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Best practice WEEE collection systems in Europe

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EXECUTIVE SUMMARY

Recycling and re-use of used electric and electronic equipment (WEEE) number among the urgent problems of modern waste management. WEEE includes valuable resources as well as hazardous compounds. The collection of WEEE as the first step in waste management experiences a number of difficulties. The amended WEEE directive urges the Member States to collect 45% used appliances as compared to the mass of electric and electronic devices put on the market in three foregoing years. The minimum collection target is valid from 2016 on and will be increased up to 65% in 2019.

Being aware of the ambitious targets, the question arises how Member States with “best practice” organise their collection systems and how they enforce the parties in this playing field, especially the citizens. Therefore, the WEEE schemes of some countries with high collection rates (Sweden, Denmark, Switzerland, Germany, and the Flemish province of Belgium) were investigated with special focus on the categories IT and telecommunications equipment (IT/TC, category no. 3), consumer equipment like audio systems (no. 4) and discharge lamps containing hazardous substances, e.g. mercury, (part of no. 5).

We conclude that there are some important prerequisites for successful collection:

- The relations between producers, municipalities, citizens, waste management companies, and retailers should be designed very carefully. The responsibility of each group of stakeholders has to be defined. Different economic interests may disturb the whole system and should be oriented towards the common goal using adequate tools.
- People get accustomed to separate collection of WEEE by time. Raising public awareness for separate collection by smart information campaigns, and collection systems being convenient for the citizens seem to be of importance.
- In most countries under investigation, recycling yards turned out to be the most important collection points for WEEE. Special containers in shopping centres, lidded waste bins, and complementary return of used devices in all retail shops for electric equipment are useful supplements.
- Kerbside collection of WEEE is suffering from theft and destruction of used appliances. The integration of the informal sector remains a challenge.

The results from the study serve as an indication for best practice methods for WEEE collection.

INTRODUCTION

Waste from electric and electronic equipment (WEEE) covers an enormous potential of non-renewable resources, especially non-ferrous metals. Informal collection in Europe [Lange et al. 2011] often leads to illegal export of WEEE to China, West Africa, and India, where unsafe recycling practices may cause enormous contaminations. This highlights the importance of separate collection of WEEE. The first WEEE directive urged the member states to collect 4 kg inh⁻¹ yr⁻¹ of used electric and electronic equipment. The amount of used electric and electronic devices collected separately differs widely in Europe. The amount of electric and electronic equipment sold

correlates with the national per capita GDP as has been demonstrated by an empirical investigation [Huisman et al. 2007, Huisman 2010]. Therefore, the absolute collection target, i.e. 4 kg inh⁻¹ yr⁻¹ is very low with respect to booming national economies and may be too high for new Member States in Eastern Europe. As a consequence, new goals were introduced based on the relation between the amount of WEEE separately collected and the amount of new appliances put on the market in the three foregoing years. The new objective will be 45% in 2016 and will be increased to 65% in 2019 or alternatively 85% of WEEE generated. Only few European countries are in the position to meet the 45% target as may be taken from EEA statistics [EEA 2013].

DESIGN OF THE STUDY

In this study, the “state of the art” of WEEE collection shall be evaluated by comparing the implementation of the directive and the practice of European countries with relatively high collection rates. The following questions should be answered:

- Which collection channels for WEEE have been introduced?
- Which collection channels are working more or less successful?
- How citizens are informed about bring back- and take back-obligations?
- What about re-use of electric appliances?

From a former study about problems of WEEE collection, the relations between stakeholders turned out to be of crucial importance [Friege 2012]. Therefore, the interface between producers, municipalities, citizens, waste management companies, and retailers was focused. Two collection groups (CG) are of special interest for this study: IT and telecommunication equipment (WEEE directive 2002, category 3), video and audio devices (WEEE directive 2002, category 4) with a high concentration of non-ferrous metals, and gas discharge lamps (WEEE directive 2002, category 5b) because of the mercury content.

The countries were chosen as follows: The amount of WEEE collected in Denmark and Sweden exceeds 15 kg inh⁻¹ yr⁻¹. The same is true for Switzerland which does not belong to the European Union. With respect to the new objective, the amount of WEEE collected in Germany (2010) is near 45% [Sperlich 2013]. Belgium (~ 9 kg inh⁻¹ yr⁻¹) was also included in the evaluation because of increasing collection results and special regulations in the Flemish region with ambitious objectives.

For each country, the implementation of the directive with special focus on the relationships between the stakeholders as well as the types and relevance of collection systems were evaluated.

RESULTS

The data for the appliances put on market in 2007-2009 (mean value) and the amount of used devices collected in 2010 in these countries are summed up in Table 1 using the new definition for the collection rate [EC 2012]. Switzerland does not report figures for electric appliances sold. The specific GDPs (mean values between 2007 and 2009) are also indicated in Table 1. It is easily seen that the specific GDPs correlate with the amount of electric and electronic devices put on the market. For more details the reader is referred to [LANUV 2014] and [Friege et al. 2015]. Figures on re-use or refurbishment are only partially available.

Germany

Collection of used electric and electronic devices was introduced in 2005. In contrast to many other European countries, there are no producer responsibility organisations (PRO) with the exception of a special organisation for gas discharge and LED lamps. The national register for waste electric equipment (“Stiftung ear” - EAR) was founded by producers as their Clearing House for the purposes of the German law on WEEE (ElektroG). The collection is due to the municipalities which are also obliged to store the devices until delivery to WEEE treatment facilities. EAR coordinates the provision of containers and the pick-up of electrical and electronic waste equipment at the municipal transfer points for WEEE. Public local authorities inform the citizens about take back opportunities. Due to the decentralized collection system of WEEE, there are no nationwide awareness campaigns with the exception of gas discharge lamps.

Table 1: Electric and electronic equipment put on the market between 2007 and 2009 (mean value) and amount of WEEE separately collected in 2010 (data taken from [EEA 2013])

Germany GDP/inh: 29,533 €	Put on market 2007-09		Collected 2010		Collection rate [%]
	[Mg]	[kg/inh * yr]	[Mg]	[kg/inh * yr]	
All types of (W)EEE	1,718,400	21	777,035	9.5	45%
CG 3	572,667	6.9	409,197	5.0	72%
CG 4	99,234	1.2	11,876	0.1	12%

Belgium GDP/inh: 31,867 €	Put on market 2007-09		Collected 2010		Collection rate [%]
	[Mg]	[kg/inh * yr]	[Mg]	[kg/inh * yr]	
All types of (W)EEE	282,910	27	105,556	9.7	36%
CG 3	101,433	9.2	41,351	3.8	42%
CG 4	30,866	2.8	2,713	0.3	9%

Denmark GDP/inh: 41,667 €	Put on market 2007-09		Collected 2010		Collection rate [%]
	[Mg]	[kg/inh * yr]	[Mg]	[kg/inh * yr]	
All types of (W)EEE	174,217	32	82,931	15	48%
CG 3	50,100	9.1	41,507	7.5	83%
CG 4	6,673	1.2	702	0.1	11%

Sweden GDP/inh: 34,883 €	Put on market 2007-09		Collected 2010		Collection rate [%]
	[Mg]	[kg/inh * yr]	[Mg]	[kg/inh * yr]	
All types of (W)EEE	246,190	27	161,444	17.3	66%
CG 3	96,130	10	69,565	7.4	72%
CG 4	16,633	1.8	4,396	0.5	26%

Switzerland GDP/inh: 45,600 €	Put on market		Collected 2010		Collection rate [%]
	[Mg]	[kg/inh * yr]	[Mg]	[kg/inh * yr]	
All types of (W)EEE			117,400	15.1	
CG 3			50,700	6.5	
CG 4			1,130	0.1	

The costs for collection and storage of WEEE have to be paid by the municipalities, whereas all other costs are due to the producers and importers. The cities and counties have the right to recycle or sell the WEEE collected choosing one or more complete collection groups for one or more years. Driven by the increasing prices of metals, most German cities now sell collected electric and electronic appliances with the exception of freezers or bulbs on their own account thus decreasing the waste charges. This leads to problems for the producers which have to pay for the residual WEEE fractions part of them including hazardous materials to be disposed. Statistical data for refurbished and re-used electric appliances of all types are highly varying from year to year. For 2010, re-use of 8872 Mg WEEE was reported. This is about 1% of all WEEE collected.

The collection of CG 3 yielded 409,000 Mg in 2010 ($\sim 5 \text{ kg inh}^{-1} \text{ yr}^{-1}$); this number covers 76.4% and 90.8% of the mass of category 3 and 4, respectively, put on the market in the same year. The high amount of category 4 may be explained by the exchange of CRT devices by light flat screens (LCD or plasma). Consequently, the amount collected separately decreased in 2011 and 2012. The collection of CG 4 yielded about 12,000 Mg ($\approx 12\%$). Statistics about the collection channels

are not available. In many large cities, kerbside collection of WEEE, especially of large household devices, freezers, and TV's, seems to be the most important take-back system. There are about 1,700 recycling yards accepting more or less all types of valuables from waste. The amount of WEEE taken back by department stores and DIY (on a voluntary basis) is relatively small. Kerbside collection of WEEE is often disturbed by waste pickers. Valuable parts like copper tubes are cut off from freezers and refrigerators leading to emissions of chemicals like CFCs. Similar destructions may be observed with CRT's. Many devices are stolen and either sold to scrap dealers in Germany or illegally exported. ~ 37% of all WEEE are collected by waste pickers.

Denmark

Collection of used electric devices was already established before 2005. Dansk Producentansvarssystem (DPA) keeps the register for new electric and electronic products and acts as a supervisor for other players – e.g. PROs, municipalities, recycling facilities – within the WEEE system. For CG 4 a special organisation has been founded. Consumers pay for WEEE management when purchasing a new appliance. The Danish ordinance obliges the municipalities to inform the citizens and to collect e-waste. The PROs have contracts with the municipalities regulating temporary storage facilities and information exchange. The reimbursement of municipalities is not explicitly regulated by law, but the costs for WEEE collection are partially refunded. Retailers take back used devices on a voluntary basis. WEEE collected has to be delivered to the PROs. The producers and importers have to finance recycling, disposal and central storage areas where communities and retailers drop off post-use equipment.

Elretur, LWF and other PRO's inform the citizens about WEEE in general. The municipalities inform people about take-back points. About 90% of all devices are collected by the municipalities which operate about 400 recycling yards. These facilities are the most important take-back points, especially in rural areas. In a number of cities, additional systems for small WEEE are established. In 2011, the mass of TV screens and computers put on the market decreased, whereas the amount of separately collected devices exceeded the mass of new devices. This finding underlines the importance of replacing CRTs by lighter screens. As to CG 4, the mass of separately collected lamps increased from 458 Mg in 2004 to 705 Mg in 2012, but the collection rate remained nearly constant.

DPA publishes all data for collection on a local basis and also all data for recovery of WEEE thus motivating the stakeholders to enhance their results.

Sweden

Producer responsibility for WEEE was introduced in 2001. The implementation of the EU directive is similar to the Danish system. Electric and electronic appliances are registered by the Swedish environmental agency. The most important PRO in Sweden, EI-Kretsen, made contracts with all 290 municipalities which are responsible for the collection of WEEE; the reimbursement of the municipalities depends on the amount of collected material. EI-Kretsen also pays the costs for transport and recycling of WEEE. PRO's and municipalities are working for higher awareness of citizens towards collection and recycling of WEEE. Special campaigns (e.g. "Tack og hej" – "thank you and good bye") have been launched for CG 4 because of relatively low collection rates.

600 recycling yards serve as the backbone of the collection: ~140,000 Mg are dropped there each year. In the cities, these facilities are also open at the weekends. About two thirds of Swedish local authorities offer additional service for households like kerbside collection, special waste bins for the door to door collection, vans ("miljöbilen") and WEEE container in public areas. As to CG 3, developments similar to Germany and Denmark could be observed. Most used lamps and bulbs are brought back to the recycling yards, but the importance of take-back points in shopping malls is increasing.

Belgium / Flanders

RECUPEL is the only PRO in Belgium consisting of several organisations each being responsible for one WEEE category. RECUPEL raises money from the producers to finance transport and recycling of WEEE as well as for the reimbursement of the communities. Flanders has its own

waste management law. The Flemish regulations cover a collection target of 8.5 kg inh⁻¹ yr⁻¹ and a compulsory take-back by retailers in case of purchasing a new appliance. The municipalities are responsible for the collection of WEEE. They have to leave the collected appliances to the PRO. Useable appliances may be handed over to non-profit workshops for refurbishment.

There are 547 recycling yards in Belgium, most of them (320) in Flanders. Used items may also be dropped at about 4,000 retail shops and more than 20 second hand stores. Kerbside collection of WEEE is unusual. A network of second hand stores and workshops has been established, which is supported by the Flemish Government. As to the Flemish region, the specific collection rate (11.5 kg inh⁻¹ yr⁻¹) was considerably higher than in the other parts of the country. For take-back, recycling yards are most important, but a considerable amount of used items is going to a relatively small number of second hand shops. The amount of WEEE re-used was nearly 5,500 Mg in 2010 (~5% as compared to all WEEE separately collected) being far higher than in the other countries investigated. In the case of gas discharge lamps take-back by retailers seems to be more important as compared to the municipal systems.

Switzerland

In contrary to the EU, there are no obligations for the registration of electric and electronic appliances and also no objectives like recycling rates. The costs for the WEEE management are paid by the consumers when purchasing new electric or electronic devices ("vRG": advanced recycling fee). These fees are used for all WEEE activities. All post-use appliances collected have to be delivered to the organisations of the producers. Consumers are obliged to bring back their used devices to public or private recycling yards. Retailers have to take back used devices even if the client does not purchase a new one. As there is no information about the amount put on the market, the development of the collection rate is not clear. The amount of WEEE comparable to CG 3 increased from less than 30,000 Mg in 2003 to more than 60,000 Mg in 2012. Also in Switzerland, more than 50% of these items are dropped off at the recycling yards, retailers ranking behind. In 2012, 1,161 Mg lamps with hazardous components and 2,241 Mg other lamps and bulbs were collected.

DISCUSSION

The amount of WEEE collected has normally increased with few exceptions since the installation of national systems. In Table 2, some details about the collection channels are summarized. Unfortunately, statistical data are often incomplete. The high importance of municipal collection systems is in line with an investigation of the implementation of the directive in a number of European countries [Cahill et al. 2011]. Kerbside collection of white goods, freezers and other used electric appliances is executed in many large German cities, the relationship between the different collection channels not being clear due to lack of statistical data. Municipal collection (kerbside collection plus recycling yards) exceeds take-back by retailers by far. In all other countries investigated, recycling yards turned out to be the most important drop-off option. A weak relation between the total amount of WEEE separately collected and the number of people sharing one recycling yard was found ($R^2 = 0.69$). As may be taken from the results presented, retailers prove to be the next important collection channel. For appliances belonging to CG 3, the order of precedence seems to comply with WEEE in general, whereas the importance of retailers is equal or greater as compared to recycling yards in the case of CG 4.

CONCLUSION

Extended producer regulations (EPR) often do not achieve the desired results or cause side effects [Huisman 2010; Khatriwal et al. 2008; Rotter et al. 2011; Scheijgrond 2011; Massarutto 2014]. The results presented here underpin that EPR is a raw tool which has to be forged carefully to obtain satisfying results. The relationships between stakeholders are extremely important to make EPR schemes really working. Coordination between PROs, retail chains, and municipalities is necessary. Take-back channels and information thereon by producers or PROs should be adjusted with the municipalities being in close contact with the citizens. The acceptance and popularity of recycling yards for all types of WEEE should be used to optimise this drop-off channel

- by extending the opening hours,
- by information of the public about the location of take-back and collection
- by installing more recycling centres, e.g. one per 50,000 inhabitants or less.

Besides that, it is necessary to develop collection methods which cannot be disturbed by waste pickers, e.g. door-to-door collection, lidded waste bins, take-back machines in shopping malls.

Table 2: Relevance of collection channels

	Obligatory take back of WEEE by retailers	Relevance of collection channels				
		Kerbside collection	Recycling yards	Retailers	Second-hand shops	Others
Germany	No, only voluntarily	Mostly executed in large cities	1,700 recycling yards	unimportant	unimportant	unimportant
Denmark	No, only voluntarily	Only in densely populated areas	94.4%	3.8%	?	1.7%
Sweden	No, but engagement of the retailers	Only in densely populated areas	Most important (> 90%?)			
Belgium (Flanders)	Yes, in case of new product purchased	Generally unusual	60% (54.2%)	24% (27.0%)	10% (12.2%)	6% (6.5%)
Switzerland	Yes, independent of purchasing a new product	Generally unusual	58%	17%	unusual	25%

Retailers have a complementary role for taking back post-use appliances. Direct take-back systems of producers could gain of importance for certain products; today, they are more or less restricted to B2B solutions.

Collection rates should be published in detail (e.g. on the municipal level according to take-back channels) to enhance the motivation for the stakeholders involved and to simplify optimisation of rates and costs. This allows also public competition between municipalities in waste management with respect to the recycling systems offered to their citizens. This might help to increase collection rates.

Systematic support of re-use activities by the authorities could become more important to reduce waste from WEEE thus complementing collection activities in general. Examples found in Europe like the Flemish initiative should be carefully investigated to learn about an optimal legal and economic framework.

Though the experiences of various countries presented here cannot be transferred in a simplistic manner due to different cultural and historical developments influencing waste management, they may be used as an indication for best practice in Europe.

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The separate collection of small waste electrical and electronic equipment (WEEE) in Florence area

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Abstract

The article sets out to describe our approach to Waste Electrical and Electronic Equipment (WEEE) separate collection, included in the bundle "R4 – R5" identified by Decree 151/05. Quadrifoglio, which manages municipal wastes in Florence and in its area, has enabled a new form of collection that provides for the interception of small household waste through the conferral by the users in the network of collection points displaced on the territory. The project, called "Ecotappa" provides that in the non-residential users such as museums, libraries, schools and associations shall identified spaces for the collection of the wastes by households that cannot be collected with the normal collection. With this system are collected waste such as batteries, expired drugs, aerosol cans, toner cartridges, vegetable oil, neon and low-power lamps and Small home appliances (WEEE). For example, fall into this type of collection phones, radios, MP3 players, CD players and portable recorders small, small mixers, shavers, irons, electric toothbrushes, cordless.

For the same types of waste in the main city markets are brought the Ecofurgone: presence during the hours of the market guarantees citizens the possibility to deliver their waste.

The system of collection of WEEE through ecotappa will also be integrated with control waste delivery system, that allow the user recognition: The identification process improves the relationship quality between user and waste company, linked to the user responsibility on behavior and habits, and consequently on the own waste production.

Introduction

In comparison with the main European countries, Italy has one of the lowest rates of collection of small WEEE (16.8%), below the continental average of 26%. The reason for the success of the best performing countries is the density of ecologic island, one for every 10,000 inhabitants, whereas in Italy is notable less diffusion of ecologic islands.

The information on the separate collection of electronic waste remains a major weakness: while 80% of citizens know the collection of municipal waste only 50% are aware that WEEE must be managed as a specific waste stream.

The collection of small WEEE is stronger than the other groupings WEEE, recording a collection grow rate of 6 percentage points higher than the national average for the entire WEEE sector (3%) between the years 2013 and 2014. It is estimated waste from small WEEE collected on the total

generated ones, it is believed that in Italy we have come to a value of about 17.6% (40 million tons of 231).

In Italy almost half of the adult population (about 23 million adults) buys an average of more than two units in one year and 37% throws away at least one small electronic device or small appliance. 19 Millions of Italians have managed the disposal of an electronic device, but only 8.5 million (i.e. only 42%) have adopted the correct behaviour, or by going to the ecological island collect WEEE from the shopkeeper.

Furthermore, the increasing diffusion of separate collection shows the need to develop new types of collection for all types of waste, as separate collection of small waste electrical appliances: Waste Electrical and Electronic Equipment (WEEE) is one of the fastest growing waste streams. Small electrical appliances are made up of materials which are in limited supply, such as rare metals and plastics, and so we should be reusing and recycling them wherever possible.

Quadrifoglio s.p.a. Servizi Ambientali Area Fiorentina

Quadrifoglio s.p.a. Servizi Ambientali Area Fiorentina, is engaged in the services of collection, sweeping and treatment of urban waste in the Municipality of Florence, Sesto Fiorentino, Campi Bisenzio, Calenzano, Signa, Bagno a Ripoli, Scandicci, Fiesole, Greve in Chianti, San Casciano Val di Pesa, Impruneta and Tavarnelle Val di Pesa with a total area of about 922 sq km and about 664 thousand inhabitants and a production of 410,000 t of waste. This number is strongly influenced by the enormous attraction that holds the town of Florence.

During the years the percentage of recycling shows a steady increase due to the significant reduction of mixed waste collected for either a greater sensitivity to the collection, both for raising projects carried out, both for the general decline in consumption in recent years.

WEEE Collection

Quadrifoglio collect WEEE through different modes:

- Waste collection center / ecological islands
- Collected by appointment
- One-for-one at a retailer
- Ecotappa and Ecofurgone.

- **Waste collection center / ecological islands**

The “Eco-stations” and “Collection Centers” allow to increase recycling, by conferring directly from users all type or size of separate waste that are not compatible with the road waste collection. Quadrifoglio manages 7 collection centers, located evenly in the territory. The management of the collection centers is assigned to 19 employees that allow the activities of the service for about 15,000 hours / year. In 2014 they had access to the service and 60,936 users have collected 4,276 tons of waste: 43% of this amount is represented by WEEE, to about 1,245 tons.

- **Collected by appointment.**

Quadrifoglio collects at home bulky waste and waste electrical and electronic products from households. The service is intended for large volumes of WEEE as an alternative to the

transfer to the collection center. This system has allowed us to collect 1,176 tons of WEEE in 2014.

- **One-for-Zero and One-for-one at a retailer.**

The introduction of the "one-for-zero" for collection of small WEEE is the new higher of those introduced by Legislative Decree 49/2014 regarding the WEEE (waste electrical and electronic equipment) passed in implementation of Directive 2012/19/EU. "one-for-zero" is the withdrawal of small household WEEE (external dimensions of less than 25 centimeters) by the distributor, even if the consumer does not purchase new equipment and equivalent.

This mode is added to "one on one", that is when consumers purchase new equipment and equivalent to the old one which leaves at the distributor.

In Quadrifoglio area these systems allow us to collect 1,191 tons through Distributors.

- **Ecotappa and Ecofurgone.**

Ecotappe and Ecofurgone systems are essentially dedicated to the interception of waste that cannot be conferred on the Collector road, door to door or bins, but for size or type can be managed without having to give the Ecological Station or at the collection center.

The network of small containers is distributed over the entire area managed, as well as the presence of the van at the markets, providing the service to all users.

During 2014, the system has collected 142 tons of WEEE, coming entirely from small appliances.

Ecotappa and Ecofurgone

The EU directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE) defines the Small Appliance as a device with no external dimension more than 50 cm, including home appliances, consumer equipment, Luminaires, Equipment reproducing sound or images, musical equipment, electrical and electronic tools, toys and equipment for leisure and sports, medical devices, monitoring tools and control, vending machines, equipment the generation of electric current.

The same directive calls for appropriate interventions to minimize the disposal of WEEE as unsorted municipal waste and to ensure the correct treatment with the aim of:

- achieve a high level of separate collection by setting up systems allowing final holders and distributors to return such waste for free;
- ensure the availability and accessibility of collection centers considering the density of the populations;
- organize a network of distributors to collect small WEEE (external dimensions below 25 cm) for free and with no obligation to buy EEE of an equivalent type.

Quadrifoglio has enabled a new form of small WEEE separate collection providing for the interception of small household waste through the conferral by the users in the network of collection points displaced on the territory.

The model outlined in the European context brings to the organization of a structure of collected WEEE in which integrates well with the collection procedures adopted by Quadrifoglio.

We call this network of collection points Ecotappa – Ecofurgone:

- The Ecotappa is a place identified in a non-domestic user (as museums, libraries, schools and associations) that are agreement with the operator of the MSW. The area is equipped with suitable and appropriate boxes for separate collection by domestic users of particular types of waste which are not conferrable to the normal collection system.
- The Ecofurgone is equipped vehicle used to bring the collection points to citizen needs. It is parked at main city markets according to specific time slots and is controlled by one of our employees in charge of waste collection.

With this system are collected waste such as batteries, expired drugs, aerosol cans, toner cartridges, vegetable oil, neon and low-power lamps and Small home appliances (WEEE). For example, fall into this type of collection phones, radios, MP3 players, CD players and portable recorders small, small mixers, shavers, irons, electric toothbrushes, cordless.

Since 2008 the network "Ecotappa - Ecofurgone" was developed with nearly 1600 boxes: there are currently 46 active collection points Ecotappa, while 33 markets are served through the Ecofurgone. The increase in the amount of small WEEE is mainly attributable to the collections from Ecotappe and Ecofurgone. This is evident when you consider that over 43% of R4 and the 83% of R5 are collected with this system.

During the six years of activity we have seen the increase of oil collection, the Household Hazardous Waste (HHW) and especially of WEEE. Excluding the first year, the average annual growth of the total waste collected was equal to 27.5%, of whom WEEE accounted for the 40%.

Overall in 2014, the ecotappa has collected 484 tons of waste, divided into 145 tons of WEEE, 183 household hazardous waste (HHW) and 155 of vegetable oil, with an average increase of 10.6% over the previous year.

The labor resources used to deliver the service are formed by a worker and a truck cab, both for the emptying of the collection points fixed (Ecotappe), both for the market presence with the Ecofurgone. In 2014, the collection service has been carried out through the use of 7 vehicles and 7 workers.

The development of the collection has the goal of increased amounts of small appliances collected through the system Ecotappa: the increase of the collections can be achieved through the recognition of the user at the time of the contribution and a rewarding linked to the number of contributions made in the time period set.

The main purpose is the spread of good behavior towards the environment, going beyond the simple collection, focusing users on the recovery of all those objects that cannot be collected with the normal service in bins or door-to-door .

The realization of a efficient and shared separate collection project can be based on technologies and organizational communication tools favoring the active participation of citizens and management innovation. The level of the user's involvement depends by the communication and information of process: in this case the waste collection.

An high level of interconnection and involvement occurs when all the access points to the collecting services (Bins, collection center, points of distribution kit, ecovan, Hazard urban waste collection points, etc .) are equipped with a **control waste delivery system**.

The development of this project is made possible through the contribution of the WEEE Coordination Centre, which aims to encourage the increase of the collection of WEEE within the

general tasks of management of the system on a national scale through collective take-back systems.

The identification process improves the relationship quality between user and waste company, linked to the user responsibility on behavior and habits, and consequently on the own waste production. The Manager knows the user habit, the user know that the company can process this knowledge to define his waste producer profile.

To identify the user at the Ecotappa is necessary to integrate the container suitable to the characteristics of the waste to be collected with the control waste delivery system.

The user identification is possible through the possession and use of an electronic key with code RFID and uniquely tied to user code of municipal tax. The electronic key is the passepartout to the services of the Manager in the municipality of residence of the user: the electronic key will be provided to all users of the area served, thus allowing access to all the services involving use.

EWIT: Developing an e-waste implementation toolkit to support the recycling and the secondary raw material recovery strategies in metropolitan areas in Africa.

The project on the collection of small appliances is candidate tool in a development project of the WEEE management in the metropolitan areas of some African cities.

Urbanization is on the rise in Africa and this trend is expected to continue in the future. The fast growing use of technology is creating a rising ewaste stream, for which there is limited recycling capacity. Waste management infrastructures and public awareness of the health issues is largely non-existent. Basic environmental precautions are almost absent and health and safety regulations are loosely enforced. Improvements are therefore urgently needed to combat related health issues, alleviate poverty and develop the local recycling sector. EWIT project's aim is to address these challenges, assisting African municipalities in the implementation of effective e-waste management systems for their communities.

The project will develop a comprehensive mapping of the baseline data of African metropolitan areas related to e-waste management, analyzing the most relevant experiences, processes and legal tools available. It will then deliver a dynamic and easy to use information and service portal to offer guidance and practical support for the design and development of e-waste collection and recycling systems. EWIT will generate the expected impacts through 5 coordinated work packages. The working model is based on two different set of workshops, one led by "Cities" and the other by "Experts". Tools, implementation models, policies and procedures will feed a dedicated information and service platform called "E-waste implementation toolkit". This dynamic and easy to use internet portal will be a strategic source of knowledge for decision makers at industry and local government level. Dissemination will play a key role to assure that the project's deliverables are well understood and ready to be applied. EWIT will define the conditions and actions necessary to implement effective waste recycling systems in metropolitan areas, increasing recycling opportunities for entrepreneurs, generating new jobs and improving environment and health protection of local communities.

Conclusions

This activity feeds the urban mining, that is, the process of reclaiming compounds and elements from products, buildings and waste. In fact, in technologies including smartphones, flat-panel TVs, hybrid cars and wind turbines, a number of elements represent crucial components, for example indium, used in liquid crystal displays, europium in televisions and laser technology or terbium, used in electronic devices.

The amazing annual growth recorded allows us to consider further development of the draft collection through the extension of the network of Ecotappe view to the expansion of the collections in the area and the increase of the separate collection.

This collection system is developing rapidly: it shows an exponential increase of the amount collected between 2008 and 2014: it is essential that the growth could continue also in the coming years in order to achieve economies of scale that reduce the current high unit costs.

The goal can be achieved by increasing the number of containers available over the threshold 1.56 per 10,000 inhabitants that was reached in 2014, far higher than the European average. This would result in an increase of the amount above the average per capita to feed processes of Urban Mining and activities of materials recovery.

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