

Alternative management of waste of electrical and electronic equipment in Greece

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Abstract

Recycling of Waste of Electrical and Electronic Equipment (WEEE) in Greece is in the primary stage. Whilst recycling programs in general and for WEEE in particular, are common in other countries such as the UK, Netherlands, Denmark etc, in Greece it was only in 2000 that the qualified authorities began to discuss such recycling. The need for new WEEE management options, such as recycling, came up when the integration of community law in national legislation set obligations, requirements and targets concerning WEEE recycling. However, there are several factors to consider in the development of a successful national recycling program. This program should be based on its economic sustainability, technical feasibility and a realistic level of social support for the program. Since electronic recycling has a short history, there is not yet a solid infrastructure in place or the knowledge and a positive attitude to recycling. On the other hand, the existing collective system faces many weaknesses and obstacles, such as the turnover of recycling products in the informal market, which complicates further the effective implementation of the obligations that Greek and European legislation sets. Several issues are discussed concerning the awareness of all involved in the WEEE management process.

Keywords: recycling, Waste of Electrical and Electronic Equipment, collective system.

1 Introduction

The production of different types of electrical and electronic equipment constitutes one of the most rapidly developing sectors of the industrial production in the western world. This development, however, has made WEEE



as one of the most critical categories of waste. The problem that results from the production of WEEE is related with several factors such as their increasing volume, the wastefulness of raw material and energy, and finally with the environmental risks at the disposal site (landfilling, combustion etc) [1].

Electrical and electronic equipment (EEE) is assembled from more than 1000 materials (e.g. chlorinated and brominated substances, biologically active materials, acids, plastics, plastic additives and heavy metals such as lead, cadmium, mercury, hexavalent chromium) [2], which are toxic. Most of the consumers are unaware of the toxic materials in the products they use and this fact affects their attitude towards the way they treat them when these products reach their end-of-life.

So far the most common treatment methods all over the world for WEEE have been incineration and landfilling. Both of these treatment methods cause contamination problems due to air emissions and leachate to water sources. Concerning incineration, the major problem is that EEE consists of a variety of different substances. Due to that fact, incineration is particularly dangerous. The burning of electronic wastes results in high concentrations of metals in slag, fly ash, flue gas and the filter cake [2]. According to research in USA and Canada, municipal incineration is the largest point source of dioxins in the environment and among the largest point sources of metal contamination of the atmosphere [2]. The hazard of disposing the WEEE in landfill sites is inevitable, because none of the existing landfill sites are completely safe and in most cases leakage has been occasionally observed. For example, when brominated flame retardant plastics (a substance common in electrical and electronic devices) are landfilled, polybrominated diphenylethers (PBDEs), which are extremely toxic to human health, may leach into the soil and groundwater [2].

The conventional and most common disposal method for WEEE in Greece is disposal in landfills. Due to the fact that Greece has a peculiar geomorphology (too many islands, intense inland geomorphology) the increasing need for landfills is a burden to our environment. The lack of landfills, the shortage of existing landfills capacity, the lack of infrastructure and the lack of sensitivity of people for the consequences of inappropriate WEEE treatment lead to the need of alternative WEEE treatment methods.

The need for new WEEE management options such as recycling came out when the integration of community law in national legislation set obligations, requirements and targets about WEEE recycling. The European and Greek legislation set several quantitative targets for the collection and treatment of WEEE.

2 The transposition of the European legal framework for WEEE in the legislative milieu of Greece

As mentioned before, production of WEEE is one of the most rapidly developing waste streams in Europe. Due to this fact, many European countries have already adopted several legislative documents, laws etc., in order to face and control the emerging issue of proper management of WEEE.



European Commission (EC) published Directive 2002/95/EC (“on the restriction of the use of certain hazardous substances in electrical and electronic equipment” – RoHS Directive) [3] and Directive 2002/96/EC (“on waste electrical and electronic equipment” – WEEE Directive) [4], considering the environmental problems that are related with the management of WEEE, in order to implement and transpose the same framework for alternative management of WEEE among all EU members. These Directives show the community’s will to decrease the rate of WEEE production, to minimize the negative effects in environment and in human health as well as to spare natural resources via reuse and recycling [1].

In Greece, law No. 2939/2001 (“Packaging and alternative management of packaging and other waste. Foundation of National Organization of Alternative Management of Packaging and Other Waste”) [5] is the only law that describes and sets the frame for the alternative management of waste, in general, and for electrical and electronic equipment waste (WEEE), in particular. The basic aims of the law [5] include the reduction of the volume and the risks of the waste, the reduction of the uncontrollable disposal of WEEE, the adoption of quantitative targets for reuse and recycling of WEEE, commitment of administrators to participate in collective or individual systems of alternative management of WEEE products, and finally information and sensitization of citizens.

With regard to the financing of WEEE, producers will fund collection either through self-compliance and financing guarantees or through a collective system [6]. Although individual compliance is an option provided for in the law, it would be very difficult for companies to fulfil their obligations this way. The current legislative provisions, determine the following national quality and quantity targets:

- Separate collection of at least 4 kg of WEEE of domestic origin per resident per year, should be achieved until the December 31, 2006.
- Specific objectives as far as reuse and recycling of WEEE are concerned, should be reached by December 31, 2006. The percentage of reuse and recycling varies from 50% up to 80% minimum, depending on the average weight of the appliance as well as on the category of equipment.
- The above objectives of the separate collection and treatment will be re-determined by December 31, 2006 [6].

3 Collective system for the management of the Waste of Electrical and Electronic Equipment in Greece

The company “Appliances Recycling S.A” is the approved body for the operation of the Collective System for the Management of the WEEE in Greece. The role of “Appliances Recycling S.A.” is organisational and controlling. The company functions on a non-investment and non-for profit basis. It aims at the achievement of the national targets in order to implement the national and European Law as well as the effective monitoring of the cost of the alternative management of WEEE [6, 7].



Furthermore, pursuant to the Presidential Act 117/2004 and the Law 2939/2001 the producers of electrical and electronic equipment are obliged either to organise an individual system or to join a collective system for alternative management [6]. Therefore, the producers that have not proceeded to the organisation of an individual system participate in a collective system of alternative management. According to the legislation, producer of EEE is considered any person who:

- manufactures and sells EEE using his brand,
- resells equipment produced by other suppliers, using his brand,
- imports, by profession, EEE.

The benefits of the producers that join the “Appliances Recycling S.A.” are:

- The exemption from the obligations that are imposed by Law 2939/2002 and Presidential Act 117/2004 regarding the alternative management of WEEE.
- The right to mark their products with the special symbol as a proof of registration to the collective system of the alternative management of the WEEE [8].

The main categories of the products, according to the legislation concerning the management of WEEE, that “Appliances Recycling S.A.” collects, are [7]:

1. Large household appliances (such as large cooling appliances, refrigerators, washing machines etc.).
2. Small household appliances (such as vacuum cleaners, irons, toasters etc.).
3. IT and telecommunications equipment (such as minicomputers, printer units, laptop computers, telex, telephones etc.).
4. Consumer equipment (such as radios, televisions, videos etc.).
5. Lighting equipment (such as different types of lamps etc.).
6. Electrical and electronic tools (with the exception of large-scale stationary industrial tools) such as drills, saws sewing machines etc.
7. Toys, leisure and sports equipment (such as electric trains or car racing sets, video games etc.).
8. Medical devices (with the exception of all implanted and infected products) such as radiotherapy equipment, cardiology, pulmonary ventilators etc.
9. Monitoring and control instruments such as smoke detectors, thermostats etc.
10. Automatic dispensers such as automatic dispensers for hot drinks, for solid products, for money etc.

Alternative management is defined as the sum of activities of collection, transport, temporary storage, reuse and treatment (recycling and recovery for energy) of WEEE or/and their components and their subassemblies (including their consumables) so that after their treatment, they are streamed back into the market [8]. “Appliances Recycling S.A” collects from the points that have already marked, transports, takes care of temporary storage and final transportation to the treatment plant that exists in Korinthos, Greece [7]. In the treatment units, the first activity that takes place is disassembling of the products

they receive in order to remove the hazardous substances from the products in case it is necessary. For example, fluorescent lamps contain mercury, televisions contain lead which need to be carefully removed. After disassembling and the removal of hazardous materials, these materials are led to hazardous waste disposal sites. The rest of the components that consist of a variety of materials that could be useful go to steelworks plants, so they can be sold and feed the market. Such materials are stainless steel, iron, aluminum, copper etc. that exist in many devices such as refrigerators, televisions etc. [7].

“Appliances Recycling S.A.” uses three different ways of collection of WEEE. Which method will be used depends on the contracted party that joins the collective system. In the first alternative, “Appliances Recycling S.A.” makes an agreement with the municipalities, which have according to the Law the responsibility to collect the WEEE from the collection points. The municipalities sell the collective products to the “Appliances Recycling S.A.” for 40 Euros/ton. The advantage of this alternative is that the municipality has a special relation with the citizens and the right ways to communicate with them in order to implement the collection. On the other hand, municipalities have already organised the collection points and the most convenient route for the collection. When this collection method is used, it is possible for the “Appliances Recycling S.A.” to locate several containers at the collection spots. This way, depending on the volume of the containers, citizens may dispose the devices per category. The volume of the containers depends on the municipality’s facility to offer enough space for the containers. In the second alternative, stores sign a contract with “Appliances Recycling S.A.” for the collection of the obsolete products. In that case, stores according to the Presidential Act 117/2004 are obliged to receive the obsolete materials when the consumers wish to give them for recycling. The consumers have to transport the EEE themselves to the store where they can be temporary stored. The third alternative option takes place when the citizens call a transportation company which transports the EEE to the “Appliances Recycling S.A.” facilities. The third alternative includes the agreement with a transportation company to do the transportation on behalf of “Appliances Recycling S.A.” [7].

A substantial requirement for all three alternative ways of collection is the safe transportation of the devices. It is absolutely essential that the EEE should not be cracked or broken in order not to cause pollution problems from the air emissions. For example refrigerators contain freon, which is extremely dangerous to the environment in case it is released to the atmosphere [7].

So far, 510 stores all over Greece, which sell EEE from producers such as Siemens, Pitsos, Bosch, Toshiba, Philips, Panasonic etc. have joined the alternative management system that “Appliances Recycling S.A.” provides [8]. Furthermore, 23 collection points have already been marked all over Greece that serve and cover 67% of the population of Greece and it is expected that 90% of the population will be covered by 2008 [7].

The total cost of alternative management of the WEEE includes the following individual costs [8]:

- Cost of collection, transport and temporary storage of WEEE,
- Cost of transport of the WEEE at the treatment units,



- Cost of treatment of the WEEE,
- Cost of sensitisation of the public,
- Administrative costs of the system.

Producers bear the responsibility of covering a contribution fee for each product. The contribution fee that is evaluated by the alternative management system is imprinted separately in products' sales invoices except in the case of final consumer invoices. In the invoices or in the receipts of retail sale that are directed to the final consumer, the contribution fee is included in the final price of the product [8].

The calculation of the contribution fee results from the total costs of alternative management of WEEE and it is based on the following parameters [8]:

- Sustainability of the alternative management system.
- The administration cost should be covered from the contribution fee of the affiliate producers.
- Non- partiality in the competition between similar products.
- Quantities of distribution per category of products.
- Difficulty of collection.
- Difficulty of treatment.
- Expense for the removal of hazardous substances.
- Sale value of the materials that come up from WEEE treatment.

Table 1 shows the financial contribution for the alternative management of products of EEE per unit of weight per category.

Table 1: Financial contribution for the alternative management of WEEE [8].

Category of electrical and electronic equipment	Kind of product	Contribution per unit of weight including V.A.T. (Euros/ton)
1	Large household appliances	85.72
2	Small household appliances	95.81
3	IT and telecommunications equipment	302.55
4	Consumer equipment	302.55
5	Lighting equipment	148.75
	Electric lamp	0.120 (per item)
6	Electrical and electronic tools (excluding the stable industrial tools of large scale)	121.02
7	Toys, leisure and sports equipment	181.52
8	Medical devices	59.5
9	Monitoring and control instruments	181.52
10	Automatic dispensers	90.76

4 Conclusions and suggestions

Appropriate alternative management and treatment of WEEE can only be achieved if all factors involved (producers, recyclers, local/ national European authorities) work together on the basis of a common agenda and of shared responsibility [9].

In any case, the conformity with the legislation constitutes a time-consuming and laborious process. The planning, the implementation and the operation of an effective system of alternative management of WEEE in Greece, presume not only the active attendance of all partners involved but also extensive scientific research aiming at environmental protection, as well as financial sustainability.

- Further sensitization and awareness for environmental issues of both general public (society) and administrative bodies, through the conducting of informative campaigns, relevant speeches in schools [7] etc.
- Improvement of the existing Collective System, through the inclusion of informal dealers and retailers, such as Roma people, in the formal and legal system of collection of WEEE.
- Confrontation of the weaknesses in the local governments, concerning the organization of local collective systems and their financing and educating local authorities.
- Improvement of treatment and disposal facilities and the encouragement of EEE producers to minimize and recycle – reclaim – reuse WEEE.

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