An eco-efficiency study for a WEEE recovery network: the Portuguese case

Maria Isabel Gomes-Salema\textsuperscript{a}, Ana Barbosa-Povoa\textsuperscript{b} and Augusto Q.Novais\textsuperscript{c}

\textsuperscript{a}Centro de Matematica e Aplicacoes, FCT – UNL, Monte da Caparica, 2829-516 Caparica, Portugal. e-mail: mirg@fct.unl.pt
\textsuperscript{b}CEG-IST, Av. Rovisco Pais, 1049-001 Lisboa, Portugal.
\textsuperscript{c}Dep. Modelacao e Simulacao, INETI, Est. do Paço do Lumiar, 1649-038 Lisboa, Portugal.

Abstract

The rapid growth of electric and electronic equipment waste (WEEE) transformed this waste stream into a worldwide problem. The Directive 2002/96/EC on electrical and electronic waste aims at the reduction of the environmental impact of WEEE, encouraging end-of-life management, eco design, life cycle analyses and extended producer responsibility. However, this legislation may not produce the results the legislator aimed for. In this work we analyse the environmental impact of a WEEE recovery network in the Portuguese context. With this aim, a model, previously developed by the authors for the optimal design of this network using economic indicators (Salema, 2007), was now adapted to design the network subjected to the minimization of environmental performance indices.

The original mathematical formulation was found to be flexible and easily adapted to the two types of indices and the major differences between the optimal network configurations obtained, were identified and discussed.

Keywords: Recovery network, environmental impact, optimization.

1. Introduction

The rapid growth of electric and electronic equipment waste (WEEE) transformed this waste into a worldwide problem. The European Union estimates a growth of 3 to 5\% per year for the WEEE, a figure three times greater than for general waste. Around 90\% of WEEE is going to landfills. In order to deal with the problem the Directive 2002/96/EC on electrical and electronic waste was defined that aims at the reduction of the environmental impact of WEEE, encouraging end-of-life management, eco design, life cycle analyses and extended producer responsibility. Under this directive, producers are responsible not only for new products placed on the market, but also for those equipments sold before this directive. This represents a new driving force that will compel producers to support collecting and recycling costs of their products.

In Portugal, a non-profit organization (Amb3e) was created by a group of 57 equipment producers, whose mission is to design and manage the integrated system for the recovery of WEEE.

Within this organization producers were able to deal with this challenge in a more efficient way since it allows for economies of scale, reducing the usual uncertainty associated to the quantity and quality of end-of-life equipments.