Design of a recovery network in Portugal: the electric and electronic equipment case

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Abstract—An European directive established that all EU countries must have, until the end of 2006, a recovery network for the electric and electronic equipment waste (WEEE). In Portugal, a group of producers formed a non-profit organization to design and manage this waste flow. In this work, a model developed previously by the authors to design and plan a generic WEEE network is presented and applied to the Portuguese case. The results obtained are discussed and compared with the network that is currently operating.

Index Terms—Recovery network, electric and electronic equipment, optimization model, facility location

Topic: 3.3 Closed loop Supply Chains

I. INTRODUCTION

Waste generation is a characteristic of modern societies. Until recently, products once used were simply disposed by customers and sent to landfills.

Due to an increasing environmental concern, waste management has become a subject of extreme importance to industrialized countries. In Europe, several countries face land use problems with small and overloaded landfills. The price of land is high and waste is not a “product” that increases its worth. In order to overcome this problem, together with the rationalization of original raw materials consumption, the European Union (EU) has been producing legislation regarding waste recovery and recycling. In 2002, an European directive established the extended producer responsibility to electric and electronic equipment waste. This directive covers all electric and electronic products that are used by consumer or within a professional environment. Among its objectives is the encouragement of the design and production for disassembly, in order to ease the recovery, re-use and recycling of WEEE, and the sorting of collected products, in order to protect the human health and environment. With this aim, the directive proposes the setting up of public collection points, the sorting of WEEE and the introduction of targets in terms of recovery rates. Finally, a collection rate of 4 kg per capita per year was set until the end of 2006.

Across the EU, countries are facing the challenge of implementing these new regulations. Some, however, had anticipated the European directive and their recovery networks are already in place.

In Belgium, the system has been working since June 2001 [1]. When the European directive was published, Belgium had already its system working for two years, whereby all three regions had agreed on a single and unified network. It started with the collection of only some household appliances and, subsequently, the system was extended to all EEE covered by the EU directive. In order to support the cost of the take-back system and make the recycling of EEE economically viable, a recycling fee is added to the selling price of every new product, [2].

Sweden has a nationwide system, managed by El-Kretsen, with about 950 centres and 27 recycling plants. It liaises with the municipalities, which are responsible by the collection of used products. El-Kretsen is in charge of the transportation of collected products to disassembly (by pre-treatment facilities) and, finally, either to recycling, proper incineration or treatment of hazardous waste. The legislation concerning the EEE producer responsibility was introduced in Sweden in 2001 [3]. El-Kretsen is a non-profit organization owned by 21 business associations and its services are used by more than 1000 companies. Its system differentiates products coming from business to those from households. Each stream has its own collection centres, the pre-treatment centres are the same for both flows. In 2006, it collected an average of 16.4 kg per capita, which is four times the EU legal target.

In Norway, the first legislation regarding WEEE appeared in 1999, [4]. The non-consumer products and household appliances are treated separately by two systems, Renas AS and Elretur AS. Other companies have also set up their own system, which suggests the existence of business opportunities in this market. In 2006, the collection volume was about 28 kg per capita, which is five times greater than the EU target[5].

In Spain, the system is very different from those described above. Six organizations integrate the WEEE Forum as members. This forum is a non-profit association of collective WEEE take-back systems operating in Europe, [6]. The diversity of Spanish systems is mainly due to the existence of its seventeen Autonomous Communities, each one with its own legislation. The existing take-back systems may either collect all ten product categories defined by the EU directive or be dedicated to a single type, such as IT&T products.

In Portugal, the problem also emerged. In 2005, a group of