register](#) allowing consumers to locate precisely which collection point they need according to the type of equipment they wish to return. The website is hosted by the Ministry of

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Environment. There are also web-based maps where PROs publish their own collection network and thereby provide information to consumers where to take their WEEE. An example of such is the [map](#) by Elektrowin.

Existing treatment and recovery infrastructures and their performance

Providers of collective systems hold contracts with individual treatment facilities. Contracts include a requirement for the facilities to ensure environmentally sound procedures to fulfil the recovery, re-use and recycling targets [10]. There is sufficient treatment capacity in the country for the first treatment steps (e.g., dismantling, shredding etc.) while capacity for material treatment is not always sufficient for all materials (e.g. dedicated metal and plastic treatment facilities), some have to be exported to other EU countries for final treatment. There are thirteen authorised treatment operators which are listed below.

Table 6 List of WEEE treatment operators in the Czech Republic [6]

Operator Company name	Contact Info
STEELMET	https://www.steelmet.cz/
RESPONO	https://www.respono.cz/
GLOBAL RECYCLING	http://www.globalrecycling.cz/
Charita Opava	https://www.charitaopava.cz/
ENVIROPOL (3 facilities)	https://technoworld.cz
AVE	https://www.ave.cz/cs/praha/ave-servises-s.r.o
RUMPOLD RCHZ	http://www.chladicizarizeni-rchz.rumpold.cz/
ELEKTROODPADY RECYKLACE s.r.o.	https://www.eore.cz/
Rumpold-T /chráněná dílna/ s.r.o.	www.tyn.rumpold.cz
CELIA - CZ s.r.o.	http://www.celia-cz.cz/
RECYKLACE EKOVOUK, a.s.	http://www.kovopb.cz/recyklace-ekovuk/
Praktik system s.r.o. (3 facilities)	https://www.praktiksystem.cz/
Ripkov Trade s.r.o.	https://www.ripkov.cz/

Description of WEEE circulation in unauthorized/illegal markets. Across the globe and in the European Union, a large share of the WEEE flows is 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 [5].

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Those flows are difficult to quantify, and specific figures of the Czech Republic were not found in this study. However, an estimate of the European eastern region is available in a UNITAR (United Nations Institute for Training and Research) study:

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.

The 2020 UNITAR study estimates 1.7 ± 1.0 kg/inh in Eastern Europe countries.

WEEE is also often disposed of by households, enterprises, and public institutions into waste bins, thus entering the mixed residual waste. It is then managed with mixed waste and most likely either incinerated or landfilled in Europe – UNITAR estimates 1.2 ± 0.6 kg/inh in Eastern Europe countries.

UNITAR report states that 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 [14].

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. UNITAR estimates 0.5-1.4 kg/inh in 2012 for whole European territory.

3. Greece

3.1 National legislation on e-waste

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 a part of metal scrap dealers who do not follow proper treatment practices or are disposed of in waste bins. It should be noted that the PROs are contracted with many licensed metal scrap dealers who are active in the WEEE collection business. The main hindrances to achieving the target include the limited engagement of authorities and municipalities collection services and lack of implementation of useful measures for limiting the activities of the illegal sector [5].

Despite the harsh economic situation, Greece has implemented a number of good practices in WEEE management. First, there is significant effort to control illegal collection and unaccounted waste treatment. Secondly, local authorities have assumed more active role in waste management operations. Third, education campaigns have shifted consumer behaviour and increased awareness over WEEE recycling. Lastly, financial incentives have been given to consumers to recycle their old electric appliances by subsidizing the purchase of new ones. In addition, commercial strategies and programs have been developed in order to include more retailers in the WEEE collection process. Even though such measures are applicable throughout the EU, Greece managed to effectively implement such actions only recently. However, there is still challenges to be tackled such as, the more elaborate control of the illegal collection and unaccounted treatment as well as further action to improve statistics on EEE put on the market.

Table 7 Summary dashboard of Greece

Description	
Population of country (2021)	10 678 600 [4]
Surface of country	131 957 km ²
Extended Producers Responsibility (EPR)	2 PROs organise their own network of collection points for the return of WEEE from private households, provide services for the return of WEEE from commercial, industrial, institutional and other sources (B2B), organise the transfer of the collected WEEE to facilities for treatment, prepare for reuse, recycling and recovery of

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	WEEE, and are liable for the environmentally sound management of the collected WEEE (Ministerial Decision/2014).
National standards	Greece adheres to the minimum European environmental safety requirements set by the DIRECTIVE 2012/19/EU.
E-waste collection target	65% According to the DIRECTIVE 2012/19/EU
Unreported flows (2018) [5]	Waste bin – 1.3 kg/inh of WEEE
	Export
	Metal scrap – 1.5kg/inh of WEEE
	Informal recycling
	Unknown – 8.7 kg/inh of WEEE
Environmentally Sound e-waste management system in place [15]	16 treatment facilities 2 PROs Over 24845 collection points Take-back system for households, businesses and public organizations.
E-waste collection	Latest data (2021) 42% [13] as the percentage of POM average of the last 3 years

E-waste Legislation-legal framework

According to community standards, all EU countries must adhere to the stipulations of the 2012/19/EU Directive on Waste Electrical and Electronic Equipment (WEEE). Greece implemented the 2002 Directive through the Presidential Decree No. 117 on alternative management of WEEE and its amendment through Presidential Decree No. 15, which together account for the measures, terms and programmes in place for the alternative management of waste electrical and electronic equipment in line with the provisions of the 2002 Directive. The 2012 Directive has been transposed through the Ministerial Decision of 9th May 2014 No. 23615/651/E103/2014.

EPR system

Currently there is one collective EPR system in place run by two Producer Responsibility Organizations (Appliances Recycling and Fotokiklosi) as stipulated by Ministerial Decision 105134/2004. More specifically,

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the bill sets the framework for the management of all categories of WEEE, domestic and non-domestic, including historical waste (older appliances placed on the market before the publication of the WEEE Directive). Both PROs organise their own network of collection points for the return of WEEE from private households, provide services for the return of WEEE from commercial, industrial, institutional, and other sources (B2B), organise the transfer of the collected WEEE to facilities for prepare for reuse, recycling and recovery of WEEE, and are liable for the environmentally sound management of the collected WEEE. For the process of collecting, transporting, storing, and treatment of WEEE, PROs cooperate with licensed professionals, who have the required infrastructure and the licenses provided for by the country's environmental legislation. WEEE is currently treated in 16 properly licensed WEEE treatment facilities throughout the country.

Certification Schemes & National standards

As for treatment facilities, there is, currently, no national requirement for their certification and overall implementation of CENELEC/WEEELABEX standards. However, "Appliances Recycling", the bigger of the two PROs, is requiring from those treatment facilities that is contracted with, to be certified according to CENELEC standards. Fotokiklosi also has a contract with one treatment operator certified through CENELEC/WEEELABEX Standards and aims to have all partners certified.

The Hellenic Environmental Inspectorate (HEI), part of the Special Body for the Environment Building Energy and Mining Inspectorate established under Law 3818/2010 is responsible for inspections to monitor compliance with the terms and conditions set in the environmental permits of establishments, proposing fines to be imposed by the Minister of Environment and Energy and also referring those who violate environmental provisions to Justice. Furthermore, the Hellenic Recycling Agency (HRA) is responsible for supervising the PROs to ensure their compliance with the terms and conditions set in their approval of operation decision - the legal requirement of a PRO to operate. HRA can perform checks and controls to producers and to all parties involved in the management of WEEE (treatment plants, transporters etc). Based on the outcome of those actions, HRA can propose to the relevant authorities to impose administrative penalties to those parties (such as producers, PROs etc.) not complying with their legal obligations.

As stipulated by article 8 paragraph 9 in the 2014 Ministerial Decision, Greece adheres to the minimum treatment and depollution requirements set by the DIRECTIVE 2012/19/EU. More specifically, the bill imposes an obligation to facilitate dismantling, in particular for prepare for reuse and treatment of WEEE, its components and materials, in accordance with the protection of the environment and public health as one of the obligations on producers of EEE.

Financing mechanisms

According to the Ministerial Decision of 2014, producers (either on the individual or collective basis) must finance WEEE management relating to the quantity and type of the products they place on the market. Any natural or legal person from abroad, when shipping its products directly to an end user in Greece, should

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also provide access to a take-back system for his own products placed on the Greek market. Overall, producers contribute a financial fee to the PROs, calculated according to the quantities and the categories of the EEE that they place on the national market. The fee per category of EEE has been calculated based on the cost of waste management and has to be approved by HRA.

There are national funding opportunities for building new plants, with the idea to promote new technologies in the recycling industry in general. The main aim is to promote the development of other regions outside of the Athens region, depending on the location, some regions may be provided with higher subsidies than others.

National e-waste collection target

According to the 2012/19/EU Directive, member states are ought to be targeting the collection of 65% of the average of the three previous years POM amount. In 2021 Greece reported to have collected 42%, i.e., 5.9 kg/inh, while their target was 9.1 kg/inh, so they fell short of reaching the set rate by 3.2 kg/inhabitant [13]. The target is calculated based on 65% of the average of the three previous years POM amount.

Collection scheme (Take-Back)

There are two collective take-back systems, handling both household and non-household types of WEEE with 24845 collection points throughout Greece: All types and categories of WEEE are handled through the operation of the two take-back systems. Household WEEE can be returned free of charge on a one-to-one basis when purchasing new electrical and electronic equipment of the same category or at public collection points, specific supermarkets and retailers as well as licensed waste collection companies. Bulky WEEE is also collected. There are no specific arrangements for the return of WEEE not containing essential components from private household users, while users other than private households are not allowed to dismantle and remove any components from the returned WEEE.

According to the UNITAR study [5], 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.

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3.2 National e-waste statistics

Market descriptions and volumes

In the table below data EEE/WEEE flows can be seen for the year 2020.

Table 8 Greek EEE/WEEE flows in 2020 [11] [16]

Flow description	2020
Products placed on the market	207.588 tones
Imports	3,71bn in US dollars
Exports	1,37bn in US dollars
Waste Generation	190.144 tones
Waste Collected	47% (2021)

In the table below the trend in WEEE flows can be seen for earlier years (2015-2018).

Table 9 Greek EEE/WEEE flows between 2015-2018 [8]

Flow description/Time	2015	2016	2017	2018
Products put on the market	125,136	130,438	134,420	145,828
WEEE collected	49,008	53,715	55,831	58,040
WEEE treatment	49,359	55,603	56,637	58,411
Recovery	43,888	49,583	46,981	50,425
Recycling and preparing for reuse	43,888	45,881	43,998	46,825

Market distortions, barriers to entry

According to the most recent available reports there are no barriers to entry in the domestic market.

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In Greece there is currently no legal framework [17] for the creation of hazardous waste landfills. All hazardous waste is exported to other EU countries for treatment. WEEE licensed treatment facilities have to bear the cost for exporting hazardous waste in third countries. This situation creates conditions of unfair competition between legal and illegal WEEE treatment facilities, as companies operating illegally do not face any obligations for the export of hazardous waste.

WEEE circulation in unauthorised/illegal markets (estimation)

There is not data available on the unauthorised flow, however according to industry actors in 2020 around 67% (of the WEEE accounted for officially) was provided by scrap dealers, contracted with PROs, to the authorised WEEE treatment facilities. It should be noted that as this percentage is constantly decreasing; the share of scarp dealers in 2022 according to Appliances Recycling SA was 49,5%, the Retailers 42,5%, Municipalities 2% and other Organizations and B2B 7%.

3.3 E-waste management

Collection systems

For the collection of Waste Electrical and Electronic Equipment, Greece has developed a take-back network consisting of over 24 845 collection points including municipalities, agencies, public service providers, organizations, waste management companies, universities and businesses. For the transport of the WEEE collected, PROs have partnerships with licensed transport companies. Accordingly, treatment companies and facilities perform under the quality standards set by relevant legislation (Ministerial Decision, 2014). In an interview with a WEEE recycler operating on the Greek market they confirmed that 80% of the WEEE reported originates from scarp dealers and 20% is coming from other sources. According to Appliances Recycling SA data this share has been annually decreased since 2015 and in 2022 the share of metal scrap dealers contracted with Appliances Recycling SA has reached 50% as this is a result from a change in the commercial strategy as also from a Partnership Agreement for the Development Framework for Greece - EU funded program “Recycling-Replace Appliances” that begun on 2022 and gave incentives to citizens to return their high energy consuming equipment (fridges, freezers and air condition units).

According to a new legislation in Greece – green collection points will need to be set up by every municipality. This can be static or mobile depending on the region. There are, also, door to door and curb side collection organised by the municipalities. The municipalities provide a call for tenders and the company with the winning tender gets to organise the collection activity.

There are two PROs operating in the country, which are Appliances Recycling S.A. and Fotokiklosi S.A> [18]

Existing treatment and recovery infrastructures and their performance

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In the list below the names and contact details of the Greek WEEE treatment facilities can be seen.

Table 10 List of WEEE management operators contracted by Appliances Recycling [19] and Fotokiklosi [20]

Operator Company Name	Contact Info
AEGEAN RECYCLING - HYTIRIA ABEE	anakiklosilesvos@gmail.com +30 22510 31077
ECORESET SA	contact@ecoreset.gr +30 216 4000820
EDISAK LTD	info@edisak.gr +30 2810 361610
HELLENIC FRIDGE RECYCLING SA (HFR SA)	+30 27410 49999
HELLENIC RECYCLING CENTER SA (E.K.AN.)	info@ekanrecycling.gr +30 27410 49999
ZARMAKOUPIS THEODOROS (RCPS)	info@rcps.gr +30 210 5550200
KONSTANTINIDIS BROS SA	info@aksa.gr +30 2310 781132
HELLENIC ENVIRONMENTAL RECYCLING (HER)	INFO@HERSA.GR +30 2410 811 200
POLYECO SA	info@polyeco.gr +30 210 55 30600
HERMES LTD	info@xermes.gr +30 2310 784400
OIKOKIKLIOS SA	Info@oikokiklios.gr + 30 22210 34885
KATHERIS SA	+30 2810 264840
K.E.D.A. I.K.E.	+30 24610 27853

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Description of WEEE circulation in unauthorised/illegal markets

According to the 2020 UNITAR study [5] where the WEEE flows were estimated for 2018, 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 scavenging¹ practices of valuable parts of WEEE, and the analysis conducted by Appliances Recycling SA 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, motors, coils and cables.

¹ Scavenging refers to the removal of valuable parts of WEEE by illegal actors e.g. compressors from refrigerators.

4. Hungary

Table 11 Summary dashboard of Hungary

Description	
Population of country (2021)	9 730 800 [4]
Surface of country	93 030 km ²
Extended Producers Responsibility (EPR)	Implemented through a central government body
National standards	Legislative requirements
E-waste collection target	Derogation but from 2021: 65% of average of POM of the last three years.
Unreported flows [5] <i>estimate for Eastern Europe except where stated otherwise</i>	Waste bin: 1.2 ± 0.6 kg/inh
	Illegal WEEE Export in EU28: 0.5-1.4 kg/inh
	Metal scrap: 1.7 ± 1.0 kg/inh
	Informal recycling
	Unknown
Environmentally Sound e-waste management system in place	42 WEEE recyclers
E-waste collection	Latest data (2020) indicate a collection rate of the previous 3 years average: 52.2% [8]

4.1 National legislation on e-waste

E-waste Legislation-legal framework

The current version of the e-waste directive (WEEE Directive) valid for EU member states entered into force on August 12, 2012, under the name 2012/19/EU. Most of the changes were enforced by Hungarian legislation from January 1, 2018.

The EU legislation defines the amount of waste to be collected uniformly at 65% of average of the amount placed on the market in the previous 3 years. At the same time, some member countries, including Hungary, were subject to extended deadlines for meeting the targets, the collection target is set on 40-45% of the

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amount placed on the market by August 14, 2021. The following legislations regulate the WEEE related issues in Hungary:

- Law LXXXV of 2011 provides for the obligations related to the waste of electrical and electronic equipment.
- Government Decree 343/2011 (XII.29), amended by Act CXXXI of 2017, provides for the environmental protection product fee.
- Law on the implementation of Act LXXXV of 2011 on the environmental protection product fee,
- Government decree 197/2014. (VIII. 1.) on the management of e-waste provides for waste management activities related to electrical and electronic equipment
- Government decree 443/2013. (XI.27.) provides for metal trade activities
- Government Decree 385/2014 (XII. 31.) on residential waste transport, detailing the conditions for the provision of waste management public services for the selection of waste transported from the citizens, its recycling, and the operation of waste yards.

EEE Manufacturers can fulfil their obligations related to waste collection and recycling by registering with the National Tax and Customs Office.

The decree also contains obligations for traders: distributors of EEE are obliged to take back used or declared WEEE. When buying a new device, the distributor must encourage the return of the unused device by giving a purchase voucher. The minimum value of the purchase voucher is regulated by Annex I of Government Decree 197/2014. (VIII.11) within a value limit of HUF 100-1000.

Fulfilment of the collection rate is not the responsibility of the manufacturer but must be ensured "in the framework of the national collection obligation".

According to the provisions of the RoHS directive on the use of hazardous components during production, since July 1, 2006, electronic equipment containing lead, mercury, cadmium and chromium (VI), and the plastic parts used with PBDE or PBB flame retardants may no longer be placed on the European market. The Hungarian legislation transposing this Directive is the Government Decree 374/2012. (XII. 18.).

On December 16, 2022, the Hungarian Parliament enacted a law amending several waste management laws. According to this, the manufacturer of the product is financially responsible for the management of its waste during the entire life cycle of the product. The concession company (MOL Nyrt) fulfils the waste management obligations with the financial contribution of the producers. The proposed amendment of environmental product fees is an economic regulatory tool aimed at influencing demand and shaping consumer behaviour. The fee is imposed on products that cause serious waste management problems due to their large quantity or environmentally hazardous nature. For this purpose, Annex 2 of the Act updates the fees for the waste list of products and materials, including EEE.

Extended Producer Responsibility system

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Hungary has set minimum targets for each producer. Each manufacturer must reuse, collect and reprocess a certain percentage (which depends on the product categories) of the amount of EEE it sold on the Hungarian market in the previous year. The method of calculation is laid down in detail in the Government Decree on the WEEE, with particular regard to § 3, § 4 and the annex of Government Decree 197/2014 (VIII.1.).

Annex 2 to 197/2014. (VIII. 1.) For government decree:

The minimum collection rate for electrical and electronic equipment that has become waste per EEE category can be seen in the table below:

Table 12 Minimum collection rates for electrical and electronic equipment in Hungary by WEEE category

	A	B
1	Electrical, electronic equipment category	Collection rate
2	1a. Heat exchange equipment, with the exception of medical devices	75%
3	2. Screens, monitors and equipment containing a screen with a surface area of more than 100 cm ²	68%
4	3. Lamps	58%
5	4a. Large machines (with any external dimension exceeding 50 cm), excluding medical devices and lighting fixtures	48%
6	4 v. Large luminaires (with any external dimension exceeding 50 cm)*	10%
7	5a. Small machines (of which no external dimension exceeds 50 cm), excluding medical devices and lighting fixtures	23%
8	5 v. Small luminaires (no external dimensions of which exceed 50 cm)*	10%
9	6. Small computing equipment and telecommunications equipment (neither of which has an external dimension exceeding 50 cm)	70%
* The 4v. and 5v. instead of fulfilling the prescribed collection rates for EEE categories, it is possible to choose to fulfil the 10% collection rate for both categories together.		

Producers report their activities annually to the competent authority (NAV-National Tax and Customs Office). Failure to meet predetermined targets can result in heavy fines.

Between 2010 and 2011, there were five collective systems for household WEEE in Hungary. On January 1, 2012, the National Waste Management Agency (OHÜ) took over and became the only existing collection system for all categories except category 5 (lamps and luminaires). A separate collective system operates for category 5.

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On December 31, 2014, OHÜ was replaced by NHKV - National Waste Management Coordinating and Asset Management Private Limited Company (registered at the Companies Court on January 20, 2016). NHKV Zrt. is to create and develop a regionally optimized system of public waste management services in Hungary and uniform in terms of service level, by implementing a long-term sustainable financing system and sectoral operation.

The responsibility of manufacturers is partly financial and partly operational. They are responsible for the proportional financing of the specified amount of collection and utilization based on the principle of full net cost bearing - including the necessary transport, storage, data processing, etc. also its costs, for achieving the proportionate collection and utilization goals, for the return of the products. They are obliged to provide information to the state, to take an active role in shaping public opinion, and they are also obliged to prioritize eco-design in product development and production.

Retailers are obliged to take part in the take-back, collection and recycling in a specified way and to the extent of informing the end users and passing on information. Manufacturers reduce waste management tasks and financial burdens on the state by collecting waste, handing it over to the waste manager and preparing it for re-use if suitable. using it.

They are therefore considered individual waste managers – based on the performance of their waste management activities they pay a discounted environmental protection product fee, according to the formulas specified in Annex 3 of Act LXXXV of 2011. The collection can also be confirmed by a contract concluded with the state coordinating organization (NHKV).

Certification Schemes & National standards

There is no standard, for companies that manufacture and/or distribute/use EEE, because they must comply with Government Decree 197/2014 (VIII.1) and the provisions of Act CLXXXV of 2012 on Waste.

WEEELABEX, standard series 50625 and standard 50614:2020 – CENELEC are used in the country by some of the WEEE treatment facilities, but the standards and certification are not mandatory.

Financing mechanisms

Manufacturers of EEE are obliged to pay a product fee in order to fulfil their obligations related to the recycling of waste generated from their products. The Ministry of Innovation and Technology will use part of the money received from this to promote the selective collection and recycling of WEEE through tenders.

According to Act LXXXV of 2011 on environmental protection product fees, the manufacturer or importer must pay a product fee in Hungary for nine product groups, and EEE are one of the nine product groups.

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The product fee system has a dual role. On the one hand, it creates resources for the waste management tasks necessary to comply with the European Union targets (packaging, EEE, batteries, tires), and on the other hand, it encourages changes in consumer habits from an environmental perspective.

Over the years, the WEEE material flow has been increasingly contributed by the state product fee for revenues. In 2019, it generated the second largest revenue after plastics.

The manufacturer has to provide financial guarantee to ensure the fulfilment of collection and handling obligations (§ 13 of Government Regulation 197/2014 (VIII.1)) unless it pays a product fee for its product or it fulfils its collection and management obligations through an intermediary organization.

The amount of financial deposit per kilogram to determine the obligation for the current year can be seen in the table below:

Table 13 Financial deposit quotient per kilogram by WEEE category in Hungary

1	Electrical, electronic equipment category	Amount per kg, (HUF)
2	1a. Heat exchange equipment, with the exception of medical devices	100
3	2. Screens, monitors and equipment containing a screen with a surface area of more than 100 cm ²	95
4	3. Lamps	190
5	4a. Large machines (with any external dimension exceeding 50 cm), excluding medical devices and lighting fixtures	26
6	4 v. Large luminaires (with any external dimension exceeding 50 cm)*	190
7	5a. Small machines (of which no external dimension exceeds 50 cm), excluding medical devices and lighting fixtures	85
8	5 v. Small luminaires (no external dimensions of which exceed 50 cm)*	190
9	6. Small computing equipment and telecommunications equipment (neither of which has an external dimension exceeding 50 cm)	90

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* The 4v. and 5v. instead of fulfilling the prescribed collection rates for electrical and electronic equipment categories, it is possible to choose to fulfil the 10% collection rate for both categories together.

Amount of financial security and method of calculation:

If the manufacturer does not start its activity during the year, the method of calculating the annual financial guarantee is:

$$B = M_i \times b_i$$

Where B: the amount of financial guarantee to be created; b_i : the amount of financial guarantee per kilogram determined by equipment category in the table above; M_i : the amount of equipment in given category produced or imported by the manufacturer in the previous year (given in kilograms).

National e-waste collection target

As part of the national collection obligation, from January 1, 2019, it must be ensured that the total weight of WEEE reaches

- a) either at least 65% of the average weight of EEE put on the market in the 3 years preceding the current year, or
- b) at least 85% of the WEEE generated in Hungary (§ 34 of Government Regulation 197/2014 (VIII.1)).

Hungary in 2019 collected 52% or 8.5 kg/inhabitant WEEE of the 65% target. The target was 10.6 kg/inhabitant, meaning they were short of 2.1 kg/inhabitant to reach the target [13]. It must be noted that as mentioned earlier Hungary had a derogation, so the 65% target was to be achieved only from 2021.

4.2 National e-waste statistics

Market descriptions and volumes

Separation of WEEE collected by public services from municipal collection yards is very difficult, as it is not clear in which separately collected waste stream it is collected (e.g., a public service waste yard could not say in which category e-waste is accepted, what is written on the acceptance ticket).

Regarding 2020, the proportion of metal waste in the pre-treatment of public service providers is 6.3%, plastic 13.9%, while 67.1% is landfilled [21].

In the table below WEEE flows for the previous years can be seen.

Table 14 Hungarian EEE/WEEE Flows between 2015-2018 [8]

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Flow description/Time	2015	2016	2017	2018
Products put on the market	103,993	115,590	133,608	230,027
WEEE collected	52,120	58,615	63,197	69,858
WEEE treatment	52,047	58,544	63,192	68,472
Recovery	46,405	50,399	54,185	58,704
Recycling and preparing for reuse	43,415	49,216	53,228	58,319

There are no specific data available on the WEEE generated, but the estimated amount for hazardous WEEE indicated by the National Environmental Management System (OKIR) around 41 000 tons, while the non-hazardous WEEE was around 127 000 tons. [22] In contrast the Eurostat data indicates an estimate of a total of 106 858 tons of WEEE Generated in Hungary for 2020. [8]

Table 15 Waste generated by manufacturers in 2020 (there is no data separated by type of waste) [22]

Industry code	Description	Amount of waste generated in 2020 (t)	
		Hazardous waste	Non-hazardous waste
26	manufacture of computer, electronic and optical products	3 616.341	53 850.183
27	production of electrical equipment	37 842.284	71 632.011
95	repair of computers and personal household goods	69.082	1 174.349
	Total from OKIR system	41 527.707	126 656.543
	Total	106 858	

Source: OKIR (National Environmental Management System)

Market distortions, barriers to entry

In the case of all material flows, it can be said that a different proportion of the total budget is spent for recovery purposes than the share of the given material flow in the state income for the given year (e.g., WEEE state income 21% → utilization 34%).

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In the period between 2012 and 2018, only 19-29% of the state revenue collected as WEEE product fees was intended for recycling, which shows that a significant part of the total revenue is not used for this purpose. Public procurements are of a framework nature, so there are deviations from the call both up and down, no data on this is publicly available. In 2019, the state allocated HUF 3.5 billion from the HUF 13 billion product fee paid to finance collection and recycling.

Several EPR directives are not fulfilled, e.g., the principle of transparency, which means making the responsibility and organizational rules for waste management clear and public, including the financial contribution of each actor, as well as the way they are determined.

The use of the amounts (budgets) intended for recycling is made difficult by the fact that the long turnaround time of public procurement does not allow continuous financing of the system. After the publication of the OGYHT (National Waste Collection and Utilization Plan), it still takes many months to call for public procurement, even more than 7 years after the transformation of the system. The results of the tender announced for WEEE collection activities for 2019 were announced only in January 2020, which brings enormous uncertainty into the system and basically prevents the entry of new companies.

WEEE circulation in unauthorized/illegal markets (estimation)

The waste of electrical and electronic equipment generated on unlicensed/illegal markets (estimated) is approx. 40% of the total generated. [22]

4.3 E-waste management

E-waste sources, volume, and types of WEEE products collected, treated, and recovered officially

The latest WEEE collection data shows that the collection of WEEE keeps on increasing every year.

Table 16 WEEE collection in Hungary by WEEE category in 2019-2020 [8]

	Collection in tons	Collection in tons
WEEE Category	2019	2020
Temperature Exchange Equipment	6,184	6,298
Screens	10,600	11,575
Lamps	892	973
Large Equipment including PV panels	43,941	45,354

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Small equipment	15,431	17,070
Small IT equipment	6,356	7,638
Total	83,404	88,908

Existing treatment and recovery infrastructures and their performance
Table 17 List of Hungarian E-waste treatment facilities

1.	Flextronics International Termelő és Szolgáltató Vámszabadterületi Korlátolt Felelősségű Társaság
2.	MÉH Hulladékgazdálkodási és Környezetipari Zrt
3.	SARPI Dorog Környezetvédelmi Korlátolt Felelősségű Társaság
4.	ERECO Kelet-Európai Hulladékfeldolgozó és Környezetvédelmi Zrt.
5.	NHSZ Miskolc Környezetvédelmi és Hulladékgazdálkodási Kft.
6.	PALOTA Környezetvédelmi Kft.
7.	ÉMK Észak-magyarországi Környezetvédelmi Kft.
8.	ECOMISSIO Kereskedelmi és Szolgáltató Korlátolt Felelősségű Társaság
9.	NHSZ TATABÁNYA HULLADÉKGAZDÁLKODÁSI ÉS KÖRNYEZETVÉDELMI ZRT.
10.	Design Hulladékgazdálkodási Kft.
11.	BIOMARK 2000 Nonprofit Korlátolt Felelősségű Társaság
12.	ZALA-MÜLLEX Hulladékgazdálkodási és Környezetvédelmi Korlátolt Felelősségű Társaság
13.	Netta-Pannonia Környezetvédelmi Kft.
14.	Silver-Select Kereskedelmi És Szolgáltató Kft
15.	Szelektív Hulladékhasznosító és Környezetvédelmi Nonprofit Kft.
16.	Alcufer Ipari, Kereskedelmi és Szolgáltató Kft.
17.	Metálker Hungária Kereskedelmi és Szolgáltató Kft.
18.	Celli HUKE Hulladék Kezelési Nonprofit Kft.
19.	Kiskun MÉH Hulladékkereskedelmi Korlátolt Felelősségű Társaság

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20.	Paksi Hulladékgazdálkodási Nonprofit Korlátolt Felelősségű Társaság
21.	ARCUS CENTER Környezetvédelmi és Energetikai Korlátolt Felelősségű Társaság
22.	INTER-METAL Recycling Kft.
23.	ÉLTEX Kereskedelmi és Fuvarozó Korlátolt Felelősségű Társaság
24.	ECOMETALEX RECYCLING Kft.
25.	Steel Metál Hulladék Kereskedelmi és Szolgáltató Korlátolt Felelősségű Társaság
26.	FE-FERRUM Kereskedelmi és Szolgáltató Kft.
27.	Fémker Fémkereskedelmi és Másodlagos Anyagokat Hasznosító Kft.
28.	UD STAHL RECYCLING Ipari, Kereskedelmi és Szolgáltató Korlátolt Felelősségű Társaság
29.	KER-HU Szolgáltató Kft.
30.	FE-GROUP INVEST Vagyonkezelő, Tanácsadó és Nagykereskedelmi Zrt.
31.	Metalex 2001 Hulladékkereskedelmi Kft
32.	"Intermetal Kereskedőház" Kereskedelmi és Szolgáltató Korlátolt Felelősségű Társaság
33.	Dexiker-97 Kereskedelmi És Szolgáltató Korlátolt Felelősségű Társaság
34.	AUTÓ MANDY CAR Kereskedelmi és Szolgáltató Kft.
35.	Avarem Termelő, Kereskedelmi És Szolgáltató Korlátolt Felelősségű Társaság
36.	Saubermacher-Magyarország Szolgáltató Kft.
37.	Ferro-Crom Kereskedelmi Kft.
38.	ALBA-FÉM Kereskedelmi, Szolgáltató és Ipari Kft.
39.	METÁL CÁR Kereskedelmi és Szolgáltató Bt.
40.	Metal-Mix Szolgáltató És Kereskedelmi Korlátolt Felelősségű Társaság
41.	ENVIROINVEST Környezetvédelmi és Biotechnológiai Zártkörűen Működő Részvénytársaság
42.	Metal Shredder Hungary Zrt

The mechanical processing capacity of some companies processing electronic waste in Hungary without any claim to completeness:

- Small household appliances (max. size: desktop copier): FE-GROUP - Budapest (QZ1200): approx. 1.5 t/h (chain breaker)

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- Large household appliances (max. size: washing machine, photocopier): E-ELEKTRA - Dunaújváros: approx. 3...4 t/hour (chain breaker)
- Large household appliances and refrigerators: E-HULL - Karcag (QZ2000): refrigerators 50...60 units/hour or small and large household appliances approx. 4...6 t/hour
- (Explanation of the abbreviations: QZ = chain breaking device / number = internal diameter of the breaking chamber in mm)
- Copper cable processing: METALEX - Budapest: 3...4 t/hour, Metal-mix-Cegléd: 1 t/hour
- Dry cell processing: PLANNING - Kecskemét: approx. 500 kg/hour
- Small household appliances, electric motor: Serenity Solution Kft. (Serenity Recycling)-Miskolc: 3 t/hour

Description of WEEE circulation in unauthorized/illegal markets

Among the WEEE material flow, the illegal trade is mostly waste with a high content of precious metals (PC, CPU, RAM, etc.). In many cases, devices created by the public or scrapped by companies end up in the circle of illegal dealers.

It is difficult to estimate these values, however the 2020 UNITAR [5] study estimated the following for the countries in Eastern Europe:

Across the globe and in the European Union, a large share of the WEEE flows is 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 [5]. Those flows are difficult to quantify, and specific figures of the Czech Republic were not found in this study. However an estimate of the European Eastern region is available in a UNITAR study [5]:

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.

The 2020 UNITAR study estimates 1.7 ± 1.0 kg/inh in Eastern Europe countries.

WEEE is also often disposed of by households, enterprises, and public institutions into waste bins, thus entering the mixed residual waste. It is then managed with mixed waste and most likely either incinerated or landfilled in Europe – UNITAR estimates 1.2 ± 0.6 kg/inh in Eastern Europe countries.

UNITAR report states that 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

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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 [14].

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. UNITAR estimates 0.5-1.4 kg/inh in 2012 for whole European territory.

5. Poland

Table 18 Summary dashboard of Poland

Description	
Population of country (2021)	37 840 000 [4]
Surface of country	312,696 km ²
Extended Producers Responsibility (EPR)	Yes, EPR in place
National standards	No
E-waste collection target	Derogation until 2021, from 2021 65% of average POM of three last years
Unreported flows [5] <i>data for Eastern Europe except where stated otherwise</i>	Waste bin: 1.2 ± 0.6 kg/inh
	Illegal WEEE Export in EU28: 0.5-1.4 kg/inh
	Metal scrap: 1.7 ± 1.0 kg/inh
	Informal recycling
	Unknown
Environmentally Sound e-waste management system in place	128 recycling companies [12]
E-waste collection	Latest data (2020) indicate a collection rate of: 61.8% [8] as the percentage of POM average of the last 3 years

5.1 National legislation on e-waste

E-waste Legislation-legal framework

- Act on Waste of 14 December 2012 - Primarily refers to municipal waste, how it is handled, waste management records, municipal and WEEE management plans as well as permits and decisions.
- Act of September 13, 1996 on maintaining cleanliness and order in municipalities. Regarding WEEE, information on the location of collection points, the organization of collection and the availability of organized collection points can be found therein.
- Act of 11 September 2015 on waste electrical and electronic equipment - The Polish Parliament adopted the 2012 Recast WEEE Directive 2012/19/EU on 11th September 2015, which entered into

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force on 1 January 2016. It states the obligations of participants in the WEEE management system, requirements for waste equipment, how to handle it, and rules for managing waste equipment [23].

- REGULATION OF THE MINISTER OF CLIMATE AND ENVIRONMENT 1 of December 13, 2022 on the method and detailed method of calculating the minimum annual level of collection of waste electrical and electronic equipment. This regulation describes the activities to implement the law and the basis for executing rights and obligations.

Extended Producer Responsibility system

The Extended Producer Responsibility System applies to EEE in such a way that when selling a new large household appliance, the store is obliged to accept the old equipment of the same type and performing the same function from the consumer free of charge. Regarding small appliances (e.g., a hair dryer), consumers can return broken or used equipment free of charge at any large retailer offering such products. Manufacturers - as part of the EPR system - guarantee and finance the above options. Manufacturers are also obliged to ensure that WEEE is recycled in sufficient quantities.

The goal of the EPR is to create and finance such a system of collecting and recycling waste so that it circulates in the economy and is not wasted. Manufacturers are required to create a system in which waste is treated as a valuable resource. In this case, all stages of a product's life cycle (design, production, distribution, consumption, waste collection and recycling) serve the goal of maintaining materials circulation. This provides the achievement of both economic and environmental goals. EPR meets these requirements while creating a fair and predictable system in which roles and responsibilities are clearly defined.

In Poland Producer Responsibility Organisations (PROs) can be established by producers, economic operators that put EEE on the market as well as associations of employers or commercial chambers representing them.

The producer is required to organize and finance the collection of WEEE from households and non-household users. Producers introducing an equipment onto the market should achieve the minimum annual collection targets set by the law and prepare WEEE for reuse or recycling and keep records of this waste. They should establish contracts with treatment facilities for dismantling and preparation for reuse as well as develop information for these facilities on waste handling. The responsibilities also include conducting public education campaigns and paying a product fee. The above obligations can be performed by the introducer himself or through a WEEE recovery organization.

The simplified scheme of WEEE management system is as follows:

1. Company introducing WEEE onto the market (aka EEE producer):

- Introduces WEEE to the market,
- Organizes and finances the collection and processing of WEEE, individually or through WEEE recycling organization,

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- Provides the achievement of the minimal annual collection and preparation for reuse (recycling) levels of WEEE,
 - If the required minimal annual collection and recovery values are not reached - pays a penalty in the form of a product fee,
 - Informs about the WEEE collection points.
2. WEEE distributor:
- Sells WEEE,
 - Informs about the WEEE collection points,
 - Accepts WEEE - in specific cases.
3. WEEE acquirer:
- Acquires WEEE from a WEEE distributor,
 - Produces WEEE,
 - Disposes of WEEE at a WEEE collection point.
4. WEEE collector:
- Performs the business of collecting WEEE,
 - Segregates WEEE for reuse - in specific cases,
 - Sends the collected WEEE to the processing plant,
 - Communicates to the Municipality in which it conducts its business the information about the WEEE collection points it operates.
5. Processing plant:
- Receives WEEE – in specific cases,
 - Performs the business of dismantling WEEE and preparation for further reuse of WEEE or waste from WEEE processing,
 - Transfers waste generated from the treatment of WEEE to a recycling and non-recycling recovery plant.
6. Recycling and non-recycling recovery plant:
- Performs the business of recycling and non-recycling recovery of waste fractions arising from the treatment of WEEE,
 - Issues a certificate for the treatment facility confirming the recycling and non-recycling recovery process of WEEE.
7. WEEE recovery facility:

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- Performs business activities on behalf of WEEE producers and the employer associations or chambers of commerce representing them,
- Performs the business of organizing, managing or carrying out projects related to the collection, treatment, recycling and other than recycling recovery processes, and disposal of WEEE (waste from WEEE) [24]

Certification Schemes & National standards

Records must be kept by any entity that either generates or manages waste this is registered at the BDO system (waste database). Entry in the BDO registry is granted after applying to the relevant regional marshal or ex officio (without submitting an application). The latter applies to companies that have received:

- Integrated permit,
- Waste production permit,
- Waste collection permit or waste processing permit,
- A decision authorizing an extractive waste management program or a permit to operate an extractive waste facility.

There are no specific WEEE management standards implemented in Poland related to WEEE. It is estimated that introducing a standard is too costly for treatment facilities, many of them are new entities and have no financial resources to implement such standard. If any standard is to be mandatory in the future, it should be introduced gradually so the facilities can comply [25].

The Regional Environmental Inspectorates carry out annual inspections of processing plants to determine whether they operate in compliance with the WEEE Act. A database of businesses and organizations responsible for recovery of WEEE is operated. Annual reports are compiled on WEEE management [10].

Voivodship Inspectorates for Environmental Protection – to be found in every region of Poland - controls entities collecting WEEE and treatment facilities. They are required to inspect facilities where WEEE is treated once a year (Article 86 ust. 1 of Act dated September 11, 2015 on waste electrical and electronic equipment). In addition, they carry out inspections of other entities dealing with WEEE. Voivodship Inspectorates for Environmental Protection create work plans for the calendar year which contains a control plan. In most cases plans are not publicly available but sometimes they are on the websites of the individual Voivodship Inspectorates for Environmental Protection (only in Polish). In conclusion it can be considered that an inspection plan considering at least WEEE collection and treatment exists for the whole territory of Poland. In 2015, the Inspectorate conducted 188 checks. Irregularities were detected in 67 cases, only few concerned failed to comply with technical requirements for treatment facilities. As a result, 58 post control checks were conducted, 19 fines were imposed, and 23 cases were forwarded to other authorities. The Inspectorate conducted also checks of 226 other entities (collection companies, producers, recyclers) [11].

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Financing mechanisms

The recycling fee is a part of the price of any new equipment placed on the market and represents the cost of waste management, including the cost of collecting and processing the WEEE. The fee paid by the consumer, through the distributor, is entirely paid to the WEEE producer, who is obliged to arrange and finance collection from collectors of WEEE and processing of it, including contracting with the operator of a processing plant that dismantles and prepares WEEE for reuse. At processing plants, funds from the "recycling fee" collected from PROs are used for: acquisition of waste equipment from collectors and its transportation, processing, and disposal of hazardous substances generated from disassembly that cannot be reused in production processes. The processing plants' source of revenue is also the sale of the resulting recycled materials to recyclers [26].

The WEEE system is entirely financed by producers. Producers pay a monthly financial contribution which is calculated on the basis mass of products placed on to the Polish market by each producer in the previous year.

Companies placing EEE on the market have to provide financial security (e.g. bank guarantee, deposit paid) for the purpose of financing WEEE management, unless they make an agreement with a WEEE recovery organisation. Information on the level of waste management costs must be supplied to the retailers and wholesalers. Visible fee: Retailers and wholesalers of household WEEE must inform purchasers of the amount of such costs, if they have obtained such information from the persons placing the equipment on the market [10].

In Poland funds from the National Fund for Environmental Protection and Water Management were used under the 'Rational Waste Management' programme to finance projects for constructing waste management facilities. Projects submitted for funding were assessed according to criteria that included requirements for eco-innovation. Furthermore, the technologies used in installations brought into service for the first time or modified, must use substances with low-risk potential, be efficient in terms of energy- and resource-use, and consider emissions, scientific and technical progress [10].

National e-waste collection target

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.

The producer is obliged to achieve minimum annual collection rates for waste equipment, which are:

1. from January 1, 2018 to December 31, 2020. - not less than 40% of the average annual weight of equipment placed on the market, and in the case of IT and telecommunications equipment - not less than 50% of the average annual weight of equipment placed on the market;
2. from January 1, 2021. - not less than 65% of the average annual weight of equipment placed on the market or 85% of the weight of waste equipment generated in the national territory.

Collection scheme (Take-Back)

The figure below shows the financial and WEEE flow in the Polish system.

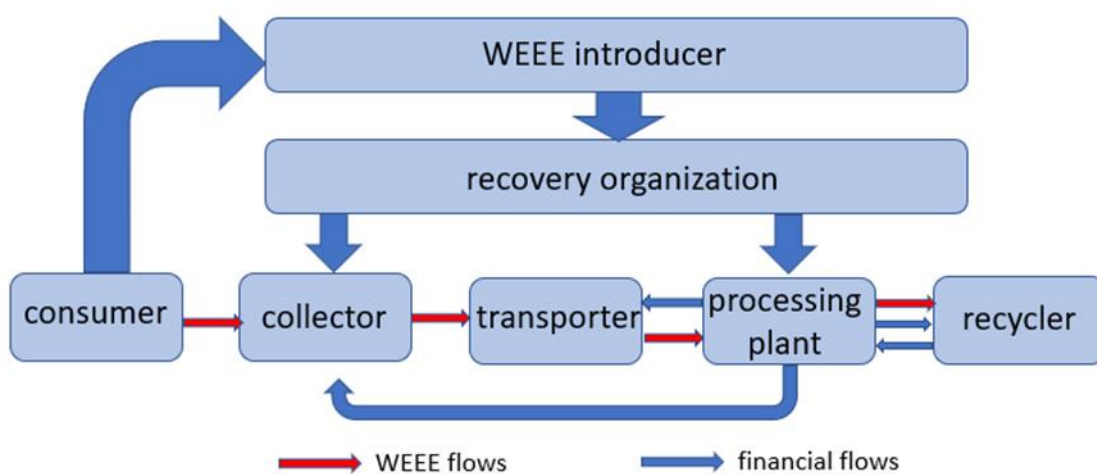


Figure 1 Scheme of Polish WEEE collection system [26]

5.2 National e-waste statistics

Market descriptions and volumes

According to the available information, in 2015, approximately 44% of the EEE produced domestically was placed on the market in Poland. The chart below shows the sources of EEE in 2015 [24]. (please note translation error in the referenced study: WEEE meant to say EEE)

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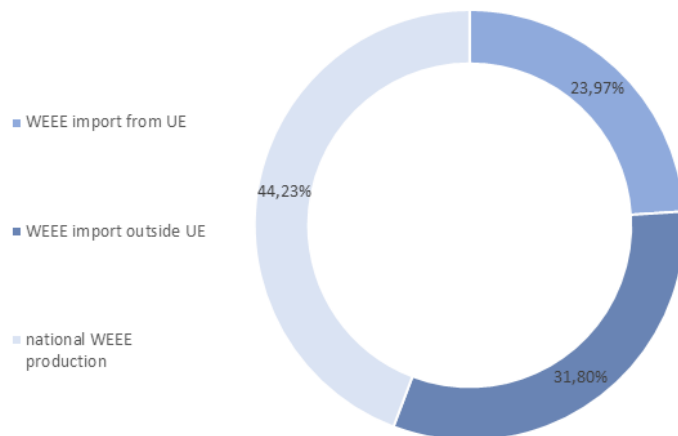


Figure 2 EEE production in Poland in 2015 [24]

Approximately 527,000 Mg of EEE was introduced to the market, as the chart above shows, and the total equipment introduced is higher than in previous years.

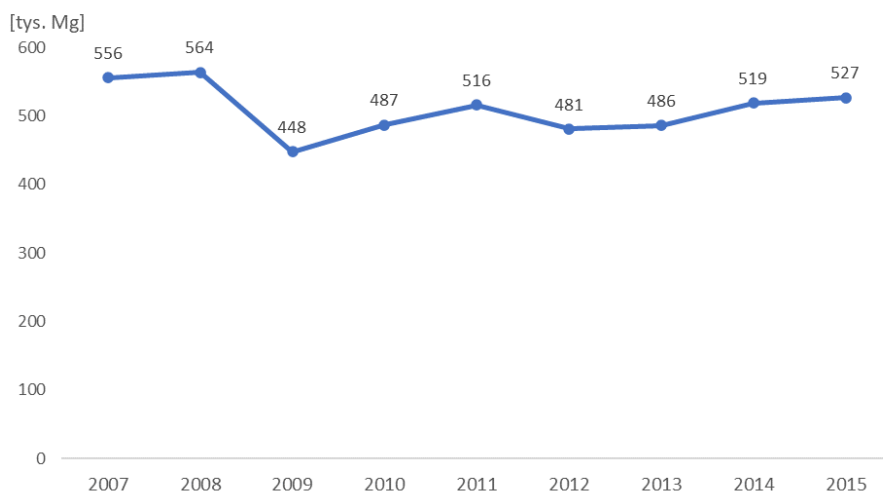


Figure 3 Mass of EEE put on the market in 2007 – 2015 [24]

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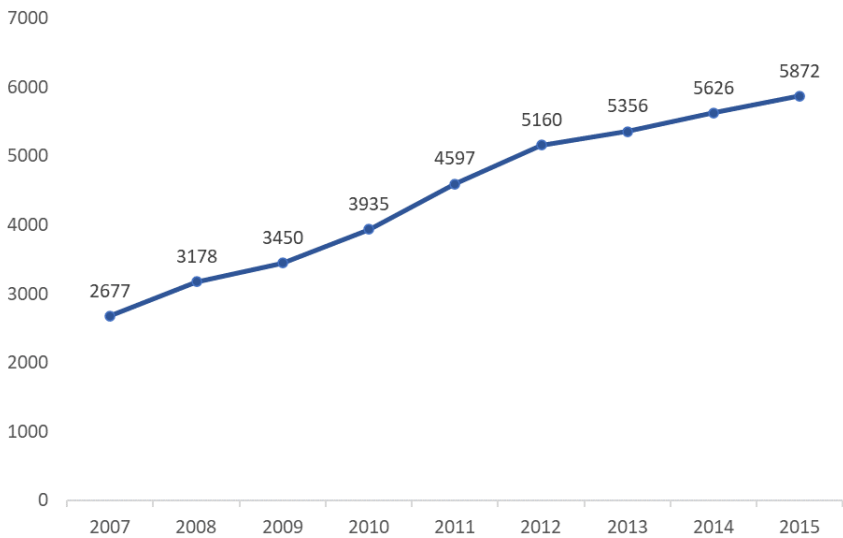


Figure 4 Number of companies involved in the introduction of EEE between 2007 and 2015. [24]

The number of EEE producers continues to grow, which may mean that the market is not yet saturated for the equipment in question, and that there will be a need to increase the mass of WEEE collection and processing in the coming years.

According to the available data, the sources from which most of the collected waste is collected are households. They account for 95% of the collected waste.

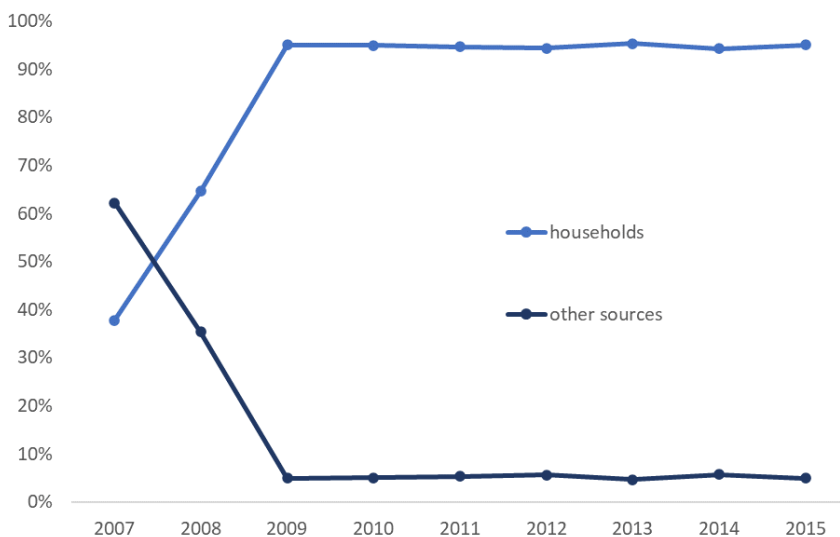


Figure 5 Sources of WEEE collected between 2007 – 2015. [24]

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There was an increase in the number of WEEE equipment collected. This can be attributed to the increasingly shorter product life cycle and the development of WEEE as well as the increased demand for this type of equipment. It can also relate to better collection systems and citizen's awareness.

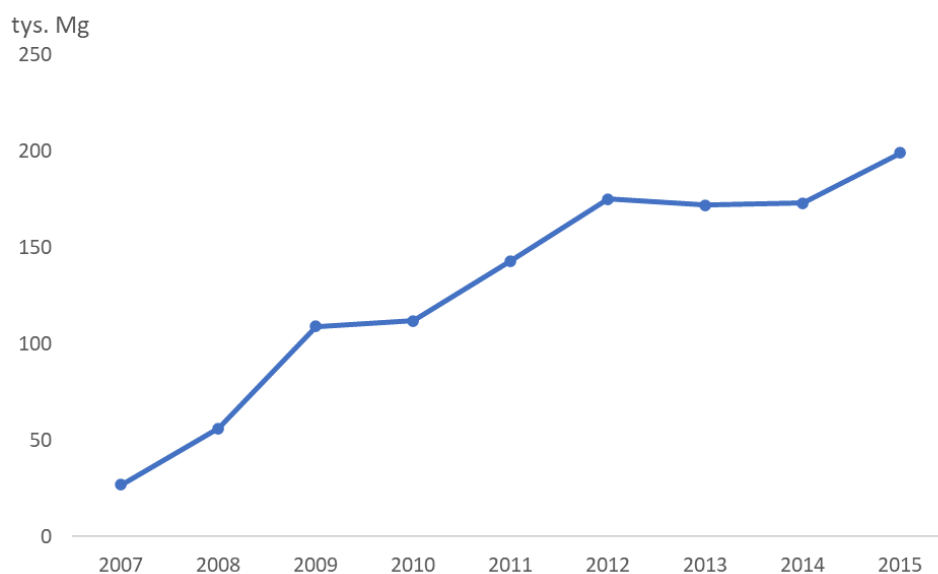


Figure 6 Amount of WEEE collected 2005-2017 [24]

Volumes of e-waste officially collected and flows for the years 2015-2018 can be seen in the table below. The data has been reported to Eurostat by Polish national authorities.

Table 19 Polish EEE/WEEE flows between 2015-2018 [8]

Flow description/Time	2015	2016	2017	2018
Products put on the market	526,91	583,14	607,24	660,437
WEEE collected	199,16	232,65	246,46	255,625
WEEE treatment	168,94	223,86	256,03	256,055
Recovery	140,02	192,00	204,51	225,499
Recycling and preparing for reuse	138,91	191,19	203,75	223,993

Market distortions, barriers to entry

Several factors may be responsible for the WEEE management system not working properly:

- The companies that operate within the WEEE system do not comply with WEEE regulations – over 60% of inspections conducted by provincial environmental inspectorates found inaccuracies [27],
- There is a lack of standards for the treatment of WEEE, and the statutory requirements for treatment facilities are low – WEEE processing facilities in most cases perform manual dismantling [27],
- WEEE reporting system is not providing accurate and reliable data – the companies fail to comply with reporting obligations, and the adopted method of verification makes it impossible to determine whether all entities have complied with these obligations,
- Supervision over WEEE management system is insufficient [27].
- Among the WEEE-related challenges is the imbalance between the ecological and economic goals of the WEEE management system. Many processes that are optimized for economic reasons do not always coincide with the maintenance or improvement of environmental standards.
- The management of the WEEE system is a complex process consisting of many entities, which makes it difficult to adequately control all stages of waste management.
- The regulatory framework for PROs does not specify criteria for approval and little on operations, which result in a system where only some PROs work towards fulfilment of obligations whereas other are driven by economic factor to attract producers and not focusing on meeting legal obligations [12]
- As mentioned above, a PRO can be established by producers, economic operators that place EEE on the market as well as associations of employers or commercial chambers representing them, however, PROs can set their own treatment facilities. Some actors consider that this can result in conflict of interest concerning the fulfilment of obligations, reporting and approval by the same entity [12].
- PROs are non-for-profit organizations, in principle they should reinvest all net revenue to finance the system, whereas it is possible for PRO to distribute dividends to producers instead [12].
- Number of municipal collection points is not sufficient. In addition, they are not dedicated to WEEE exclusively; in this case, they can be mixed with other waste in collection points [12].
- Illegal disassembly of EEE outside of the treatment facilities constitutes a problem. In this sense, the Act on WEEE specifies that only authorized entities are allowed to collect incomplete or parts of EEE.
- Despite that the WEEE management system exists since over 10 years, the authorities still observe that many collection entities fail to report, and producers and PROs still make mistake in reporting [12].
- Only some PRO finance information campaigns as several have no financial resources as they distribute net revenue to shareholders. It is estimated that the public awareness on the WEEE

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related issues is improving, about 50% of consumers are aware that WEEE can be hazardous if not disposed of properly, but the majority does not know how to deal with such waste. Resources dedicated to information campaigns are not sufficient to reach all the population. It is also estimated that highest awareness is in middle-sized cities and in those areas, municipalities are generally more involved in waste management [12].

5.3 E-waste management

E-waste sources, volume, and types of WEEE products collected, treated, and recovered officially

In 2019 the country has surpassed by 7% the 65% collection rate compared to the put on the market average of the three preceding years. The target was 10.6 kg/inhabitant, and the country collected 11.7 kg/inhabitant. It must be noted that though the official collection rate was defined as 65%, Poland had the possibility to postpone the achievement of 65%; their target for most of the EU WEEE categories was set at 55% of the POM of the three preceding years until 14 of August 2021. The exception was Cat. III (lamps) where the target was set as 60% [5]

According to the study: Update of WEEE Collection Rates, Targets, Flows, and Hoarding – 2022 in the EU-27, United Kingdom, Norway, Switzerland, and Iceland [13] in 2019 Poland has reached 96% collection rate compared to target of 85% of the WEEE Generated. The collection target was 10.3 kg/inhabitant however as mentioned above the collection was 11.7 kg/inhabitant.

Collection systems

The entire system for collecting waste equipment from users of private household equipment has been based on waste equipment collection schemes, i.e. operators of waste equipment collection points, including retailers and wholesalers, as well as municipal services that collect municipal waste and businesses that hold permits for the collection of municipal waste.

The municipality has an obligation to dispose of WEEE appropriately, as clarified in the ordinances on the maintenance of cleanliness and order in municipalities.

The municipality has an obligation to enable and arrange for the collection of WEEE from owners. Efficient collection of equipment is made possible by providing information to consumers about:

- addresses of WEEE collection points in the municipality,
- information about the collecting company (company name, address, name of the WEEE collector).
- The collection can be arranged in the following forms:

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- collection of the equipment from outside of the property at the time specified by the collector,
- delivery to the collection point by the owner of used equipment.
- The owner of waste equipment may hand over the equipment:
 - in the store as part of the purchase of new equipment of the same type (refrigerator for refrigerator) in the amount corresponding to the equipment purchased,
 - at the point of repair, if it accepts waste,
 - through a specialized company for a specified fee,
 - to the store, the area of which is more than 400 m² - the size of the equipment does not exceed 25 cm,
 - to the special container [28].

Some retailers (chains of shops) have contracts with PROs that take back WEEE directly in shops.

Collection points can refuse taking back the WEEE if it can pose a risk to health and life of the persons accepting it [12].

Some PROs make available to consumer the list of collection points they operate. An example of one of these is the [collection map](#) for WEEE prepared by ElektroEko.

Existing treatment and recovery infrastructures and their performance

There are 170 treatment facilities in Poland and some operators have several facilities in different locations.

Treatment capacity was reported to be 905,115.6 t in 2014. This seemed to be sufficient for the as the domestic treatment capacity for the treatment of WEEE.

Domestic capacity of WEEE treatment in 2015 was as follows:

- recycling (R2 to R9 recovery process): 7,406,000 t (128 registered companies)
- recovery other than recycling: 573,000 t (15 registered companies)
- recovery R12: 1,011,000 t (170 registered companies) [12]

Below the link to the list of collection points can be found and the link to the registry of the WEEE recyclers. List of [collection points](#) – ElektroEko

The [List of WEEE recyclers](#) can be found in the website of the national producers register (Baza Danych o Produktach i Opakowaniach Oraz o Gospodarce)

According to the national registry, there are 9 Producer Responsibility Organisation in Poland.

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Table 20 List of PROs in Poland

TOM Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego S.A.
AURAEKO Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego S.A.
INTERZERO ORGANIZACJA ODZYSKU SPRZĘTU ELEKTRYCZNEGO I ELEKTRONICZNEGO SPÓŁKA AKCYJNA
ERP Polska Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego i Organizacja Odzysku Opakowań
Biosystem Elektrorecykling Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego Spółka Akcyjna
ELECTRO - SYSTEM Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego S.A.
RLG RELECTRA Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego S.A.
ElektroEko Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego S.A.
Asekol PL Organizacja Odzysku Sprzętu Elektrycznego i Elektronicznego i Organizacja Odzysku Opakowań S.A.

Description of WEEE circulation in unauthorised/illegal markets

Across the globe and in the European Union, a large share of the WEEE flows is 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 [12]. Those flows are difficult to quantify, and specific figures of the Poland were not found in this study. However an estimate of the European eastern region is available in a UNITAR study:

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.

The 2020 UNITAR study estimates 1.7 ± 1.0 kg/inh in Eastern Europe countries.

WEEE is also often disposed of by households, enterprises, and public institutions into waste bins, thus entering the mixed residual waste. It is then managed with mixed waste and most likely either incinerated or landfilled in Europe – UNITAR estimates 1.2 ± 0.6 kg/inh in Eastern Europe countries.

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UNITAR report states that 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 [13].

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. UNITAR estimates 0.5-1.4 kg/inh in 2012 for whole European territory.

6. Romania

Romania like many other countries is facing challenges to reach the 65% POM based WEEE collection target. According to the country study: Quantifying WEEE in Romania 2015 vs 2019 [29], the targets will be difficult to reach if using the 65% POM methodology in a country where many of the new products purchased are not replacing an existing product, so sold amounts do not mean an increase in the collection of WEEE. The study estimates that more than 55% of the EEE stock in households is less than 5 years old. Another factor that hinders the WEEE collection is the 34% by weight of the waste discarded is passed for reuse by a relative or a friend. A relevant share of 7.2 kg/person of the not used appliances are kept at home (hoarded) instead of being brought for separate collection.

Table 21 Summary dashboard of Romania

Description	
Population of country (2021)	19 201 700 [4]
Surface of country	238,397 km ²
Extended Producers Responsibility (EPR)	Yes, EPR is in place
National WEEE standards	Requirements set in legislation
E-waste collection target	Derogation till 2021, from 2021 – 65%
Unreported flows [5] <i>data for Eastern Europe except where stated otherwise</i>	Waste bin: 1.2 ± 0.6 kg/inh
	Illegal WEEE Export in EU28: 0.5-1.4 kg/inh
	Metal scrap: 1.7 ± 1.0 kg/inh
	Informal recycling: 50% of all WEEE in Romania
	Unknown
Environmentally Sound e-waste management system in place	78 WEEE treatment companies [29]
E-waste collection (2018)	Latest data (2020) indicate a collection rate of the previous 3 years average: 32% [13]

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6.1 National legislation on e-waste

E-waste Legislation-legal framework

The 2002 Directive was transposed by the Government Decision on WEEE (No. 448/19.05.2005) which outlines measures related to the prevention of WEEE, recycling and others forms of recovery. The national transposition of Directive 2012/19/EU on WEEE entered into force via the Order on waste electrical and electronic equipment on 26 April 2015. Below can be seen the list of relevant national legislations on EEE and WEEE.

EEE / WEEE legislation [30]

- Emergency Ordinance no. 196/2005 on the Environmental Fund.
- Order no. 578/2006 of June 6, 2006 for the approval of the Methodology for calculating the contributions and fees due to the Environmental Fund
- Order 1494 for the approval of the procedure and criteria for granting the operating license
- EMERGENCY ORDINANCE no. 5 regarding electrical and electronic equipment waste, published in the Official Gazette on April 16, 2015;
- ORDER 1441 2010 guarantees regarding the establishment of the methodology for establishing and managing the financial guarantee for the producers of electrical and electronic equipment;
- Order 556 of 2006 regarding the specific marking applied on the market after December 31, 2006;
- ORDER Nr. 269/2019 of March 20, 2019, on the approval of the Procedure for establishing the registration, reporting, frequency of reporting to the National Register of Producers, as well as the manner of evidence and reporting;
- ORDER Nr. 417/2021 of March 10, 2021 on European standards in the field of treatment

Waste legislation [30]

- GD no. 322 of 2013 on the List of prohibited substances in electrical equipment
- OM no. 95 of 2005 regarding the storage of impurities
- EMERGENCY ORDINANCE no. 92 of August 19, 2021
- Decision 200/532 EC Waste Classification
- Law 132 of 2010 - selective collection of public institutions;

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Waste shipment legislation [30]

- HG Nr. 1061 of September 10, 2008. on the transport of hazardous and non-hazardous waste on the Romanian territory.

Extended Producer Responsibility system

There are currently 20 PROs operating in the country to fulfil producers EPR obligations. The list of PROs in Romania can be consulted at the following link and in the table below: [List of Producer Responsibility Organisations](#).

Table 22 List of PROs in Romania

	Name of PRO	Website	License number
1	ARCwaste Collection S.R.L.	https://arcwaste.ro/contact/	14/06.05.2021
2	ASCENTA DEE S.R.L.	https://ascentadee.ro	18/12.10.2021
3	CCAT DEEE	www.ccat-deee.ro	19/02.12.2021
4	CCR LOGISTICS SYSTEMS RO S.R.L.	www.relectra.ro	4/28.09.2020
5	CENTRUL NAȚIONAL DE RECICLARE ELECTRICE SI ELECTRONICE	www.cnree.ro	13/10.12.2020
6	ECO LIGHTING COLLECT	www.ecolightingcollect.ro	6/18.11.2020
7	ECO ONE	www.ecoone.ro	8/02.12.2021
8	ECOPOINT	www.eco-point.ro	5/28.09.2020
9	ECO-POSITIVE S.A.	ecopositive.ro	10/28.09.2020
10	ECOTIC	www.ecotic.ro	1/30.12.2022
11	ECOTRON	https://ecotron.ro	16/06.05.2021
12	ELECTROWASTE CONSULTING	https://electrowaste.ro/	20/29.04.2022
13	ENVIRON	www.environ.ro	3/30.01.2020
14	GREEN FORT	http://greenfort.ro	12/02.10.2020
15	RECOLAMP	www.recolamp.ro	2/30.12.2022

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16	REDPOINT MANAGEMENT SOLUTION	https://redpointrecycling.ro/contact/	17/06.05.2021
17	RESPO DEEE	http://respo.ro/	9/02.08.2022
18	ROMECC GREEN S.R.L.	www.romec.ro	15/06.05.2021
19	RoRec		licensing in process
20	Safe Waste D.E.E.E. S.R.L.	www.safewastedeee.ro	11/28.09.2020

Only a few of these are operated by producers. There is a mandatory hand-over system; meaning all WEEE should be collected by operators contracted by the PROs or should be handed over to facilities contracted by the PROs. Unfortunately this is not implemented, the majority of the collectors are not in contact with the PROs or producers. Romanian PROs are penalised for missing their targets and their permits will be revoked if they fail to achieve targets for 2 consecutive years.

Certification Schemes & National standards

There are no obligatory standards in place in Romania for the management of e-waste. There are however several WEEELABEX certified WEEE treatment facilities in the country, which are GreenWEEE International S.A., RematHolding Co. s.r.l., Total Waste Recycling s.r.l. [31].

Financing mechanisms

Producers are required to finance management of historical household WEEE and WEEE resulting from equipment placed on the market after 31st December 2006. The producers must guarantee the financing in the form of participation in appropriate systems, recycling insurance or a blocked bank account. Users must meet costs for historical non-household WEEE outside the one-to-one system. Visible fee: Producers may inform the purchaser when buying a new product about WEEE management costs (e.g., by 13th February 2011 for products under Annex IA, and for category 1 of the same Annex by 13th February 2013) [10].

Financing of the development of recycling facilities: Romania has established an environment fund for funding programmes and projects in waste management, including hazardous waste [10].

National e-waste collection target

With the new recast WEEE directive annual targets for collection and recycling of 4 kg/inh were replaced with a formal collection and recycling rate of 65% of the average weight of products put on the market by producers in the three preceding years (to become effective from 2019). As mentioned earlier, some

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countries were allowed to derogate from the 65% POM target (applicable to other countries) till 2021, which was defined in the WEEE Recast Directive. Romania was one of the countries that could postpone the increase of the collection target by two years. The national target for Romania was set as 45% of the annual average POM of the three preceding years up to 2020 [29]. In 2018 Romania collected 32% compared to the 45% target which was set [13].

National considerations pertinent to WEEE recycling

Romanian legislation introduced an “orphan” product status – when producer ceased activity or cannot be identified when the product becomes waste. To avoid financing of treatment of such WEEE by consumers or other producers, every producer is required to provide a bank guarantee / insurance guarantee when putting a product on the market; it covers operations to manage any EEE put on the market. This measure is not required from producers being part of a PRO [25].

In the field of waste electrical and electronic equipment (WEEE), several European countries have adopted a policy of liability exclusively of manufacturers. This means that the WEEE collection target assigned to the state is “delegated” exclusively to producers. Romania is a leader in this regard. The set of punitive measures attributed to producers and implicitly to those to whom these responsibilities are partially delegated - the organizations implementing the extended liability of producers (OIREP or popular OTR - Organization of responsibility transfer) - are the most drastic in Europe: 4 lei / kg contribution at AFM for unreachd WEEE target (and 20 lei / kg for lamps). Also, if an OTR has failed to meet the targets, its license shall be suspended for two consecutive years. It should be noted that “OTR” is a name closer to reality, as these organizations take over *partial* responsibilities of producers. Aspects such as: eco-design, labelling and consumer information at the time of sale remain the responsibility of manufacturers [32].

6.2 National e-waste statistics

Market descriptions and volumes

WEEE collection in Romania has been increasing steadily since the recast WEEE Directive. The amount of WEEE collected in Romania increased from 1.61 kg/inh in 2014 to 3.3 kg/inh in 2018. The collection rate compared to the WEEE Generated was 30% for 2018, or 32% using the EEE POM methodology. In 2018, Romania was short of the target by 3.5 kg/inh for 65% EEE POM target and 6 kg/inh for the WEEE Generated target [13].

The increase seemed to slow down in the recent years. According to the study: *Update of WEEE Collection Rates, Targets, Flows, and Hoarding – 2021 in the EU-27, United Kingdom, Norway, Switzerland, and Iceland* [13], Romania’s collection rate in 2018 was 32% (only 1% more than in 2016) based on the POM methodology and was 30% based on the WEEE Generated method, consequently they have not reached either target. In comparison to other Member States, Romania’s collection rate is among the lowest in

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Europe. According to the UNITAR study [5], there are different factors that have an influence on this performance. Some of these attributes are:

- the inadequacy of the collection infrastructure;
- the lack of awareness of proper disposal of e-waste;
- large quantities of WEEE collected and managed by metal scrap dealers;
- e-waste being disposed of in waste bins;
- Hoarding practices are also among the factors;
- the country's reuse culture is being more prominent than in other European countries.

In the table below WEEE flows for the previous years can be seen.

Table 23 Romanian EEE/WEEE Flows between 2015-2018 [8]

Flow description/Time	2015	2016	2017	2018
Products put on the market	168,179	200,685	238,044	261,150
WEEE collected	40,774	46,654	49,689	63,779
WEEE treatment	35,955	43,486	48,158	59,165
Recovery	30,095	39,941	44,839	55,968
Recycling and preparing for reuse	26,908	34,509	41,444	52,988

Market distortions, barriers to entry

- Insufficient coverage of territory with municipal collection points available to consumer [5],
- insufficient consumer awareness regarding end-of-life of WEEE and undeclared collection by scrap collectors [5]
- The level of equipment is not at the maximum. A lot of new equipment are a first purchase and not a replacement of old equipment. That is one of the reasons why the collection rate is not easy to attain [12].
- Competitive disadvantages for certified treatment facilities due to substandard informal treatment of WEEE. The scrap dealers do not declare the quantity of waste collected coming from WEEE flow [12].
- Poor performance regarding inspections and controls. Some treatment facilities were caught double counting, i.e. they were reporting the same WEEE amount to different PROs [33].

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6.3 E-waste management

Collection systems

Public authorities must undertake separate collection of WEEE from private households and establish locations for collection points for producers (one for each county (41 in total), one for each town with more than 20,000 inhabitants (104 in total) and one for each district of Bucharest (6 in total). There are 347 operational collection points/WEEE centres where private households and distributors can bring WEEE, at least free of charge. Distributors are required to establish a system to take-back WEEE at least free of charge or against a payment that takes account of the value of the reusable components, and on a one-to-one and like-for-like basis. Producers have set up and operate individual and/or collective take-back systems for WEEE from private households [10].

As this measure is not mandatory and a large part of local authorities do not provide collection points, there are very few municipal collection points available to citizens (population of coverage is about 10% in urban areas and almost not existing in rural areas) [25]. Consequently the majority of the household WEEE collection comes from retailers (50%), followed by PRO awareness and collection campaigns.

Lack of official municipal collection points, 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) [5].

Some Romanian PROs make available on their websites maps and applications to easily find the nearest collection points for consumers. Two of such examples are that of Environ and Ecotic:

- Environ: [application to find nearest collection point](#)
- Ecotic – [map of WEEE collection points](#)

Existing treatment and recovery infrastructures and their performance

The list of authorized treatment and collection facilities is made available on the website of the Ministry of Environment. At present there are 112 organisations in the list [34], but there is no indication which ones have license to collect and which ones have license to treat WEEE. According to the study from 2020 “In-depth Review of the WEEE Collection Rates and Targets in the EU-28, Norway, Switzerland, and Iceland, 2020” [5] 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. There are only a few WEEELABEX certified facilities. The number of unauthorised facilities is unknown, but they are mostly small entities that dismantle WEEE to extract iron and copper.

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Description of WEEE circulation in unauthorised/illegal markets

Other non-reported 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.). 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 [5]

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7. Slovenia

7.1 National legislation on e-waste

E-waste Legislation-legal framework

The national transposition of Recast Directive 2012/19/EU on WEEE entered into force via the Decree on waste electrical and electronic equipment (Official Gazette No. 55/15, 47/16, 72/18, 84/18 – ZIURKOE, 108/20 and 44/22 – ZVO-2) on 8 August 2015.

It sets out the rules for handling waste electrical and electronic equipment in accordance with Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012 on waste electrical and electronic equipment (WEEE).

The Decree covers the following areas:

- EEO planning and marking and providing EEO information
- Environmental objectives in WEEE collection and treatment
- WEEE handling rules
- Producer's obligations
- Determination of shares and equalization of producers' obligations
- Financial guarantee
- Obligations of the collector
- Obligations of the treatment operator
- Record of producers
- Cross-border shipping of used EEO
- Reporting to the European Commission
- Control of the implementation of decree
- Penal provisions

EPR system

According to the Decree (Official Gazette No. 55/15, 47/16, 72/18, 84/18 – ZIURKOE, 108/20 and 44/22 – ZVO-2) the producers and importers that put the EEE on the Slovenian market are obliged for the environmentally friendly disposal of the EEE after end of life. The producers and importers can fulfil their

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legal obligation individually or through the Producer Responsibility Organizations. Producers and importers must ensure the collection of the WEEE on the entire territory of Slovenia. This is the main reason that there are no individual collective schemes in Slovenia. The holders of the WEEE can drop off their appliances at the collection points and municipal collection yards free of charge. End users can also drop off their waste electric equipment to the distributors/retailers when buying a new one. In Slovenia the citizens can dispose of the WEEE also in street containers dedicated for the collection of the small WEEE (dimensions below 0,5 m). The PROs are obliged to take over all WEEE from the municipal waste yards free of charge. The collected WEEE is transported from the collection points by the logistic companies to the consolidation points where is sorted to different categories (large domestic appliances, small domestic appliances, TVs, IT equipment, cooling and freezing equipment, lamps) and transported to different recycling facilities in Slovenia and abroad. All activities in the process are financed by the PROs. In addition to the collection, transport and recycling, the PROs are also obliged to contribute with campaigns raising the awareness of the public.

Certification Schemes & National standards

There are no certification schemes in Slovenia, however it is legally binding that all treatment facilities be certified according to the CENELEC 50625 standards. At present only two recyclers are certified, Ekologo d.o.o. and Blok d.o.o. Other recyclers are not certified because the diction of the legislation is ambiguous. It requires that the treatment of the WEEE must be carried out in accordance with the general requirements for WEEE treatment, but not explicitly that the recycler must be certified.

The collection and recycling companies that have a certification are certified by the WEEELABEX Organisation with registered office U Habrovky 11/247, 140 00 Praha 4, Czech Republic accredited by the Český institut pro akreditaci, o.p.s. on 5 June 2019 in accordance with ČSN EN ISO/IEC 17065: 2013.

According to article 16 of the decree the treatment of the WEEE must be carried out in accordance with the general requirements for WEEE treatment from the standards SIST EN 50625-1, SIST EN 50625-2-1, SIST EN 50625-2-2, SIST EN 50625-2-3, SIST EN 50574-1 and SIST EN 50574-2 and using the best available techniques.

The SIST standards correspond to the following CENELEC standards:

EN 50625-1 General requirements

EN 50625-2-1 Gas discharge lamps requirements

EN 50625-2-2 Displays requirements

EN 50625-2-3 Temperature exchange equipment requirements

EN 5074-1 Collection, logistic and treatment requirements for end-of-life household appliances containing volatile hydrocarbons

The standards cover the following areas:

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- General and legal compliance and document management
- Documents and downstream monitoring
- Material reception, sorting, handling and storage
- Training, facility safety and emergency planning
- Depollution
- Batch tests and Recycling & Recovery rates

Financing mechanisms

According to the Decree (Official Gazette No. 55/15, 47/16, 72/18, 84/18 – ZIURKOE, 108/20 and 44/22 – ZVO-2) the producers and importers that put the EEE on the Slovenian market are obliged to finance the cost of their EPR obligations. Producer Responsibility Organisations organize the WEEE management operations for the EEE producers and importers. The producers and importers have a contract with the PROs and pay them the environmental fee for each EEE that is put on the Slovenian market. The environmental fee must not be higher than the cost of the WEEE management. Possible excesses must be used for the fulfilment of the future obligations of the producers and importers.

Obligatory visible fee has not been stipulated by the national decree. There are no financial mechanisms to promote the building of recycling or collection facilities.

National e-waste collection target

According to the Decree on WEEE the collection target is 65% of the average annual weight of the EEE put on the Slovenian market in previous three years. In 2021 this meant that the target (using the 65% POM methodology) was around 25 757 tons. In 2021 the collection rate was 39%, some 15 545 tons. So the distance to target remains at 26%.

In 2022 the collection target is 29.087 tons (internal calculation of ZEOS (based on requirements of the Decree) which has been calculated using the POM method, i.e. 65% of the average annual weight of the EEE put on the Slovenian market in previous three years.

National considerations pertinent to WEEE recycling

According to industry actors the collection of the WEEE in Slovenia is well organized but nevertheless some quantities pass through the official system and are not registered, especially large domestic appliances and

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IT with the high value of the raw materials. Large domestic appliances are shredded together with other metal scrap without being depolluted.

Due to the small national market, there is no recycling capacity for some categories, namely cooling and freezing appliances, solar panels and lamps. These categories are exported to Italy, Austria, Germany and Czech Republic. There is also a lack of recycling capacity for the higher added value materials that can be found in WEEE (such as: plastic, printed circuit boards).

Although the WEEE legislation requires that the treatment of the WEEE must be carried out in accordance with the CENELEC standards, only two recyclers are certified.

7.2 National e-waste statistics

Market descriptions and volumes

In 2021 52.144 tons of EEE was put on the Slovenian market of which 11.514 tons (22,1%) was produced in Slovenia and 40.629 tons (77,9%) imported. In the same year 15.545 tons of WEEE were collected and recycled. This quantity represents 35% of the WEEE generated. 62,2 % of the collected WEEE was recycled in Slovenia and 37,8% exported (official data of the Agency for Environment).

In the table below EEE/WEEE flows can be seen for previous years.

Table 24 EEE/WEEE flows in Slovenia between 2015-2018 [8]

Flow description/Time	2015	2016	2017	2018
Products put on the market	31,414	35,295	33,427	36,168
WEEE collected	10,527	13,921	12,643	13,430
WEEE treatment	6,882	12,413	13,203	13,598
Recovery	9,320	11,730	12,632	12,788
Recycling and preparing for reuse	9,074	10,559	10,989	11,365

Market distortions, barriers to entry

The recycling market in Slovenia is competitive. There are no monopolies or other market distortions. The only barrier for entry is the environmental permit that must be acquired by the recyclers.

Procedures for the notification and provision of the cross-border transfer of WEEE complicate the WEEE management process and make it more expensive. They also lengthen the process, which occasionally makes compliance with reporting obligations more difficult [10].

7.3 E-waste management

E-waste sources, volume, and types of WEEE products collected, treated, and recovered officially

Table 25 WEEE collection in Slovenia in 2021 by WEEE category – publicly non available data provided upon request

WEEE collected in 2021	Amount in tons
Large domestic appliances	6.292 tons
Cooling and freezing appliances	2.667 tons
TV/monitors	1.859 tons
Small domestic appliances	4.532 tons
Lamps	195 tons
Total	15.545 tons

There are currently 5 PROs operating in Slovenia. The list of the PROs can be seen below:

- ZEOS, d.o.o., Šlandrova ulica 4, 1231 Ljubljana – Črnuče
- INTERZERO d.o.o., Beograjska ulica 4, 1000 Ljubljana
- SLOPAK, družba za ravnanje z odpadno embalažo d.o.o., Vodovodna cesta 100, 1000 Ljubljana
- TRIGANA, razvojni inženiring, d.o.o. Tržaška cesta 207, 1000 Ljubljana
- RECIKEL, d.o.o., Ljubljana, Vevška cesta 52, 1260 Ljubljana – Polje

Collection systems

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The collection system in Slovenia is well developed. The holders of the WEEE can drop off their appliances at private collection points, municipal collection yards, in shops selling EEE or in the street containers free of charge. Producer Responsibility Organisations organize also direct take back from big holders of WEEE (companies, schools). In total there is more than 800 collection points on the territory of Slovenia.

The division of WEEE collection through collection channels in 2021 can be seen in the table below.

Table 26 Slovenian WEEE collection channel division in 2021 publicly non available data provided upon request

Source of collection	Amount collected
Private collection points	2.652 tons (17,1%)
Municipal waste yards	10.274 tons (66,1%)
Shops	1.398 tons (9,0 %)
Companies, schools	1.221 tons (7,9%)

Existing treatment and recovery infrastructures and their performance

In Slovenia there are 12 treatment and recovery facilities authorised. Most of them are “type 1” and “type 2” operators meaning they perform manual treatment, including all or some depollution and mechanical treatment (pre-treatment and intermediate treatment). There are only 2 “type 3” operators who perform advanced mechanical treatment, including some or all depollution. In Slovenia there are no treatment operators for temperature exchange equipment, gas discharge lamps and PV panels.

List of WEEE recovery facilities with permit can be seen in the table below:

Table 27 Slovenian WEEE recovery facilities with permit [35]

	Name of facility	Type of facility	Address
1	Surovina d.o.o.	Reciklažni center Maribor	Lahova 38-40, 2000 Maribor
2	Surovina d.o.o.	Zbirno predelovalni center Ljubljana	Cesta dveh cesarjev 370, 1000 Ljubljana
3	Surovina d.o.o.	Zbirno predelovalni center Nova Gorica	Panovška cesta 3, 5000 Nova Gorica
4	Surovina d.o.o.	Zbirno predelovalni center Žalec	Ulica Savinjske čete 18, 3310 Žalec
5	Ekologo d.o.o.		Lancova vas 1b, 2284 Videm pri Ptujju

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6	Saubermacher Slovenija d.o.o.		Spodnji Porčič 4A, 2230 Lenart v Slov. Goricah
7	Dinos d.o.o.	Center za predelavo Ljubljana	Šlandrova ulica 6, 1231 Ljubljana – Črnuče
8	Dinos d.o.o.	Center za predelavo Celje	Trnovlje pri Celju, Gaji 37, 3000 Celje
9	Dinos d.o.o.	Center za predelavo Jesenice	Kurilniška ulica 18, 4270 Jesenice
10	Dinos d.o.o.	Center za predelavo Maribor	Tržaška cesta 55, 2000 Maribor
11	AURENIS d.o.o.		Poljubinj 112, 5220 Tolmin
12	Blok d.o.o.	Center za obdelavo odpadne električne in elektronske opreme ter reciklaža kovinskih in nekovinskih odpadkov	IOC Zapolje II 7, Logatec

Below you can see the list of collection points and municipal waste yards by the PROS: ZEOS

Table 28 List of WEEE collection points covered by ZEOS

Collection point	Address	City and postal code
1. Surovina d.o.o.	Lahova ulica 38	2000 Maribor
2. Surovina d.o.o.	Kolodvorska ulica 37	2310 Slovenska Bistrica
3. Surovina d.o.o.	Ulica Savinjske čete 18	3310 Žalec
4. Surovina d.o.o.	Cesta 4. Julija 134A	8270 Krško
5. Surovina d.o.o.	Cesta dveh cesarjev 370	1000 Ljubljana
6. Surovina d.o.o.	Mariborska cesta 44	2360 Radlje ob Dravi
7. Surovina d.o.o.	Dobja vas 188	2390 Ravne na Koroškem
8. Surovina d.o.o.	Pameče163	2380 Slovenj Gradec
9. Surovina d.o.o.	Ulica Mirka Vadnova 4	4000 Kranj
10. Surovina d.o.o.	Ulica 15. Maja 11	6000 Koper – Capodistria
11. Surovina d.o.o.	Panovška cesta 3	5000 Nova Gorica
12. Surovina d.o.o.	Puchova ulica 15	2250 Ptuj
13. Surovina d.o.o.	Hardek 21B	2270 Ormož
14. Surovina d.o.o.	Babinska cesta 8	9240 Ljutomer

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15. Surovina d.o.o.	Šmihel 2A	3270 Laško
16. Surovina d.o.o.	Dolenja Nemška vas 28	8210 Trebnje
17. Dinos d.o.o.	Šlandrova ulica 6	1231 Ljubljana – Črnuče
18. Dinos d.o.o.	Šmarska cesta 7	6000 Koper – Capodistria
19. Dinos d.o.o.	Novomeška cesta 7	1330 Kočevje
20. Dinos d.o.o.	Savska loka 24	4000 Kranj
21. Dinos d.o.o.	Kurilniška ulica 18	4270 Jesenice
22. Dinos d.o.o.	Trnovlje pri Celju, Gaji 37	3000 Celje
23. Dinos d.o.o.	Cesta Simona Blatnika 9	3320 Velenje
24. Dinos d.o.o.	Ob potoku 9	3210 Slovenske Konjice
25. Dinos d.o.o.	Tržaška cesta 55	2000 Maribor
26. Dinos d.o.o.	Markišavska ulica 7	9000 Murska Sobota
27. Dinos d.o.o.	Trimlini 1	9220 Lendava – Lendva
28. SAUBERMACHER SLOVENIJA d.o.o.	Spodnji Porčič 4A	2230 Lenart v Slov. Goricah
29. KEMIS d.o.o.	Pot na Tojnice 42	1360 Vrhnika
30. ZEOS d.o.o.	Poslovna cona A 45	4208 Šenčur
31. ZEOS d.o.o.	Gorenje 16a	3327 Šmartno ob Paki
32. AURENIS d.o.o.	Poljubinj 112	5220 Tolmin
33. TSD d.o.o.	Pod vrhom 6	2000 Maribor

Description of WEEE circulation in unauthorised/illegal markets

There is no official data about WEEE circulation in unauthorized/illegal markets. We estimate that substantial quantities of large domestic appliances are treated together with other metal waste in shredders and are not recorded as a WEEE.

Across the globe and in the European Union, a large share of the WEEE flows is 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 [12]. Those flows are difficult to quantify, and specific figures of the Slovenia were not found in this study. However an estimate of the European eastern region is available in a UNITAR study:

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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.

The 2020 UNITAR study estimates 1.7 ± 1.0 kg/inh in Eastern Europe countries.

WEEE is also often disposed of by households, enterprises, and public institutions into waste bins, thus entering the mixed residual waste. It is then managed with mixed waste and most likely either incinerated or landfilled in Europe – UNITAR estimates 1.2 ± 0.6 kg/inh in Eastern Europe countries.

UNITAR report states that 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 [13].

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. UNITAR estimates 0.5-1.4 kg/inh in 2012 for whole European territory.

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8. Conclusions and recommendations

In this section some of the outstanding reasons will be listed which contribute to missing collection targets. It is to be noted that issues were obtained via desk research from relevant sources. To ensure the accuracy of the information collected, they should be validated through consultations with the industry actors. The section will also propose mitigation measures for the issues spotted, thereby providing a sort of roadmap towards a more efficient WEEE system in the RIS countries.

The EU WEEE regulation has been in force for almost 20 years now, and though the RIS countries might have had derogations on reaching the targets, apart from Poland none of the countries managed to reach the set targets. Regulations on national level are in force in all the RIS countries.

In most cases issues resulting in missing target are related rather with the implementation and control of the legislation and in some cases, they also lack detailed specifications defining the rules and obligations of the actors.

Stakeholders' participation

In most of the country cases described in this study, the roles of the stakeholders in the country involved in collection are limited to the producers, PROs and retailers. There are however many other actors that have access to WEEE and could contribute to increasing the quantities of WEEE collected and properly treated in the countries. Defined roles and responsibilities should be assigned to all the actors that have access to WEEE or can influence collection rates such as: preparing for re-use organisations, municipalities should play an outstanding role (Italy is a good example of this), scrap and recycling companies but also customs, inspection, academia etc.

Roles should be clearly defined so every actor can contribute to reaching collection rates and collect a better quality of WEEE. Responsibilities must be aligned with the competences of each actor. Monitoring and reporting of activities engaging in WEEE collection and treatment should be extended to all the companies running these activities, not only producers and recyclers.

A coordination body and discussion roundtable gathering all the actors can be very useful for reaching agreements and plans of action, it will also provide a coordinated response and channelled communication with the main stakeholders in the country.

Environmental awareness

Apart from some country specific issues, many reasons for failing to reach collection targets are common to all countries involved in this study. The poor environmental awareness was one of the factors indicated as a reason behind the low collection rates, e.g. in Romania, Poland, Czech Republic. Although PROs in most countries have awareness raising as a mandatory activity, some simply do not carry out such activities or are

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not making an adequate effort to reach large crowds to make a difference. There is a need for national authorities to participate in the awareness raising activities with messages that form the overall environmental consciousness of the population with clear messages on the necessity and importance of separate collection.

Collection points

Another common issue among some of the countries seems to be the insufficient data from collection points. In Poland and Hungary there were issues with the separate collection of WEEE at municipal collection points. These countries reported that separate statistics for WEEE were not available either due to failure to do separate collection, or inadequate administrative practices/

requirements, i.e. WEEE being reported together with other waste flows.

Financing of setting up and operating collection points or municipal waste yards must be provided. When the legislation only sets out the obligations of the involved parties without an appropriate infrastructure to carry out the desired activities the results will lag. Making the list or map of available and operational collection points public (including retailers, municipal and other collection points, etc.) via a website or an application adds greatly to facilitating the return of WEEE by the citizens to the collection points.

Treatment standards and unfair competition

In general treatment facilities - except for the Czech Republic and Slovenia – are required to fulfil only minimum treatment standards set in the WEEE regulation. PROs might require their treatment partners in their contracts to certify against industry standards (such as the CENELEC 50625 series), but on national level this is only mandatory in the Czech Republic and Slovenia. Inspections are rare and many find inaccuracies at the treatment plants. In Hungary and Romania authorised treatment facilities claim that unauthorised facilities are not inspected due to their invisibility in the system. According to them this creates unfair competition in the WEEE market and favours illegal actors.

In Romania poor performance regarding inspections and controls was noted. In all the countries in this study substandard informal treatment of WEEE creates unfair competition for certified treatment facilities. In addition reportedly scrap dealers do not declare separately the quantity of WEEE, which hinders the accurate accounting of the total WEEE collected on country level. In Poland illegal disassembly of EEE outside of the treatment facilities was highlighted as a problem. In this sense, the legislation on WEEE specifies that only authorised entities are allowed to collect incomplete or parts of EEE. This issue of scrap dealers not contracted with the PROs treating WEEE with technologies that do not come up to the requirements, have been mentioned by Greece as well, but due to similar WEEE flow structures it is probably an issue in other RIS countries too.

Mandatory standards or a voluntary incentivised implementation of standards is not visible in most countries. It was mentioned that implementing standards may be costly and require additional training and

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improvement of the facilities, so mechanisms for facilitating the implementation of standards would be welcome in these countries.

Apart from the environmental gain of proper treatment, this would help reduce the number of illegal actors in the market and would contribute to a more transparent WEEE flow throughout the value chain.

Producer Responsibility Organizations

Although PROs have been given a significant role in collection, recycling and operation of the WEEE management system in the country, several discrepancies have been noted in many countries around their activities. PROs are in many cases one of the main industry actors that push forward and improve the WEEE collection performance in the Member States, however, Czech Republic, Romania and Poland reported that due to lack of proper regulations and controls the roles and responsibilities of PROs regarding their duties are not well defined. Several PROs take advantage of this and do not work towards the realisation of the EPR objectives. This creates an unfair competition in the market, where some PROs offer their services but do not fully carry out their obligations. In Poland, where PROs in principle are non-profit, and as such should reinvest all net revenue to finance the system, it is possible for PROs to distribute dividends to producers instead.

In Czech Republic it was noted that there is little state mediation among the PROs. The Eunomia study [10] had also identified issues relates to the distribution of WEEE among treatment operators in the Czech Republic. Some PROs have established their own processing facilities, where they limit the supply of WEEE to other entities (many of these entities had to terminate their activity or they had to significantly reduce their activities). Some actors consider that this can result in conflict of interest concerning realisation of obligations, reporting and approval by the same entity. In Romania the transparency and accuracy of the reporting by the PROs owning treatment facilities have also been questioned.

There is clearly a need to harmonise the roles and operations obligations of the PROs. This could be mitigated by the national authorities drawing up more detailed guidelines on how PROs should work. The creation of a national coordination body or clearing house is a measure that helps define the roles of the actors and fosters cooperation between the industry actors. In some countries such as France e.g. the clearing house apart from carrying out its main activity of coordinating collection of WEEE, acts also as a platform between the PROs to promote cooperation and is used for example for designing common campaigns and for engaging in joint research projects.

Mandatory handover can be another measure to foster proper treatment of WEEE, provided it is combined with a targeted enforcement activity from the corresponding authorities. According to the principle of mandatory handover, all the WEEE management should be handled by officially authorised PROs. Mandatory handover contributes bringing to the surface those WEEE flows that disappear via unreported activities and are not accounted for due to being treated together with other waste metals. However, if not properly enforced, the principle assigns responsibilities to PROs that they cannot enforce, and the expected effect of the mandatory handover is lost.

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Except for Hungary, all the countries in scope of this study count with several PROs operating in the country. A coordination body to organise resources, set operative rules and ensure a harmonised and fair distribution of the activities of the PROs could be extremely useful.

Illegal actors

In Greece, outstanding issues that needed solution were the inadequate control of the illegal WEEE collection and unaccounted WEEE treatment quantities. Illegal actors have an unfair competition when handling hazardous waste, as authorized waste treatment facilities have to export hazardous waste, while illegal actors do not incur the costs related to this activity. There were also further actions needed to improve statistics on EEE put on the market. The tackling of illegal actors is a common problem by all the countries and not just in the RIS region. An extensive inspection plan with targeted inspections and well-trained inspectors could work towards alleviating the situation. Considering applying less burdening permitting procedures is also a way to explore, so access to permits is not too costly or involves too long procedures but ensures an appropriate result. Initiatives to support the WEEE industry, and in particular SMEs, in the permitting and bureaucratic procedures to get licensed is also a program to consider and could be implemented by chambers of commerce or the corresponding government entities aimed at entrepreneurs. Mandatory treatment standards can level the playing field and force to act in line with the standards those companies who operate with a permit but are not following proper treatment practices.

Functioning EPR system

This study has identified several issues impeding the proper functioning of the WEEE management system in Hungary. Hungary has implemented the EPR system centrally. Apart for lamps and luminaries there are no PROs set up by producers permitted to work. There is a central agency carrying out the management of WEEE related activities. Issues related to the work of the central agency include untransparent spending of the product fee (fee coming from consumers and paid by the producers to the agency), reportedly only a fourth of the total income was directed to financing the collection and recycling of WEEE in 2019. In addition, actors in the market reported that there were several EPR rules unfulfilled, e.g. the principle of transparency, which means making the responsibility and organizational rules for waste management clear and public, including the financial contribution of each actor, as well as the way they are determined.

In Hungary in addition long turnaround time of public procurement does not allow continuous financing of the system. After the publication of the OGYHT (National Waste Collection and Utilization Plan), it still takes many months to call for public procurement, even more than 7 years after the transformation of the system. As an example, the results for the 2019 WEEE quantities to be collected were announced in January 2020, which brings enormous uncertainty into the system and basically prevents the entry of new companies.

This type of action is counterproductive and contributes to the lack of commitment of citizens. The role of citizens in WEEE collection is extremely relevant, and more transparent and better use of resources should be put on place.

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Reporting

In Poland the WEEE reporting system is not providing accurate and reliable data – the companies fail to comply with reporting obligations, and the adopted method of verification makes it impossible to determine whether all entities have complied with these obligations. In many countries publishing of official WEEE related statistics is slow. In Romania there have been issues with treatment facilities double counting of the WEEE material.

Poland in addition indicated the difficulty to control all stages of the WEEE management, due to the complex process consisting of many actors.

In Greece - along with other countries - it was reported that scarp dealers get hold of considerable amounts of WEEE, some of which they pass over to WEEE treatment facilities, but a major part is still treated by them. This quantity is not reported to the authorities, revealing the weak point in the reporting system that results in inaccurate WEEE collection figures.

Digitalisation and on-line tools are easily accessible and allow for more transparent and fast reporting. If properly designed, they can provide the WEEE industry, PROs and the government with monitoring and verification systems. Tools however should be designed to reduce the burden of reporting and not to require too detailed information, as the latter could trigger misreporting from actors not dedicating enough resources to it.

Tools such as WF-RepTool or BeWEEE in Belgium, can help greatly with the harmonisation and transparency of reporting.

From a practical point of view, it is essential the collection of WEEE is separated from other types of waste, either at the collection point or at later stages prior treatment. This allows for proper identification of the WEEE collected and monitoring of the volumes collected and their destinations. This is particularly important for WEEE that is collected mixed with scrap.

Suitability of collection target calculation

The calculation of the collection targets should consider market factors, like the replacement rate of appliance, and the life extension of products life due to the second-hand trade or the nature of the product. Examples can be seen in Romania and Poland, where one of the factors impeding the reaching of collection targets is that the level of equipment is not at the maximum. A lot of new equipment are a first purchase by the consumers and not a replacement of old equipment, being one of the reasons why the collection rate is not easy to attain. In Romania the high percent of re-use of EEE due to lower spending power of the citizens has been also identified as a unique factor which hinders reaching collection targets.

Another factor affecting the collection rates are including PV panel waste collection in the target to be achieved. PV panels have 20-25 years lifespan [36] they cannot be found among the collected WEEE at the moment. An example of this Romania where share of PV panels POM was quite significant between 2013

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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 from that date. 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% [5].

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