Economic Instruments for WEEE Recycling in Romania

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Abstract: The management of waste electrical and electronic equipment – WEEE, or e-waste represents one of the areas with significant potential for the implementation of economic instruments and it is highly regulated at EU level. Due to their physical characteristics, WEEE is suitable for development of recovery, repair and recycling policies, extension of their life cycle for as long as possible being an objective pursued by the specific mechanisms of circular economy.

In this paper, we will look at how Romania manages economic instruments for e-waste recycling, their implementation and potential benefits. We chose for detail the economic instrument known as "The Green Stamp". This fee is assumed by all manufacturers and retailers of EEE. The amounts thus collected are administered by the Romanian Association for Recycling (RoRec) which deals with the collection, dismantling and recycling of WEEE. The ratio between the amounts collected through the green stamp duty and the amounts invested in e-waste reduction activities is a sensitive topic at national level. The exact quantification of WEEE is very difficult: the quantities of electronic products sold at national level (POM- put on market) are very different from the quantity of WEEE registered. The WEEE collection target set at European level is 4 kg / inhabitant and Romania, with only 2.19 kg / inhabitant at the level of 2016 (Eurostat), is far from reaching it.

Keywords: *circular economy; economic instruments; WEEE management; Green Stamp.*

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1. Introduction

WEEE recycling plays an important role within the circular economy. The notion of circular economy is based on several concepts from different time periods, such as space economy [1], limiting economic growth [2], equilibrium economy [3], performance economy [4], industrial ecology [5] and "cradle-to-cradle" [6] among others.

E-waste or WEEE means discarded electrical and electronic devices. These include refrigerators, TV sets, computers, laptops, mobile phones, consoles, video games, etc. They are made of 13% non-ferrous metals (copper, aluminium, gold, silver, platinum, palladium, etc.), 21% plastic, 50% iron and steel and 16% others.

Every year, 50 million tons of e-waste are generated worldwide, of which only 12.5% is recycled (71% of e-waste produced by the US in 2012 ended up in landfills or incinerators) and 41.8 million tonnes of e-waste were transported by ship to developing countries in 2014 alone [7].

Waste management of electrical and electronic equipment - WEEE is one of the areas with significant potential for the implementation of the circular economy. The circular economy is a model of production and consumption that involves sharing, reusing, repairing and recycling existing materials and products for as long as possible [13]. Waste electrical and electronic equipment is very suitable for developing policies for recovery, repair and prolonging their life cycle for as long as possible, this being one of the main objectives of the mechanisms specific to the circular economy.

In this article we will look at how Romania manages the economic instruments for WEEE recycling, their implementation and potential benefits. We chose for detail the economic instrument known as the "Green Stamp". This tax is collected on the sale of EEE (Electrical and Electronic Equipment). The amounts thus collected by the EFA (Environmental Fund Administration) are then transferred to the entities that deal with the collection, dismantling and recycling of WEEE. The efficiency of this tool and the possibility of using other economic tools for WEEE management are the objectives proposed in this paper.

According to the commitments made before the European Commission, Romania must take all necessary measures to implement economic instruments that favour the transfer to a circular economy [14]. These economic instruments are very important for the modernization of waste management in Romania, but also for the implementation of European legislation in the field. The economic tools used in Romania for the collection and recycling of WEEE are:

- the green stamp,
- extended liability of the manufacturer and
- information and public awareness campaigns and free WEEE collection campaigns.

Of these three types of instruments, the most appropriate for WEEE management has proven to be "producer responsibility". Thus, according to Directive EC / 96/2002, transposed into Romanian legislation by GD 448/2005, in all European Union countries must be implemented a safe mechanism for collection - storage - recycling - disposal of waste from electronic and household appliances, waste that is an environmental risk [8].

Producers and importers who place on the Romanian market electrical and electronic products are required to assume responsibility for waste management resulting from the use and disposal of this equipment and, together with consumers, to bear the appropriate costs for collection, storage, recovery and / or their safe disposal.

Only producers registered in the Register of Producers and Importers of EEE, established at NAEP (National Agency for Environmental Protection), can place on the market electrical and electronic equipment. At the beginning of 2006, the registration procedure of the producers of electrical and electronic equipment in the Register of producers and importers of electrical and electronic equipment was started in Romania, according to the requirements of the legislation in force. At the end of 2018, there were 3186 registered manufacturers / importers of electrical and electronic equipment (EEE).

The green tax for household appliances or the Green Stamp represents the remuneration meant to cover the costs of collection, reuse, recycling, recovery and non-polluting disposal of WEEE and the costs of consumer awareness, activities to be financed by EEE producers, according to art. 28-32 of OUG 5/2015 [9].

The amounts resulting from the payment of the Green Stamp, at the moment when a new equipment is bought, are collected through the Administration of the Environmental Fund (AFM). Subsequently, the amounts are redistributed to organizations dealing with the collection and storage, recycling, recovery or disposal of WEEE.

As can be seen from other studies on this subject [10], one of the main problems with the implementation of this economic instrument is the lack of a consistent database.

2. Problem Statement

The WEEE collection target set at European level is 4 kg/inhabitant and Romania, with only 2.19 kg/inhabitant at the level of 2016 (Eurostat), is far from reaching it.

The indicator used for the quantification of EEE and WEEE at national level and summarized in the State of the Environment Report - prepared annually by ANPM - shows the quantities of electrical and electronic equipment (EEE) that are placed on the market, and the quantities of waste electrical and electronic equipment (WEEE) collected from households and reused or recycled, expressed in kg/inhabitant.

The figures are related to the collection target of 4 kg/inhabitant/year set at the level of the EU Member States.

Recent studies [11] show that in Romania, in 2019, a person owns about 91 kg of Electrical and Electronic Equipment (EEE), increasing by 20 kg compared to 2015, but less than 50% compared to one person from Italy or France. When the period of use of household appliances ends, they become waste Electrical and Electronic Equipment (WEEE).

In Romania, WEEE has the following destinations:

- 34% (2.8 kg) are donated or sold and thus their lifespan is extended.
- 36% (3 kg) are disposed of properly: in stores following the purchase of new products, at municipal collection points and in various campaigns or collection points carried out by producer organizations.
- 25% fall into the area of negative habits: they are taken to landfills, handed over to scrap metal street collectors or thrown at random, which leads both to the dispersion of pollutants in the environment and the risk of not meeting the targets assumed by Romania as a member of European Union.
- The remaining 5% have a diverse destination: they are kept in yards or warehouses, transformed or dismantled.

It is important to point out that, in 2019, the waste generated by households in Romania is estimated to be 8.3 kg/person (compared to 7.35 kg in 2015), while the quantities of WEEE estimated to be collected are 3.1 kg/ person compared to a national target of 5.4 kg/person.

From what has been shown, it can be seen that, in Romania, so far the recycling targets of WEEE that have been assumed within the EU have not been reached, despite the mechanisms used: producer responsibility, green stamp, information and awareness campaigns.

The National Agency for Environmental Protection presents in the Environmental Status Report 2018, without providing an exact source of data, the degree of recovery of recovered WEEE. The WEEE collected is

treated both in Romania and in other EU member states. The capitalization objectives (%) provided by the legislation and those achieved, are presented in Annex 1.

According to this information, the WEEE recovery objectives set at EU level were met in Romania throughout the analysed period, the percentage being sometimes even higher than the one proposed at European level (75%).

In a direct comparison with the data available in the EUROSTAT database [11], we can see that the WEEE recycling rate for Romania in 2016 (the latest available data) was only 25%. We can assume that the difference is due to a mismatch of the terms used:

- NAEP presents the degree of recovery of recovered WEEE (over 80%)
- EUROSTAT presents the degree of WEEE recycling (25%).

Some of the WEEE, especially those with a high metal content (large appliances, power tools, etc.) are collected along with the metal waste, in the initial phase by informal collectors, being handed over to unauthorized collection centres for WEEE management. Thus, the quantities treated for WEEE are not highlighted separately in the reports, but are assimilated to scrap metal, this aspect being due to the fact that the infrastructure necessary for WEEE collection at the level of local public authorities is poorly developed at national level.

3. Research Questions/Aims of the research

The following issues are discussed in this article:

- What needs to be done to have a better estimate of EEE waste generated in Romania?
- What economic tool should be added to the existing ones to increase the recycling of WEEE?
- If the existing mechanism is still useful or if it needs to be modified.

4. Research Methods

Research methods used in this article were: desk research, processing of data, interrogating database available, comparative analysis of data, examining data trends etc.

The data that have been analysed in this paper come from three different sources:

- data collected by the European Commission through the EUROSTAT System, regarding the quantity of WEEE collected kg / inhabitant / year;

- data presented by the National Environment Agency in the 2018 State of the Environment Report (latest available data), regarding the amount of EEE placed on the market, the amount of WEEE collected - both expressed in tons / year, as well as the assessment of meeting national objectives on the recovery of collected WEEE;
- data presented by the Environmental Fund Administration in the annual budget of revenues and expenditures of the Environmental Fund, regarding the “*contribution due by the economic operators that introduce on the national market electrical and electronic equipment*”, in short Green Stamp.

The chosen analysis period is 2013-2017, because statistical data are available for this interval both in the national reports from NAEP and EFA and in the EUROSTAT database.

5. Findings

5.1. WEEE Collecting in Romania

The WEEE collection scheme is a complex one involving several entities (Figure 1). The figure below shows the existence of more than 10 entities with various roles in the flow of collection, transport and recycling of WEEE. Some entities have a financial role (EFA, Responsibility Transfer Organizations (OTR)), others have a control role (Environmental Guard), others have a statistical and coordination role (NAEP), etc.

This system is complicated and cumbersome and does not facilitate the transfer of information between entities and does not contribute to increasing the degree of recovery / recycling of electrical and electronic equipment.

Figure 1: WEEE Collection Scheme in Romania

Source: Planul național de gestionare a deșeurilor (PNGD) [15]

The total WEEE treatment capacity in Romania is about 120,000 tons/year. Given that the largest amount of WEEE forecast to be generated in 2020 is about 70,000 tons / year, it results that there is sufficient capacity to treat WEEE to cover the entire amount of waste generated, in accordance with the principle of proximity.

The importance of estimating WEEE generated at national level stems from the need to know the value (in kg) as a basis for defining collection targets (Article 7 of WEEE Directive 2012/19/EC). Starting with 2021, Romania has the option to set the collection target either on the basis of EEE placed on the market (POM) or on the basis of generated WEEE, according to the table below. The alternatives for Romania are:

- 65% of POM average for 3 foregoing years
- 85% of WEEE estimated to be generated in one year.

Table 1: WEEE collect targets form the EU Directive and the derogations for Romania

Year	2014	2015	2016	2017	2018	2019	2020	2021
WEEE target in Directive	Min. 4 kg/pers. or average kg/pers. collected annually in 3 foregoing years (the higher value)		Min 45% POM (average of 3 foregoing years)			65% POM (average of 3 foregoing years) or 85% from WEEE generated		
Target for Romania	Min. 4 kg/pers. or average kg/pers. collected annually in 3 foregoing years (the higher value)		Min 45% POM (average of 3 foregoing years)			65% POM (average of 3 foregoing years) or 85% from WEEE generated		

Source: ECOTIC Study 2019 [10]

At European level, WEEE collection data is centralized in the European Commission's Eurostat database. The presentation of the indicator is in kg / inhabitant / year. From the statistical data available at EUROSTAT, it can be seen that Romania is on the last place in the EU, in terms of the amount of WEEE collected per capita, per year, for the entire period analysed.

Table 2: WEEE Quantity Collected in Romania and some EU Countries (kg/inhabit./year)

Country	2013	2014	2015	2016	2017	2018
<i>UE 28 (2013-2020)</i>	<i>6,06</i>	<i>6,2</i>	<i>6,91</i>	<i>7,99</i>	<i>8,02</i>	<i>7,84</i>
Great Britain	7,4	7,86	10,06	14,66	13,04	12,16
France	6,92	7,41	8,64	9,99	10,18	11,18
Germany	7,65	7,6	7,63	8,63	9,13	9,32
Bulgaria	4,67	5,73	8,19	7,89	6,68	:
Poland	4,3	4,29	4,99	5,66	5,98	:
Spain	4,33	3,79	4,61	4,95	5,63	5,96
Greece	3,36	4,02	4,42	4,84	5,08	5,28
Romania	1,55	1,5	1,79	2,19	:	:

Source: Eurostat, 2020 [11].

Although these figures increased during the analysed period, reaching from 1.55 kg /inhabitant/year in 2013 to 2.19 kg/inhabitant/year in 2016 (the

latest data available at EUROSTAT), Romania is far from the target established at European level for the period 2014-2015, which is 4 kg/inhabitant/year.

5.2. Analysis of WEEE quantities generated and collected in Romania

The National Agency for Environmental Protection is the institution responsible for the implementation of all waste management tools at national level and, therefore, of WEEE. The Environmental Status Report, which NAEP prepares annually, presents figures on the evolution for a period of five years of both the quantities of EEE placed on the market and the quantities of WEEE collected.

Figure 2: The gap between POM EEE and WEEE collected in Romania
Source: own analysis of available data [12].

The evolution of the quantities of EEE placed on the market in the period 2013-2017 is presented in Table VII.2 in Chapter VII and the evolution of the quantities of WEEE collected in the period 2013-2017 is presented in Table VII.3 of the same chapter of the Environmental Status Report. Figure 2 shows the gap between these two indicators.

The difference between the two quantitative indicators is far greater than the amount allowed by the objectives assumed by Romania in the European context.

Between 2008 and 2015, an annual WEEE collection target of at least 4 kg of waste / inhabitant had to be achieved. Despite all the efforts

made by the responsible authorities and economic operators, the annual collection target of 4 kg / inhabitant / year was not reached. The same situation, of not reaching the minimum collection objective provided by the legislation (at least 40% compared to the average of the quantities of EEE introduced on the market in the previous 3 years) was registered in 2016.

5.3. Green Stamp - an economic tool for WEEE management

The Administration of the Environmental Fund is the institution responsible for the collection and administration of the amounts obtained through the tax called Green Stamp [14]. The values of the green stamp can be found in a table available at <https://www.ecotic.ro/wp-content/uploads/2020/03/Lista-Timbru-Verde-ECOTIC-01.03.2020.pdf>. The value of the Green Stamp is relatively small: 3-7 lei for TVs, 15 lei for refrigerators, 3 lei for monitors, 2 lei for laptops, etc. Because the values are small, the amounts collected in the Environment Fund are small.

From the annual budget of revenues and expenditures of the Environmental Fund we can see which are the amounts forecasted to be obtained from this tax. Unfortunately, this appears in the institution's budget only from 2018, and for 2020 only estimated data are available. It should also be noted that every year there have been budget corrections which, although in the period 2018-2019 have not brought significant changes, may still produce variations in the final budget, especially in current economic conditions.

Table 3: Green Stamp Fee in the AFM Budget (thou lei)

Indicator	Program 2017	Program 2018	Program 2019	Program 2020
w) Contribution due to economic operators introducing electrical and electronic equipment on the national market	-	15.000	15.000	3.000

Source: Authors representation [16]

It should be noted that the relatively small amounts (of the order of three million euros per year) are therefore difficult to start investment for activities as: collection, transport, collection / sorting centres, dismantling centres, etc.

It is based on the optimistic assumption that citizens will dispose of WEEE in an orderly manner as various collection campaigns take place. These campaigns are carried out by city management, which have no direct responsibilities in this area. In 2019, EFA carried out a program called The Scrap for Home Appliances which was financed with the amount of

15,796,600 lei. The Scrap for Home Appliances program gives those who want to get rid of old appliances that consume a lot of electricity the opportunity to give them away in exchange for a voucher that can be used to buy new ones. Those who want to replace their old appliances will be able to receive vouchers with the following values:

- 200 lei to buy A ++ energy efficient washing machines and A and A + energy efficient TVs;
- 300 lei to purchase washing machines with A +++ energy efficiency, dishwasher A ++ energy efficiency and refrigerators / freezers / freezers / freezer with A ++ energy efficiency;
- 400 lei for the purchase of dishwashers with energy efficiency A +++, air conditioners, including portable air conditioners, with energy efficiency at cooling A +++ / A ++, refrigerators / refrigerators / refrigerators / freezers with energy efficiency A ++ and A ++ and A +++ energy efficient TVs.

It is estimated that approximately 100,000 vouchers have been granted so a similar number of large appliances have been replaced with new, more efficient models. This voucher system does not significantly change the stock of electrical and electronic equipment in the possession of the population.

6. Discussions

As shown, in Romania there are great difficulties related to the collection and recycling of WEEE. Existing tools, the green stamp, awareness and collection campaigns and producer responsibility are not enough to meet the recycling targets.

Green Stamp is too low and authorities in charge cannot collect amounts large enough to finance investment for the collection, transport, recycling and recovery.

Information campaigns have been going on for a long time and no longer have the desired efficiency. It would be useful to limit the money spent on information and to invest the remaining amounts in activities with a greater impact on the recycling process.

Also, the collection system is too complex and does not allow easy adaptation to realities. Basically, citizens can exchange old equipment only if a buy-back scheme is in place. Otherwise, the collection is mediated by the responsibility transfer operators who receive funding from the EFA.

In order to be able to reach the recycling targets assumed by Romania, a complex of measures is needed. These measures may be as follows:

- Increasing the value of the green stamp to 100-150 lei for a new product in the category of large appliances: refrigerators, air conditioners, televisions, washing machines etc. Buyers who exchange an old product will be exempted from paying the green stamp. From the experience of the Scrap for Appliances program, it resulted that an amount of 100-150 lei is enough to convince the buyers of new appliances to bring an old one in exchange;
- Limiting the amounts spent on information campaigns for the population and continuing them online. WEEE collection campaigns should be continuous actions and not just campaigns from time to time.
- Elaboration of feasibility studies to determine the number and locations of centres for collection and recycling of used household appliances; studies can be funded through the Environment Fund.
- Simplification of the WEEE collection system through a scheme comprising a maximum of 3-4 institutions.

7. Conclusions

The EU is the driving force behind progress in WEEE management. European Union sets policy framework for solid waste management leading to reform initiatives in new EU Member States and candidate countries.

EU policies, implementation objectives and grants establish the enabling environment that transforms the solid waste management sector in Romania and other countries. EU directives guide Member States towards achieving agreed targets without specifying in detail how specific measures should be implemented. Different directives establish the legal framework for WEEE management and provide specific data and an implementation schedule. The answers to the questions raised following the analysis of WEEE management in Romania are as follows:

	Question	Answer
1	What needs to be done to have a better estimate of EEE waste generated in Romania?	Creating a computerised system and a database that presents in real time the electrical and electronic equipment that reaches the market.
2	What economic tool needs to be added to existing ones to increase recycling in the case of WEEE?	The green stamp should be increased to 100-150 lei/appliance.
3	Is the existing mechanism still useful or is it necessary its modification?	The existing system is too complex and should be modified in the sense of a lean and more flexible system.

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Annex 1: The degree of fulfilment of the capitalization objectives of WEEE collected in Romania, 2013-2017 (%)

Nr. crt.	Category	Capitalization objective provided in legislation (%)	Achieved capitalization objectives (%)				
			2013	2014	2015	2016	2017
1.	Large household appliances	80	93	93	70	84	88
2.	Small household appliances	70	89	88	93	75	91
3.	Computer and telecommunications equipment	75	85	87	78	99	91
4.	Consumer equipment	75	88	88	83	87	77
5.	Lighting equipment	80	92	93	54	80	69
6.	Electrical and electronic tools	70	88	91	95	71	91
7.	Toys, sports and leisure equipment	70	84	84	65	82	84
8.	Medical devices (except all implanted and infected products)	-	-	-	-	-	-
9.	Supervision and control tools	70	86	88	71	89	95
10.	Vending machines	80	92	93	83	88	86

Source: NAEP, RSM 2018 [12].