

# Application of Synergetic Theory in Municipal Renewable Resource -- Net Values Model of End-of-life Products

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## 1 Introduction

With the rapid development of productions and consumptions in modern economies, end-of-life (EOL) products are causing more and more serious environmental pressures. Part of the EOL products are collected, recycled and disposed by the market but normally with an unsatisfactory recycling rate, for their components were not designed to be easily separated and materials adopted not easily recycled. One the contrary, large amounts of those EOL products are reluctant to be accepted or refused by the market for their poor recycling profitability. These EOL products such as used cars and household equipments are discarded and dumped in the nature by their last owners, not only occupying quite a lot land spaces, but also leading to earth and water pollution and wasting massive useful natural resources.

Facing the growing pressures caused by EOL products especially the dumped EOL products some waste management practitioners suggested a new solving principle, namely extended producer responsibility (EPR) [1]. Not all the EOL products need to be managed through EPR [2]. Characteristic and amount of the potential values contained in and related costs for the treatment and management of EOL products principally affect the implementation of EPR program and of the definite allocation of economic responsibilities. On the other hand, the less the EOL products are collected and recycled on the market, the more negative effects will be made to the ecological environment. This paper will further examine the relationship among the recyclable profitability, market acceptability and negative effects on ecological environment of EOL products in order to further investigate provide a method to assign the "tight" EOL products to be handled by regulatory instruments such as EPR.

## 2 Values components in recycling market

The treatment and recycling of the EOL products mainly depends on the values retained in the products. As shown in figure 1, at the post-consumption stage products with economic valuable materials/components which can be reused or recycled will be collected and managed to get the reusable and recyclable materials/components going back to the supply chain. The residuals which can not be used again, together with those EOL products having no economic reusing or recycling values at all, will be disposed in landfill. This is the case of most recycling systems. And the recyclers and municipalities or the governments are the major parties involved.

If we take a look from the economic viewpoint, recycling EOL products may cause three different parts of values, they are: (1) economic costs part, including the collection and transportation costs, disassembling costs, repair and refurbishing costs, recycling and recovery cost, marketing costs

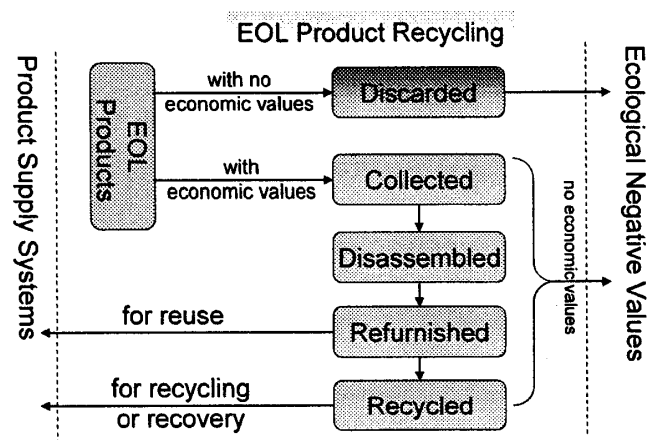


Figure 1: Recycling System of EOL Products

and other related managerial costs; (2) economic profits part, referring to the net income from selling the reused and recycled materials and components, which is the economic profits of the recycling industries as well as the ecological values achieved through increasing resource efficiencies and reducing environmental pollutions; (3) ecological costs part, or the environmental pollutions and destroys and natural resource abusing and wastes resulting from recycling residuals and also dumped EOL products which usually embodied as the landfill and final treatment payments. Among the above three values parts of EOL products recycling process, the ecological costs part is the real reason for the so-called external diseconomy or a kind of negative ecological performance which contained normally by the whole society. In this paper, we call it Negative Values (NV) of the EOL products. Next we will take a detailed look at the influence of the NV of EOL products on the final recycling extent and economic and ecological performances.

## 3 Net value model in four scenarios

Different EOL product has different recycling potentialities. Different ecological negative effects and different disposal requirements and charging standards will also

lead to distinctive profit-making possibilities.

In order to simplify the discussion, we suppose a certain percentage of the economic costs part. As shown in figure 2, the relative large of the economic profits and the ecological costs which will be partly paid as the landfill and final treatment fees will strongly affect the acceptability of the EOL products by the market. As a result, we can classify four crucial values components scenarios as for the recycling of EOL products and for the implementation of EPR program. Let's name it the profitable scenario A, reluctant scenario B, refutable scenario C, and negative scenarios D.

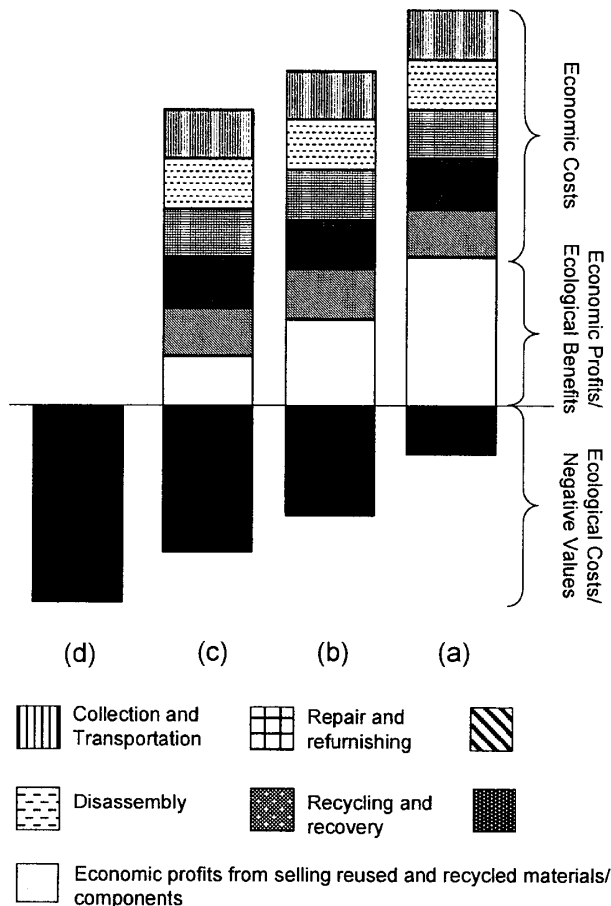


Figure 2: Values Model for Recycling of EOL Product

Profitable Scenario A

In this scenario, the discarded products have higher economic potentialities, which is higher than the negative values. Recycling such products will cause a positive cash flow in spite of the final ecological costs. See Figure 1(a). All the EOL products in this catalogue would be collected and recycled smoothly in the market, even though the governments strengthen the requirements for environmental management. For example, many EU members are going to limit the use of landfill, or increase the permitting standards for landfill or other disposal methods. Though such measures will increase the disposal costs covered by the recyclers, they can still make money by recycling EOL products in the profitable catalogue.

Reluctant Scenario B

In this scenario, the discarded products have a certain economic potentialities, which is almost equal to the negative

values. See Figure 1(b). Recycling such products will cause a positive cash flow when the recyclers are charged less than to cover all the final ecological costs. If the governments strict their environmental management, by increasing the disposal fees, the recyclers would probably earn nothing from recycling. But they could also have the possibility to get all the costs covered so as to keep their business running for some time. This is quite a marginal situation, in which both economic and environmental goals can be reached if strict environmental management and some basic economic incentive instruments such as tax preferable policies are provided.

Refusable Scenario C

In this scenario, the discarded products have much greater negative ecological effects than their profitable potentialities. See Figure 1(c). Recyclers could not be able to keep running their business unless there is only a very small charge for them to cover the related environmental costs. However, it is obviously not so easy nowadays, especially in many developed countries governments are paying more and more attentions to development sustainability. As a result driven by the market in such condition, recyclers would probably refuse to collect EOL products in this catalogue, and last owners would also chooses to throw them away in the nature illegally in order to escape such higher disposal fees. Dilemmas between environmental protection and economic development appear to be a major problem facing most of the countries in this case.

Negative Scenario D

In this scenario, the EOL products have no much economic values to be recycled and are discarded directly to the final disposal stage as shown in figure 1. It would also be a result of "Refusable Scenario C", when recyclers prefer to give up the economic values contained in the used products due to the comparative higher disposal costs. Consequently, no more used materials or components will be reused or recycled. And the whole discarded products turn out to be ecological burdens. See Figure 1(d). In such cases, it should be even harder to get either the recyclers or the last owners to pay for the negative values.

4 Conclusion

In conclusion, the model forwarded in this paper contributes to clarify the mixed and complicated economic and ecological information combined by EOL product. This is very significant as to decide where the government should focus to solve the waste management. It would also be used to set reasonable recycling and landfill price to meet the total eco-costs as well as encourage necessary eco-improvement.

Reference:

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