



Economic Aspects of Extended Producer Responsibility



OECD



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FOREWORD

Over the past two decades, waste generation has increased at a rate similar to economic growth despite interventions by governments to change this trend. If action is not taken, many OECD countries will run out of safe landfill space and other means to address consumer waste. In their efforts to find new ways to address the rise in waste, OECD governments are implementing Extended Producer Responsibility (EPR) policies. Extended Producer Responsibility involves the extension of a producers' financial and/or physical responsibility for its product to the post-consumer stage of the product's life cycle.

In 1994, OECD launched a programme to examine the concept of extended producer responsibility. From 1994 until 1998, several reports were published examining specific aspects of the concept. In 2001, OECD published a Guidance Manual for Governments in order to help governments design and develop effective EPR policies.

Soon after the publication of the Guidance Manual, governments began asking for further information and data on the performance of EPR policies. A seminar was held in 2001 to review the trends in EPR policies across the OECD, the type of products addressed and the policy instrument used. A key finding from the seminar was that there was not enough information available on the performance of EPR policies and further work was needed on the economics of EPR; specifically on the economic efficiency and environmental effectiveness of EPR policies. It was not clear whether the social costs of the policy bring about sufficient environmental benefits (The proceedings from this workshop can be found at: <http://www.oecd.org/env/policies>).

In response to this finding, OECD held a workshop on the Economics of Extended Producer Responsibility in order to examine more carefully the costs and benefits of EPR policies. Representatives from governments, industry, nongovernmental organisations and academia attended the workshop at which the economic efficiency and environmental effectiveness of EPR policies were examined. The combination of economists and policy experts provided for very rich and informative discussions and analysis of the papers presented.

This publication contains selected papers presented from the workshop on the Economics of Extended Producer Responsibility held in Tokyo,

11-12 December 2002. Special focus was placed on the objectives and targets of EPR policy, the evaluation of EPR policies and programmes, the effects of EPR policies on the rate and direction of technological innovation and the political economy of EPR policies. It provides an overview of the issues and status of the economics of extended producer responsibility and includes recent policy evaluations, a discussion on the methods for evaluating EPR policies and an analysis of the political economy of EPR.

The workshop showed that there is still work to be done. In particular, an analytical framework for evaluating the costs and benefits of EPR is needed. Further work is needed on the efficiency and effectiveness of EPR policy mixes and the influence of EPR policy on product design and waste prevention. Future OECD work on EPR will focus in these areas.

The Secretariat would like to express its gratitude to Japan's Ministry of Environment for hosting and co-organising the workshop and to all those who contributed to the workshop.

The opinions expressed in this book are those of the authors, and do not necessarily reflect the views of the individual OECD countries. The proceedings were prepared by Claudia Fénérol of the OECD Environment Directorate, with the assistance of Claire-Line Martin.

The report is published on the responsibility of the Secretary-General of the OECD.

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Executive Summary

EXECUTIVE SUMMARY

OECD has identified extended producer responsibility (EPR) as an important policy approach for environmental protection, and in particular, the prevention and better management of waste. Work on EPR started in 1994 and an important landmark was the publication of the EPR Guidance Manual for Governments in 2001.

While the Guidance Manual provides a systematic and practical analysis of EPR policies and advice on policy design and development, the Manual crystallised the need for further information and insight into the implementation and assessment of current EPR programmes. To collect further information and data on the implementation and effects of EPR policies, OECD held a seminar on EPR Programme Implementation and Assessment, 13-14 December 2001.

A key outcome from the seminar was that an in-depth analysis of the economic dimensions of EPR was a crucial link for developing and implementing more effective and economically efficient EPR policies. On the basis of this finding, OECD organised a workshop on the Economics of EPR. The purpose of this workshop was twofold: first to acquire further insight into the economic aspects of EPR; and second, to identify outstanding issues that OECD should investigate further.

Workshop on the Economics of EPR

The workshop on the Economics of EPR took place in Tokyo from 10 to 11 December, 2002. The Japanese Ministry of Environment kindly hosted this workshop at which the following topics were addressed:

- The economic efficiency and environmental effectiveness of EPR policies;
- The evaluation of EPR programmes;
- The impact of EPR policy on the direction of technological innovation; and
- The political economy of implementing EPR policy.

Participation

About 50 government officials and industry representatives from 14 countries, including representatives from China and the Philippines, attended the workshop. The workshop had a well-balanced mix of environmental economists and EPR policy experts, which facilitated rich and informative discussions under each session.

Outcome

As EPR policies develop in OECD countries, a systematic economic analysis and assessment is required more than ever. Some important questions answered by the workshop concerned how we set economically sound objectives, how do we devise cost effective EPR policy instruments? and what can we do to ensure that appropriate evaluation and feedback mechanisms are in place to verify?

The political economy has a significant influence over the design and implementation of EPR policies and with the types of product categories or waste streams selected. Most EPR scheme involves multiple levels of governments, multiple actors and multiple products. A key point of discussion focused on how to keep EPR schemes easy to manage (to reduce transaction cost), with a limited number of actors with clear responsibilities that have sufficient incentives to stimulate change in product design for waste prevention. This is an important challenge for governments with EPR schemes in place or in the process of developing a new scheme.

This publication contains selected papers and discussant commentaries from the workshop. These papers address:

- EPR policy goals
- performance of four national EPR schemes
- technical innovation and EPR policies
- political economy for implementing EPR policies; and
- EPR and cost sharing along the production chain

Policy goals

Margaret Walls discusses that the goal for EPR should be to maximise social welfare; the same as any other environmental policy goal. She emphasises that EPR policy objective should be to reduce the volume of solid waste disposal. However, other participants viewed that the reduction in the impact of waste may be a more appropriate target, steering the policy focus towards the reduction in volume and potential harm or toxicity from the waste.

She notes that when production and consumption cause negative externalities like pollution and waste, governments should intervene in private markets and attempt to attain the level of the waste or pollution where the marginal social benefit of reducing it by one or more unit is equal to the marginal social cost for reducing it. Most OECD governments view the negative externalities from certain products at their post-consumption stage to be a growing environmental problem and at a level in which an intervention is needed. The four maxims described in her paper should help guide policymakers evaluate alternative instruments to EPR.

The paper raises the issue of when EPR policies are preferred over non-EPR policies. The result of her research shows that EPR policies would be preferred when there are illegal disposal problems and/or when poorly functioning markets exist. Thus, a key argument for selecting an EPR policy mechanism over alternative policies with similar objectives would be in those situations in which illegal dumping or poorly functioning recycling markets exist.

The issue of how EPR influences product design - or design for the environment (DfE) - is addressed in the paper. There was a rich and robust discussion on this particular topic with some government participants stressing that they have explicit evidence that EPR improves collection and sorting of post consumer products, but less evidence of any upstream changes to a product that can be directly attributed to EPR policy. Other participants strongly emphasised that EPR policies do stimulate producers to change the design and resource input to products. It was also noted that the type of instrument used to implement EPR policy will strongly influence the results achieved. This discussion pointed to the need for further research and data collection on this topic and the policy instruments that tend to stimulate technical change in product design and resource inputs.

EPR programme evaluations

The trend across OECD is to implement more EPR schemes. With an increase in policies being implemented to address different waste streams, the need to evaluate the performance of EPR policies to determine their environmental effectiveness and economic efficiency is crucially important. Yet, as illustrated at the workshop, there are a limited number of EPR policy evaluations completed.

Four papers on EPR programme evaluation are included under Part 2. These papers provide an indication of the current state of evaluation of EPR schemes, methods used and the results achieved. The first paper describes the environmental performance of Alberta Canada's Used Oil Programme. The second paper discusses the system for handling packaging waste in Germany - the Duales System Deutschland (DSD). The third paper describes the revised stand on producer responsibility in waste policy in the Netherlands, based on an evaluation of their 13 EPR Covenants. The fourth paper provides an assessment of EPR schemes in Japan.

Policy instruments used and products addressed under EPR schemes can differ greatly from one scheme to the next, making any real comparisons between the programme difficult. While the methodologies used for each evaluation are not clearly defined in each paper, the papers do contain good information on the range of assessment methods used by countries and highlight the different EPR policies currently in place.

The Alberta Canada programme is a Provincial programme with the goal to reduce the impacts from used oil. Two important features of this programme is the return incentive that is paid to private sector collectors, transporters and processors to recover used oil material which is paid by consumers at the point of purchase as an Environmental Handling Charge. The paper contains a thorough description of the programme and its performance since it began in 1997.

Joachim Quoden discusses the German producer responsibility for packaging. This paper focuses on the impact of the system for packaging, and it describes the development of the scheme, technical innovations resulting from the implementation of this mandatory programme and other soft effects.

Kees Veerman describes an evaluation carried out on the use of producer responsibility as an integral part of Dutch waste policy. A key conclusion of the study was that the introduction of producer responsibility has resulted in a notable increase in the collection and recovery of products in the 13 waste

streams covered by EPR policies. While the Netherlands has voluntary covenants in place for producer responsibility, they found that producer responsibility, as it is currently designed in the Netherlands, does not drive waste prevention. This waste prevention finding raised questions by participants on the effectiveness of voluntary approaches of driving upstream changes to products or their resource inputs.

Eiji Hosoda discusses the situation of waste disposal in Japan and describes the recycling-oriented laws that have been implemented to address the country's increase of waste. A fundamental aspect in each of these laws is extended producer responsibility. The paper provides a series of examples of incremental innovation achieved in products covered stemming from the implementation of these laws.

These four performance evaluations illustrate the positive effects derived from the implementation of EPR policies irrespective of the policy instrument used. But, the available information and data concerning the results are not sufficient to clearly distinguish whether the environmental effectiveness are from the policy by itself, or as part of other policy or regulation packages, such as waste volume charges or a material tax. More consistent measuring and reporting of performance and costs of EPR schemes is needed to have a more comprehensive evaluation of EPR policies and monitoring mechanisms should be built into policies from the start.

Technical innovation

Candice Stevens reviews the state of technical innovation and EPR policies and provides a framework for analysing the relationship between extended producer responsibility and innovation. The paper emphasises that extended producer responsibility can lead to far-reaching design changes that are beneficial to the environment; however, innovation effects depend on the stringency of the EPR policy instrument used.

A positive effect of EPR, as seen through the country evaluations, is the incentive for producers to alter the design of their products to reduce their impacts at the post-consumer stage of the product's lifecycle. The extent of the innovation - incremental or radical - will be moderated through firm-specific factors relating to their motivations. Incremental changes include those made to simplify a product or modify components for easier disassembly or reuse, whereas radical innovation would be considered as a more holistic approach such as green product design or design for environment (DfE). In most cases, radical innovation will generate future profits for the producers.

What are the incentives and drivers in an EPR scheme that will stimulate action by producers to reduce the environmental impacts from their products at the post-consumer stage? Before we can answer this question at the international level, it is first necessary to discern which policy incentives are driving product design changes in an EPR scheme. Further study and identification of the incentives and drivers for innovation and results achieved amongst the different EPR schemes in OECD countries could provide important information to help governments increase the effectiveness and efficiency of their EPR schemes.

Political economy

Naoko Toja and Lars Hansson give a comprehensive review of the political economy for implementing EPR based policy instruments and reviews some of the factors related to the choice of instrument used and other issues associated with the context in which it is implemented. The paper analyses the relationship between various institutional and market factors surrounding EPR policy instruments that have been widely used by OECD governments. It stresses the importance of incentives to motivate actors along the product chain to actively participate in a scheme and provides an in-depth review of the issue of product diversity and how it can affect the management and effectiveness of the EPR scheme in reducing environmental impacts.

This paper states that producer responsibility organisations can be an effective way of organising a collective EPR scheme and could be useful in promoting innovation in cases where fees and charges are differentiated. Yet, there is sometimes a conflict with local governments when they wish to secure employment and continue to be involved in the collection of waste. The governance of producer responsibility organisations is critical to the costs and effectiveness of EPR. Careful consideration of the product, market and other structural and institutional aspects need to be fully reviewed before a collective and/or individual responsibility is designated.

The paper attempts to describe some of the different policy mixes used for implementing EPR, for instance, mandatory take back schemes with recycling targets. There may be certain policy mixes that are more effective and efficient for certain types of product categories. To provide more conclusive evidence on the performance of EPR policy mixes, the different policy mixes in OECD countries should be documented and assessed to determine their economically efficiency and environmentally effectiveness.

EPR, society and cost sharing

Kazuhiro Ueta describes the effect of EPR policy on segmented society and emphasises how EPR can be an important stimulus in the establishment of a recycling-oriented society, an important environment policy priority in Japan. He notes that economic agents make individual decisions based on their own preferences and profitability. However, to reduce the impacts of waste, it is necessary to integrate this segmented socioeconomic system. Incentives and signals to economic agents across the product chain to take into consideration the environmental impacts of the product are not self-generating and need to be created institutionally.

In his analysis, he finds that EPR is a policy promotes information about the environmental impacts of the product to producers, distributors and consumers, sending appropriate signals across the chain to take into consideration appropriate waste disposal and recycling. He also emphasises that a particular aspect of EPR policy is that EPR not only changes the allocation of responsibility, but can stimulate the sharing of responsibility and costs across the product chain. But before making any conclusions on the performance of EPR policies, he underlines the need for ex post evaluations of EPR schemes and suggests that further research should be carried out to better clarify the position of EPR within the system of public policy and in reducing the environmental impacts of certain products.

Main Findings and Conclusions

Based on the papers presented and the discussions at the workshop, several key findings and conclusions emerged. The OECD could provide further practical work in the future on many of the findings and conclusions.

- The objectives of EPR policy should be clearly specified, e.g. reducing the volume and/or the toxicity of waste, however, the ultimate goal should be to maximise social welfare by reducing the environmental impacts from post-consumer products to the optimal level.
- Economic agents involved in EPR (for example, producers, retailers, and waste recycling facilities) should be subject to appropriate economic/financial incentives to stimulate participation and to reduce the impacts of waste. For instance, producers being required to pay advance disposal fees and providing financial

assistance for recycling can be an effective approach for stimulating producers to reduce the impacts at the waste stage.

- EPR policies should be subject to continuous monitoring and evaluation and an appropriate economic evaluation framework should be developed that can be used for both *ex ante* and *ex post* evaluations. More consistent measuring and reporting of performance and costs is needed
- The range of policy mixes for implementing EPR should be defined and thoroughly analysed in terms of their economic efficiency and environmental effectiveness
- EPR policy can promote technological innovations such as new production process and stimulate producers to design products that are more environmentally compatible (i.e. design for the environment).
- EPR can work effectively if there are well functioning markets for recyclable products and materials. Recycling market failures should be identified and measures to overcome them deployed. This is currently being assessed in the context of the OECD project on “Improving Recycling Markets”.
- As more countries develop EPR policies for different waste streams and product categories, it was found that the benefits and opportunities for co-ordinating action and sharing information when EPR systems operate in different countries for similar consumer goods, and across borders, should be investigated.

The workshop demonstrated the need for further work on the economic aspects of EPR. The findings and conclusions listed above underline the need for better evaluation on the environmental effectiveness and economic efficiency of EPR policies. The first challenge is to obtain more systematic information and data on the performance of these policies through the development of an analytical framework tailored to EPR schemes and to apply the framework through country-specific case studies. This would help provide more consistent and comparable data and help to better understand the performance of EPR policies and their results achieved. This work could be carried out in conjunction with further research into the direction and rate of innovation in products resulting from the implementation of EPR. A key question needing a response is: How do the different EPR policies influence

product redesign and waste prevention? What EPR policy instruments are more effective in driving upstream changes in product design and resource inputs?

With the trend towards an increase in the application of EPR in OECD countries, there is a strong need to better define the role of EPR in public policy.

Part 1: EPR Policy Goals and Policy Choices

Chapter 1

EPR POLICY GOALS AND POLICY CHOICES: WHAT DOES ECONOMICS TELL US?

by

Margaret Walls

Resources for the Future, Washington D.C., United States

SUMMARY

Extended producer responsibility (EPR) embodies the notion that producers should be made physically or financially responsible for the environmental impacts their products have at the end of product life. There are several policy instruments that are consistent with EPR – product take-back mandates, advance disposal fees, deposit-refunds, recycled content standards, and more. The EPR concept itself, however, provides little guidance about which of these instruments might be appropriate under particular conditions and for particular products. Moreover, while the EPR goal is usually focused on end-of-life environmental impacts, in the US, at least, the goal seems to have widened to include environmental impacts throughout the product life-cycle. And even a focus on end-of-life impacts leaves the question of whether EPR is intended to deal with waste volumes, the toxic constituents of waste, the method of waste disposal, or a combination of these things. Clarifying the EPR goal is critical for choosing the right policy instrument and evaluating the success or failure of that instrument.

This paper addresses three main topics: appropriate goals for EPR; conditions under which EPR should be preferred over alternative non-EPR policy instruments; and specific policy instruments that are both cost-effective

and consistent with EPR principles. In the discussion of the second and third topics, the focus is placed on the issue of “design for environment” (DfE).

In addressing these three topics, the paper lays out four EPR policy maxims. These maxims, while by no means the only tool a policymaker needs in their toolkit, should provide some guidance in evaluating EPR policy alternatives.

The economics paradigm provides the first maxim for EPR policy.

Maxim 1. The goal of EPR policy should be no different than the goal of any other environmental policy: to maximize social welfare.

When production and consumption cause negative externalities such as pollution and waste, government should intervene in private markets and attempt to attain the level of the waste or pollution where the marginal social benefit of reducing it by one more unit is just equal to the marginal social cost of reducing it. Overall social welfare is maximized in this case. If the target level of waste or pollution is not set at the optimal level, the policy instrument should still be chosen so as to achieve the target at least cost. Other principles, such as the “polluter pays principle” and EPR, may be consistent with this efficiency, or cost-effectiveness, goal, but alone they do not provide enough guidance in choosing among alternative instruments.

The first step in designing and implementing an efficient or cost-effective policy is clarifying the environmental objective of the policy.

Maxim 2. When designing EPR policy and programmes, policymakers need to precisely specify the environmental objective they are trying to achieve.

The primary objective of EPR policy should be reducing the volume of solid waste disposal. Reducing upstream externalities associated with resource extraction or with production may be important ancillary benefits, but they are not the primary EPR policy objective. Promoting recycling or recycled content of products, and encouraging producers to “design for environment,” are not worthwhile goals in themselves, but are worthwhile as a means of cost-effectively reducing waste disposal.

Maxim 3. EPR policies are preferred over non-EPR policies for one of two reasons: (1) illegal disposal problems or (2) poorly functioning recycling markets.

A long literature has shown that Pigovian taxes on waste or emissions are efficient in addressing these negative externalities. However, when illegal dumping is a viable alternative to legal disposal, setting a Pigovian tax on legal waste disposal will create another externality. Several studies by economists have shown that, in this situation, a combination of an output tax and a recycling subsidy is the preferred alternative. Thus, studies show support for at least one kind of EPR policy over a non-EPR disposal fee.

If recycling markets do not work perfectly—more specifically, if it is too difficult and costly for recyclers to pay prices for used products that vary with the degree of the products’ recyclability – then there can be a second reason for using an EPR-based policy instrument over a downstream instrument such as a disposal tax. However, in this situation, it is inherently difficult to design policies that promote DfE. This brings up the fourth EPR policy maxim.

Maxim 4. While DfE provides a primary motivation for EPR, designing feasible and low cost policies that promote DfE is inherently difficult.

Policymakers will have to make critical trade-offs in designing their EPR policy instruments: simplicity and flexibility coupled with minimal incentives for DfE on the one hand, *versus* complexity and high administrative and monitoring costs combined with sharp DfE incentives on the other. This paper presents three possible instruments to spur DfE: (1) a combined output tax/recycling subsidy, along with a modest disposal fee; (2) tradable recycling credits; and (3) a system of DfE rewards, along with the output tax/recycling subsidy. Each of these instruments deserves further study in the context of a particular product in the waste stream. This further study should focus on their potential effectiveness at promoting DfE, their administrative costs to government or third-party organisations that manage the programme, and the transaction costs to participants.

The last part of the paper provides a brief case study on electronics and electrical equipment waste and illustrates how each of the four maxims applies to this part of the waste stream that is currently receiving a great deal of attention.

1. Introduction

Extended producer responsibility (EPR) embodies the notion that producers should be made physically or financially responsible for the environmental impacts their products have at the end of product life. The EPR movement began in Europe and has spread to other countries. The original impetus for it was twofold: to relieve municipalities of some of the financial burden of waste management, and to provide incentives to producers to reduce resources, use more secondary materials, and undertake product design changes to reduce waste (OECD, 2001).

Several countries set recycling rate targets and mandate take-back of a number of key products, including packaging, vehicles, electronic and electrical equipment, and batteries. For European countries, these policies are backed by European Union directives on packaging and vehicles and an expected electronics waste directive in early 2003.¹ Several state governments in the United States are considering legislation directed at electronics. In addition, a number of industry and multi-stakeholder voluntary efforts have arisen in the United States in recent years.

There are several policy instruments that are consistent with EPR—product take-back mandates, advance disposal fees, deposit-refunds, recycled content standards, and more. The EPR concept itself, however, provides little guidance about which of these instruments might be appropriate under particular conditions and for particular products. Moreover, while the EPR goal is usually focused on end-of-life environmental impacts, in the United States, at least, the goal seems to have widened to include environmental impacts throughout the product life-cycle.² And even a focus on end-of-life impacts leaves the question of whether EPR is intended to deal with waste volumes, the toxic constituents of waste, the method of waste disposal, or a combination of these things. Clarifying the EPR goal is critical for choosing the right policy instrument and evaluating the success or failure of that instrument.

In this paper, I address three main topics: the appropriate goals for EPR; the conditions under which EPR should be preferred over alternative non-EPR

¹. See Palmer and Walls (2002) for an overview of EPR programmes in several countries, as well as a discussion of the mostly voluntary “product stewardship” efforts in the United States.

². See www.epa.gov/epr/about/index.html for the U.S. Environmental Protection Agency’s definition of product stewardship, which clearly states that the concept covers the “environmental impacts of products.”

policy instruments; and the specific policy instruments that are both cost-effective and consistent with EPR principles. In the discussion of the second and third topics, the focus is placed on the issue of “design for environment” (DfE). DfE is one of the primary motivations for EPR and is also a major component of cost-effectiveness. At the same time, identifying feasible and low-cost policies that motivate DfE is difficult.

In addressing these three topics, the paper describes the four EPR policy maxims. These maxims, while by no means the only tool a policymaker needs, should provide some guidance in evaluating EPR policy alternatives.

The paper proceeds as follows. Section 2 discusses EPR policy goals, including efficiency, cost-effectiveness, and the importance of clarity in defining goals. Section 3 addresses the question of why EPR-based instruments should be used in particular situations, providing evidence from the economics literature on optimal solid waste policy instruments. Section 4 then continues the discussion of policy instruments in more detail, with a particular eye toward DfE. What feasible instruments might spur DfE and how costly will it be, in general, to design, implement, and enforce policies that have significant DfE effects? A case study of electronic and electrical equipment waste and how the four policy maxims apply to such waste is the focus of Section 5. Section 6 provides some brief concluding remarks.

2. The Goals of EPR

In this section, the paper discusses the goals of environmental policy generally and EPR policy specifically. The focus is on economically efficient outcomes. Also emphasized is the importance of clarity in specifying policy goals. The economics paradigm thus provides the first maxim for EPR policy.

Maxim 1. The goal of EPR policy should be no different than the goal of any other environmental policy: to maximize social welfare.

2.1 Externalities and social welfare

Production and consumption can often cause negative externalities—unintended side effects that private market transactions fail to take into account. Pollution and waste disposal are typical examples. When these problems occur, government intervention into private markets is usually called for since internalising the externality will improve overall social welfare. The objective of environmental policy, then, should be to attain the socially optimal level of

the waste or pollution – *i.e.*, that level where the marginal social benefit of reducing the waste or pollution by one more unit is just equal to the marginal social cost of reducing it. Overall social welfare is maximized in this case.

If the target level of waste or pollution is not set at the optimal level, the policy instrument should still be chosen so as to achieve the target at least cost. Thus, the objective for environmental policy generally, as well as for EPR policy specifically, should be to attain an efficient level of the environmental externality in question. When the efficient level of the externality is unattainable for political or other reasons, the objective of EPR policy should be to achieve the desired target, whatever it may be, at least cost.

2.1.1 Polluter pays principle and EPR

Other policy concepts or ideals may be consistent with this efficiency, or cost-effectiveness, objective, but they generally do not provide enough guidance on how to choose among alternative instruments.³ The “polluter pays principle” (PPP), for example, is often consistent with efficiency and cost-effectiveness ideals – *i.e.*, an efficient policy instrument will be one in which the polluter pays. However, several policy instruments might be consistent with the PPP but only one of them economically efficient. Likewise, the principle of EPR – that producers should bear some physical or financial responsibility for their products at end-of-life – can be met with many different policies but only a subset of those policies will be efficient.

2.1.2 Policy objectives and policy instruments

The first step in designing and implementing an efficient or cost-effective policy is clarifying the environmental objective of the policy. This brings me to the second EPR policy maxim.

3. It should be pointed out that, in theoretical models, more than one specific policy instrument often can be shown to be efficient. Several studies of solid waste policy have identified multiple combinations of instruments that are efficient. Fullerton (1997) and Schöb (1997) point out that there are, in fact, an infinite number of different normalizations of the tax rate that can all achieve the social optimum. In practice, however, when feasibility concerns are factored in, and administrative and enforcement costs are included in cost calculations, the set of efficient instruments is greatly reduced.

Maxim 2. When designing EPR policy and programmes, policymakers need to precisely specify the environmental objective they are trying to achieve.

Among the many goals often given for EPR are: waste diversion, reduced environmental impacts from production, such as air and water pollution, less use of virgin materials in production, and reduced toxicity of products. However, one policy instrument cannot achieve all of these goals. A long-standing result in economics, in fact, is that at least as many policy instruments are needed as policy objectives (Tinbergen, 1967). Walls and Palmer (2001), in a theoretical model with life-cycle environmental impacts—specifically, air or water pollution and a solid waste by-product during production and solid waste as a result of consumption—show that a single instrument cannot solve all problems. Thus, attempting to internalise multiple life-cycle externalities with, say, an advance disposal fee, as some have suggested (Ackerman, 1993), would be a policy mistake.

This point is particularly important in light of concerns over the use of hazardous materials in some products. In debates over how best to set policy to address post-consumer waste from electronics, for example, arguments are often made that policy instruments need to simultaneously address the volume of such waste as well as the constituents of the waste. In the latter category are usually concerns over lead and mercury. While hazardous materials and waste volumes are both legitimate environmental concerns, it is highly unlikely that they can adequately be addressed with a single policy instrument.

2.1.3 Integrated product policy

On the other hand, taking multiple problems into account when setting multiple instruments is important. Walls and Palmer (2001) obtain this result in their model. They show that even though Pigovian taxes are optimal, just as they are in a setting without life-cycle environmental impacts, the rate for each of the taxes reflects the socially optimal level of all other pollution and waste. In other words, when setting the taxes, the policymaker needs to do so simultaneously to achieve the overall social optimum. If Pigovian taxes are infeasible, as they are likely to be in many settings, an integrated policy approach is even more important. The authors show that the alternative set of efficient policy instruments includes input taxes that are set to incorporate marginal damages from multiple environmental problems. One of the most difficult tasks for policymakers is managing this simultaneity problem when setting policies. In the United States, where environmental regulations have traditionally been divided by media – *e.g.*, air, water, and land disposal—this task is especially difficult.

2.1.4 Reducing waste

The primary objective of EPR policy should be reducing the volume of solid waste disposal. Reducing upstream externalities associated with resource extraction or with production may be important ancillary benefits and should certainly be part of the overall policy picture, but they are not the primary policy objective of EPR. Promoting recycling or recycled content of products are not worthwhile goals in and of themselves, but are worthwhile as a means of cost-effectively reducing waste disposal (Macauley and Walls, 2000). Likewise, encouraging producers to design for environment is a means to an end and not an end itself. When evaluating the degree of success of EPR policies, the primary focus should be whether they cost-effectively reduce the volume of waste.

Among the set of policies consistent with EPR principles are: take-back mandates, recycled content standards, advance disposal fees (sometimes called advance recycling fees), and deposit-refund programmes. Take-back mandates can have “opt out” provisions, allowing individual producers to meet their obligations by joining a “producer responsibility organisation” (PRO) that handles all collection and recycling. The PRO, in turn, must then choose how to set the fees it charges its member firms. Alternatively, a take-back policy can require producers to take individual responsibility for their products, rather than delegating that responsibility to a PRO. Although all of these policies may be consistent with EPR and may even achieve the same waste reduction outcomes, they do not all impose the same costs on society. The goal of EPR policy should be to choose the most efficient, or cost-effective, instrument.

3. Why EPR?

With this waste reduction goal in mind, an important question is when is an EPR-based policy instrument the appropriate choice for policymakers.

Maxim 3. EPR policies are preferred over non-EPR policies for one of two reasons: (1) illegal disposal problems or (2) poorly functioning recycling markets.

I discuss each of these motivations for EPR in turn, beginning with a discussion of the problems presented by illegal disposal, and then turning to a second potential market failure, transaction costs in recycling markets.

3.1 *Illegal disposal*

3.1.1 *Policy results from economics*

Several theoretical studies by economists solve for optimal policy instruments when there is the possibility of illegal disposal (Dinan, 1993; Fullerton and Kinnaman, 1995; Palmer and Walls, 1997). These studies find that there are multiple combinations of instruments that can achieve the social optimum, but all recommend a combination of a product tax and recycling subsidy—usually referred to as a deposit-refund—as the instrument of choice. Fullerton and Kinnaman (1995), in the only study to explicitly incorporate the externality from illegal dumping in a general equilibrium framework, show that not only is a Pigovian tax on (legal) disposal inappropriate in this setting, but a disposal subsidy is called for in combination with the deposit-refund. The deposit-refund efficiently reduces waste disposal by combining the “output reduction effect” and the “input substitution effect” that are inherent in the Ionian tax without that tax’s attendant illegal dumping problem.⁴ In other words, the Ionian tax reduces waste by combining source reduction incentives and recycling incentives in a single instrument; the deposit-refund provides the same incentives in two separate instruments. Thus, several theoretical studies by economists show support for at least one kind of EPR policy over a non-EPR disposal fee.

3.1.2 *“Bottle bill” deposit-refunds*

No distinction is made in the Fullerton and Kinnaman model, nor in the other theoretical models cited above, between their conceptual deposit-refund policy instrument and the real-world “bottle bill” deposit-refund that is used in several American states. Bottle bill deposit-refunds are collected (and refunded) downstream; typically, a fixed fee – the deposit – is charged to a consumer for purchase of a container of a given size, and that fee is given back to the consumer when the container is returned. Usually the bottler, or distributor, collects the deposits from consumers via retailers; retailers pay out the refunds and typically are required to take back containers of any brands that they sell. The distributor then accepts the containers for recycling and reimburses the retailers. Who keeps the unclaimed deposits varies across states. Bottle bills usually come with high administrative and transaction costs because of the

⁴. See Spulber (1985) and Fullerton and Wolverton (1999) for more on these two effects embodied in Ionian taxes.

sorting requirements. Moreover, because the fees are fixed and do not vary on a weight basis, they provide little incentive for source reduction.⁵

The deposit-refunds that economists advocate are more general than the bottle bill prototype. They are simply a combination of a product tax and a recycling subsidy, usually set on the basis of product weight.⁶ The tax is passed on to consumers in the form of higher product prices, but the producer may be the one who actually makes the tax payment to the government. Similarly, the recycling subsidy should make itself felt by consumers but could be paid by the government to collectors and/or processors of secondary materials.

3.1.3 *The UCTS*

Palmer and Walls (1999) refer to a tax/subsidy combination in which producers of intermediate goods pay the per-pound tax and collectors of used products receive the per-pound subsidy as an “upstream combined tax/subsidy,” or UCTS. Palmer *et al.* (1997) provide some quantitative evidence on the cost savings from the UCTS over a product tax alone – i.e., an advance disposal fee (ADF) – or a recycling subsidy alone, which is not an EPR-based policy instrument. They parameterize a simple model of waste disposal using estimated demand and supply elasticities and 1990 U.S. prices and quantities for five materials commonly in the municipal solid waste stream—aluminium, steel, glass, paper, and plastic. They find that, for any given percentage reduction in waste disposal, the UCTS is the least costly option, followed by the ADF; the recycling subsidy is the most costly approach. For a 10% reduction in waste from 1990 levels, they calculate that it would be necessary to implement an across-the-board UCTS of \$45, an ADF of \$85, or a recycling subsidy of \$98. Thus, EPR-based policies—the UCTS or an ADF, in this case—are less costly ways to achieve waste-reduction goals than a non-EPR policy, a recycling subsidy.

5. California has a different - and, by most accounts, more efficient - system in which the state operates redemption centers and arranges for recycling, with no sorting by brands and no involvement by distributors on the back end. The unclaimed deposits in California go to the state, which then distributes them as grants to non-profit recycling centers and to municipal governments for the containers they collect (typically, through curbside recycling programmes). For more on U.S. bottle bills, see www.bottlebill.org.

6. Fullerton and Wolverton (1999) espouse the idea for more than just solid waste problems and refer to the tax/subsidy combination as a “two-part instrument” (2PI).

The UCTS is the most cost-effective of the three because it encourages *both* recycling and source reduction. The ADF, on the other hand, encourages only source reduction, and the recycling subsidy only recycling. Thus, the latter two instruments have to work harder to achieve the same reduction in waste that the UCTS achieves. This proves to be particularly difficult for a recycling subsidy because the cost of recycling some products—plastics, in particular—is quite high. The recycling subsidy would hold for any policy instrument that targets only recycling—recycling rate mandates, recycled content standards, and investment tax credits for recycling, to name just three. Because these instruments provide no incentive to reduce output or reduce the weight of products, they are unnecessarily costly ways to reduce waste disposal.

These quantitative findings by Palmer *et al.* thus provide more support for EPR policies as opposed to policies that target downstream recycling markets. I must emphasize again, however, that cost-effectiveness ultimately should be the deciding factor in choosing policy instruments. Both the ADF and the UCTS can be characterized as EPR policies, but the UCTS is the preferred instrument because it achieves any given reduction in waste disposal at the lowest possible cost.

3.2 *Transaction costs in recycling markets and DfE*

In the Palmer *et al.* empirical study and all of the theoretical studies cited above, the issue of product design and its effects on recycling are ignored. Moreover, the recycling market itself is not explicitly incorporated in the models. The focus of these studies is to identify optimal policies in cases where illegal disposal precludes the use of a disposal fee. But even in cases where disposal fees are feasible, there can be a rationale for EPR.⁷ This rationale comes from the existence of imperfectly functioning recycling markets.

3.2.1 *Modelling transaction costs in recycling markets*

Calcott and Walls (2000, 2001) develop a theoretical general equilibrium model in which heterogeneous producers make design choices that affect the

^{7.} Unit-based pricing (UBP) of residential waste is becoming quite common in the United States and elsewhere, and with, so far, no documented serious illegal disposal outcomes. See Miranda *et al.* (1998) for a useful survey of U.S. programmes. Most U.S. programmes set prices by the container (either bags or cans of a particular size). Linderhof *et al.* (2001) report on weight-based pricing used in a Dutch community. According to Allers (2002), a co-author of that study, illegal dumping was monitored carefully by the town and was found to be “minimal, but not nonexistent.”

recyclability of their products. The authors explicitly incorporate the recycling sector in their model: private profit-maximizing recyclers collect used products from consumers, process them, and resell to producers; the more recyclable a given product is, the lower the processing costs.⁸ The authors find that if recycling markets work perfectly - that is, if recyclers pay consumers for used products and the prices they pay vary with the degree of product recyclability - then a Ionian tax on disposal can yield a first-best, efficient level of waste disposal, recycling, and design for environment. If, however, recycling markets do not work perfectly - more specifically, if it is too difficult and costly for recyclers to pay prices that vary with the degree of the products' recyclability - then a first-best outcome cannot be reached. Calcott and Walls argue that in reality, recycling markets probably do not work perfectly. It is costly to collect and transport recyclables, and it is difficult for recyclers to sort products according to their recyclability and pay consumers a price based on that degree of recyclability.

3.2.2 *The second-best outcome*

Calcott and Walls (2001) find that although transaction costs in recycling markets preclude achieving the social optimum, a constrained, second-best optimum can be reached. A product tax/recycling subsidy (*i.e.*, a UCTS) combined with a disposal tax set at less than the Ionian rate—that is, less than the full marginal social costs of disposal—will achieve the second-best outcome.⁹

In the Calcott and Walls models, the constrained optimum is the best outcome that can be achieved given the transaction costs in recycling markets. It

8. Two other studies that address DfE concerns are Fullerton and Wu (1998) and Eichner and Pethig (2001). Producers are homogeneous in the model constructed by Fullerton and Wu. In addition, they provide no explicit treatment of the role of recyclers or of recycling costs. Eichner and Pethig (2001) do model recycling costs, but treat recyclability as a proportion of a product's material content that is of a particular type. The Calcott and Walls definition of recyclability is more general.

9. Calcott and Walls also find an alternative policy that yields the constrained optimum: a product tax/recycling subsidy in which the product tax takes on one of two rates depending on whether the product is recyclable enough to be accepted by processors - that is, processors do not incur a loss if they recycle it. The tax on products that do not reach that recyclability threshold is the standard Ionian tax and thus can be viewed as an advance disposal fee. Products that meet the threshold receive a subsidy when they are recycled that is equal to the tax paid up-front. No disposal tax is necessary with this second set of instruments.

is important to emphasize this point. If firms have a choice over the design of their products, in particular over the recyclability of their products, and recycling markets fail to work perfectly, then price signals are not transmitted from consumers and recyclers back upstream to producers. It is extremely difficult to design a *feasible* policy that overcomes this problem.¹⁰

On the other hand, the Calcott and Walls results are encouraging: the second-best outcome is attainable with a simple set of policy instruments, a set that falls under the EPR umbrella. The tax and subsidy give producers the incentive to make their products recyclable enough to get over the threshold at which profit-maximizing recyclers (who receive a subsidy from the government) will accept the products. Above that threshold, the existence of working recycling markets – even imperfect ones – spur DfE. So although the social optimum is not attained, this second-best outcome is one in which there is less consumption, less waste, more recycling, and a higher degree of recyclability of products than in the free market.

4. EPR Policy and Design for Environment (DfE)

The combination of a UCTS and a modest disposal fee, as advocated by Calcott and Walls, along with the existence of recycling markets - even those that work imperfectly - provide some incentives for DfE. Most environmentalists and environmental policymakers, however, would probably view the effects as insufficient. Also, on the face of it, a uniform product tax and recycling subsidy may seem to many observers to be incapable of having any real impact on product design.

There could be merit to these arguments. After all, some faith in markets—even imperfectly functioning ones—is required to believe that the Calcott and Walls policy motivates any DfE. In their model, for some products at some level of secondary material prices, the value of the materials being recycled outweighs the transaction costs in recycling markets, and this is what brings about product design changes to increase recyclability. If those signals don't work at all for some products, then the UCTS and disposal fee might be inadequate.

^{10.} Calcott and Walls (2001) show that a tax and subsidy that vary with the degree of recyclability of products can yield the first-best social optimum, but it is difficult to conceive of a situation in which policymakers would have enough information to set these instruments and have the political wherewithal to set tax rates that vary across firms.

On the other hand, designing, implementing, and enforcing a policy that does have significant effects on product design is likely to be difficult and costly. This brings us to our fourth EPR policy maxim.

Maxim 4. While DfE provides the primary motivation for EPR, designing feasible and low-cost policies that promote DfE is inherently difficult.

We present two economic incentive-based policy instruments here that may have the potential to spur DfE: tradable recycling credits and a DfE reward system. We then return to the issue of the cost of policy implementation.

4.1 *Tradable recycling credits*

The studies by economists that I reference here do not look beyond tax and subsidy-based policy instruments. In particular, the studies do not look at other EPR policies such as take-back and a policy that is perhaps most worthy of further study, tradable recycling credits.¹¹ Tradable recycling credits are similar in spirit to tradable emissions permits (Tietenberg, 1985). One important difference between the two approaches is that a tradable emissions permit system typically is associated with a cap on total emissions from all sources, with trading allowed between sources, whereas a tradable recycling credit system imposes a minimum recycling level or rate on a particular industry and allows trading between responsible parties to reduce the cost of achieving that minimum level.¹²

A tradable recycling credit programme for electronics, for example, might work as follows. Every manufacturer or importer would be required to meet a recycling rate target for its products. The target could be an overall weight

^{11.} Fullerton and Wu (1998) look at a variety of instruments and combinations of instruments. They purport to include take-back, but it is modeled by simply having producers pay disposal costs, and who pays has no efficiency implications. Moreover, producers in the Fullerton and Wu model are homogeneous, so standard-based instruments that lack flexibility across producers look as efficient as price-based ones.

^{12.} Another analogy would be a renewable energy portfolio standard in which electricity producers are required either to produce a minimum portion of their electricity using renewable energy sources such as wind or solar or to hold credits showing that another generator has produced the requisite amount of renewable energy. For more information, see Clemmer *et al.* (1999).

target, such as 50% of the weight of the product must be recycled, or a set of specific targets by component material type. Producers could do the recycling themselves, or they could pay a recycler to do it or – and this is the interesting twist on current policies in Europe and elsewhere – they could purchase credits from others who have recycled more than their own obligation. Recyclers would be required to keep track of what they recycled by brand. At the end of the year, producers would have to show that they had met the recycling target or hold enough credits purchased from others to comply with the target.¹³

The virtue of a tradable credit system is the flexibility it has over a system in which each firm must recycle a certain percentage of its products. Firms whose products are particularly difficult to recycle may choose to purchase credits, whereas firms whose products are recycled more easily will sell credits. Because selling credits earns firms money, the scheme should encourage firms to design products to be more recyclable. The virtue of the system over the current “take-back with PRO” model is the incentive it provides for DfE. Because the costs of recycling an individual product are borne directly by the producer of that product, the producer has the incentive to redesign the product to bring those costs down. In other words, since the costs and benefits of the design change are borne by the same entity – the producer – the policy avoids the free rider problem inherent in PRO schemes.

Of course, designing and implementing a tradable recycling credit system raises several issues and challenges. These include questions about how collection might work and the effect of different collection schemes on incentives for DfE; how to do the initial allocation of credits; whether to allow trading only within or across product types; whether to set overall recycling goals or material-specific ones; and how to set the recycling rate targets and the trading rules to deal with long-lived products. In the only existing tradable recycling credit scheme, the U.K. Packaging Waste Recovery Notes programme, an individual firm’s packaging is not tracked through the system (indeed, tracking is likely to be impracticable for packaging). The credit prices vary by material and are weight-based, so there could be some incentives for

13.

This approach is different from the approach described in a report for the European Commission, *Tradable Certificates for Recycling of Waste Electrical and Electronic Equipment*, produced by Environmental Resources Management (1999). Under that scheme, credits are awarded to the company that pays for the recycling of the electronics equipment and not to the company that originally produced or imported it. In such a system, recyclers would not keep track of exactly which firms’ products they are recycling. The costs of such a scheme might be lower than the one we describe, but so are the incentives for DfE.

material substitution and dematerialization, but other DfE incentives are likely to be minimal.¹⁴

Perhaps most importantly from an efficiency standpoint, a tradable recycling credit system targets recycling and not source reduction, and thus falls prey to the criticism of the other recycling-focused instruments we discussed above. An optimal tradable recycling credit policy would be likely to include an ADF along with it.¹⁵

4.2 *DfE rewards*

Another possibility worth exploring might be a combination of a UCTS with a system of financial rewards for the attainment of particular design objectives. The reward could come in the form of a reduced upstream product tax if particular product characteristics are met or particular recycling outcomes are reached. Alternatively, it could simply come as an end-of-year payment from the government or a private standard-setting body. It would be essential to have the reward linked directly to efforts on the part of the individual producer and not industry-wide effects. Moreover, real change would only come from financial rewards rather than positive publicity or some other kind of nonpecuniary benefit. Thus, programmes such as the USEPA's WasteWise Partner of the Year programme or the industry-based Electronic Industries Alliance Environmental Progress Award, which involve only publicity, certificates, and the like, are not the kinds of programmes that will generate substantive improvements.¹⁶

^{14.} See Salmons (2002) for more detail and analysis of the U.K. system. Further study of the workings of the Packaging Waste Recovery Notes markets and the overall strengths and weaknesses of the scheme would provide useful information for the design of tradable recycling credit systems applied to other products in the future.

^{15.} This result has not been shown in the literature, to our knowledge; however, Palmer and Walls (1997) find that another instrument focused just on recycling and not source reduction, a recycled content standard, can achieve a socially optimal amount of waste disposal only if combined with an ADF (and input taxes). A recycled content standard has other problems, however, that a tradable recycling credit system might be able to avoid. The most important one is its lack of flexibility across producers.

^{16.} For more on the WasteWise award programme, see <http://www.epa.gov/wastewise/about/winners.htm>; for more on USEPA's environmental award, see <http://www.eia.org/policy/awards.phtml>.

A DfE reward system would still mean that the government or some third party would need to determine the design objectives for purposes of rewards – a difficult task, but perhaps feasible for some products. Also, it would still be necessary to keep track of individual firms' products through the product life-cycle.

4.3 *The costs of implementing policy*

This second issue brings us back to the fourth EPR policy maxim: virtually any system with strong incentives for DfE could be very costly to implement. In my opinion, policymakers need to recognize and grapple with this problem sooner rather than later. There are critical trade-offs that need to be considered when deciding on policy options: simplicity and flexibility coupled with minimal incentives for DfE on the one hand, *versus* complexity and high administrative and monitoring costs combined with sharp DfE incentives on the other. The next section of the paper provides more discussion of these points in the context of one specific class of products in the waste stream, electronic and electrical equipment waste.

5. *Electronic Waste (E-Waste), Design for Environment (DfE), and the Design of Policy*

This last section of the paper focuses on a particular component of the municipal solid waste stream that is currently receiving a great deal of attention, electronics and electrical equipment waste, or so-called e-waste. E-waste provides an excellent illustration of each of the four maxims introduced above: (1) policy should be efficient or cost-effective; (2) objectives should be clarified and multiple objectives addressed with multiple policy instruments; (3) EPR is necessary to spur DfE because of poorly functioning recycling markets; and (4) effective policy is inherently difficult and costly to design, implement, and enforce. We address each of these points in turn, but first we provide some background on policy and proposed policy directed at waste electronics.

5.1 *Current e-waste policies and proposed policies*

In 2000, the European Union introduced its waste electronics and electrical equipment (WEEE) Directive; final approval of the Directive is expected in Spring 2003. The Directive mandates that member countries have systems for take-back and recycling of electronic waste and sets an e-waste collection target of four kilograms per household per year by 2006. The Directive also sets

recycling rate targets for specific types of waste. These targets range from 50% to 75%.¹⁷

As with all EPR policies, the United States lags behind Europe. However, several states have introduced bills in recent years to address e-waste, and a bill was introduced into the US Congress in July 2002 that would set a fee of \$10 on the sale of each new computer and computer monitor in the United States. The revenues, which would be managed by the USEPA, would be used to fund organisations collecting, processing, reusing, or reselling used computers, monitors, and other designated devices.

California, New York, North Carolina, Nebraska, Massachusetts, Minnesota, and Georgia have all introduced bills in the past year or two to address a growing concern with end-of-life computers. The Massachusetts bill introduced in late 2001 (House Bill 4716), would require any manufacturer selling a product with a cathode ray tube (CRT) to provide a system for its take-back and recycling. Several bills were introduced into both houses in California. In September 2002, California Senate Bill 1523, which would have imposed a \$10 fee on all computer monitors and televisions to fund recycling programmes, was passed by both houses. Governor Gray Davis did not sign the bill, but released a statement supporting the product stewardship concept and challenging industry to set up a voluntary programme. However, landmark legislation establishing an EPR system for electronics was signed by the Governor in 2003.

The National Electronics Product Stewardship Initiative (NEPSI), a group of state government, industry, nongovernmental organisations, and EPA stakeholders, is trying to reach consensus on a national voluntary product stewardship agreement for electronics. The group is expected to reach some agreement, the exact form of which has not been determined in 2003. In present discussions, the NEPSI stakeholders are focusing their discussions on a front-end product fee to pay for recycling.¹⁸

^{17.} The lower target holds for small appliances such as irons and toasters; for consumer equipment such as TVs, video recorders, and radios; and for electric tools and toys. The higher target applies to large household appliances such as washers, dryers, refrigerators, and microwaves.

^{18.} For more information about NEPSI and a list of stakeholders, see www.nepsi.org.

5.2 *Maxims 1 and 4: cost-effectiveness and the importance of DfE*

By all accounts, collecting, transporting, and processing electronics is quite costly. In a 1999 Minnesota programme operated by the Minnesota Office of Environmental Assistance, along with electronics companies Sony and Panasonic, Waste Management's Asset Recovery Group, and the American Plastics Council, the cost of collecting, transporting, processing, and marketing materials from the electronic equipment collected in the programme averaged \$448 per ton. Collection and transport together accounted for approximately 75% of this cost (Hainault, 2001; Hainault *et al.*, 2001). A USEPA (1998) study of electronic collection efforts in five communities found that costs ranged from \$200 to \$1,000 per ton. The Northeast Recycling Council (2002), in a national survey of municipal electronics collection programmes in the United States in 2001, found that costs averaged \$374 per ton across all locations and all types of programmes.¹⁹ These costs far outweigh the costs of collecting, transporting, and recycling the materials traditionally collected in municipal curb side programmes.

Recycling fees paid by communities to electronics reproprocessors have been reported in several studies. These fees provide further evidence on costs. The NERC study finds that fees average \$330 per ton across the communities in their sample. In Massachusetts, where the state has entered into contracts with two processors to accept materials from all Massachusetts communities at a fixed price, those communities pay \$260 per ton or \$300 per ton (depending on volumes) and the community pays for transportation to the processor. If the processor collects from the municipality, the costs are higher. Hennepin County, Minnesota, which has one of the longest-running programmes and accepts the broadest range of materials, pays \$900 per ton in recycling fees (Northeast Recycling Council, 2002).

The American Plastics Council (2000) reports that the average cost to use advanced recycling methods to process plastics from electronics ranges from \$460 per ton to \$1,040 per ton. By most accounts, plastics are the most difficult material in e-waste, with the possible exception of Cathode Ray Tube (CRT) glass. The California Integrated Waste Management Board (2001) sponsored a survey of electronics waste processors in California in which processors were asked their costs for processing computer processing units (CPUs), televisions, and computer monitors. The reported costs - which do not include collection

^{19.} Nearly 500 communities were sent surveys; 176 completed surveys were returned and used in the sample.

costs - ranged from \$613 per ton for a CPU to \$963 for a monitor, and as high as \$1,488 for a television.²⁰

There are several reasons for the high costs of managing electronics. Collection and transport costs are high because the items are bulky and often need to be transported long distances because of the relatively small number of e-waste processors. Processing costs are high for a number of reasons. Waste electronics contain a variety of materials, including steel, aluminium, copper, glass, plastic, precious metals (including gold, palladium, silver, and platinum), and other miscellaneous materials such as rubber and wood. This means that the separation, sorting, and dismantling cost component of overall reprocessing costs is large. And no single material is valuable enough and present in a large enough quantity to justify these costs. Results from collection programmes show that nearly half of the material recovered from electronic equipment is metal, but only half of that metal is the type for which there is a well-developed recycling infrastructure. Plastics comprise the next highest percentage, at 33%. But an American Plastics Council (2000) study found that only 35% of the plastics collected in the Hennepin County, Minnesota, programme were suitable for reprocessing because of the presence of contaminants such as paint, labels, coatings, and lamination. In the acceptable sample, nine different plastic resins could be identified. Most of the resins are ones for which well-established and high-value secondary markets are lacking.²¹

20. The survey did not tell respondents exactly what costs to include but left that up to the individual respondent. The report states that costs are likely to include “hauling, processing, storage, and labour (p. 8).” The report publishes costs in 2006 dollars (because it is focusing on future cost and capacity issues) and assumes a 2.7% annual inflation rate; the numbers I report here are deflated back to 2001 dollars.

21. The processor used in that study, MBA Polymers, experimented and had some success with producing a 100% pure stream of high impact polystyrene (HIPS) from television plastics, the most common resin in the waste sample. A more recent study using data from Hennepin County and co-sponsored by the American Plastics Council showed some improved results. Fisher *et al.* (2000) report that MBA accepted 100% of the sample it received as opposed to the earlier 35%; this was because better sorting and culling was done before the materials were shipped. Moreover, MBA achieved a greater yield when making the pure HIPS than in the previous study. No information is provided in the Fisher *et al.* study, however, on how much sorting and culling was done before materials were shipped to MBA, *i.e.*, what percentage of the total plastics collected were shipped for further processing.

These findings about the costs of electronics collection and recycling programmes suggest that the benefits of such programmes need to be quite high to cover current costs. Some recent research suggests that the benefits of recycling CRTs fall far short of the costs. Macauley *et al.* (2001) look at several policy options to reduce disposal of CRTs and find that these options would all increase disposal costs by far more than any benefits gained.²²

The Macauley *et al.* findings might lead some observers to argue that, on economic efficiency grounds, there should be no government policy directed at reducing disposal of electronics waste. This paper does not argue this point here, except to draw attention to the fact that there seems to be growing public concern about e-waste and that concern is generating a great deal of attention on several policy fronts. Instead, what should be argued is that these results highlight the importance of finding cost-effective policy instruments. And cost-effective policy instruments will be those that spur product design changes that bring down the net cost of recycling. In other words, the high recycling costs indicate the significance of Maxim 3 and the role DfE plays in cost-effective EPR policy.

There seem to be several targets for design changes that would reduce the net costs of recycling electronics. (1) The presence of contaminants leads to rejection of materials, thus reducing the use of labels, laminates, paints, and coatings on the plastics in electronics, as well as reducing the use of metal used with and on plastics, will improve the chances that the plastics in electronics can be recycled. (2) Reducing the different types of plastics and other materials that are used in a given product, and labeling the types that are used, will improve recyclability. (3) The net costs of recycling are lower when products are easier to disassemble, thus designing products for disassembly is important. (4) Finding ways to use secondary materials from electronics in the production of new electronics, *i.e.*, closed-loop recycling, is critical. This happens to some extent with CRT glass, but more could be encouraged. Plastics face a high hurdle in this regard; at present, most plastics in electronics, if they are recycled at all, are recycled into much lower valued products such as lumber, outdoor furniture, and materials for roads.

22.

The Macauley *et al.* study measured only benefits from reduced lead releases from incinerators, but the authors argue that these are the most important benefits from reduced disposal of CRTs because lead from incinerating CRTs far outweighs lead in leachate from landfilled CRTs. Although the authors do not measure any upstream life-cycle environmental benefits, they argue on the basis of their numerical results that those benefits would have to be several orders of magnitude greater than the direct end-of-life benefits to yield positive overall net benefits.

Articulating these product design objectives is one thing; designing *feasible* policy instruments that achieve these objectives is quite another. Moreover, many policies that are intended to have one effect often turn out to have another. We return to this issue in greater detail after discussing Maxim 2, the need for clarity in policy objectives.

5.3 *Maxim 2: Clarifying policy objectives*

E-waste is a good example of how easy it can be to obscure the objectives of a proposed EPR policy. And obscuring the objectives can lead to costly policy choices.

Once again, the Macauley *et al.* (2001) study is used for illustration. The authors assume in that study that the only measurable benefits from recycling CRTs come from reduced lead releases from incinerators. Because of this, they conclude that the most cost-effective policy option is one in which CRTs are banned from incinerators. Although this policy yields a low recycling rate compared to the other options the authors analyze, it is the most effective at reducing incinerator lead emissions and the least costly policy option on their list.²³ The highest recycling rate in the Macauley *et al.* study comes from a combined ban on all disposal, in landfills and incinerators, and a recycling subsidy of \$10 per monitor. However, this is the most costly of the instruments they analyze. The authors do not address EPR-based instruments.

In discussions about policies directed at electronics waste, one often finds that participants have different views on policy objectives, *i.e.* different views on exactly which environmental problems and which electronics products should be the focus of policy. CRTs are an interesting case in point. Most of the e-waste legislation introduced at the state and federal level in the United States is focused on CRTs, or on computers more generally, and not broadly on other electronics. If lead emissions are the primary environmental concern, as assumed by Macauley *et al.*, this may be appropriate. On the other hand, if reducing waste volumes is the policy objective, it should be kept in mind that CRTs account for only about 12% of the weight of materials collected in electronics collection programmes (USEPA, 1998). Policy instruments thus need to have a broader target to cost-effectively reduce overall electronics waste disposal.

^{23.} The authors do not address enforcement issues or the potential for illegal disposal. These problems could change their results.

Even if lead emissions are the primary concern, policymakers need to be careful to devise policies that account for a number of market factors, not the least of which is the increasing market penetration of flat panel displays. Flat panels may make the lead disposal externality go away eventually on its own. Policymakers need to guard against the potential problem of devising a costly policy that quickly becomes, at best, moot and, at worst, stifling to innovation and growth.

Discussion in the NEPSI process, which is focusing on developing a voluntary electronics recycling system, have included disagreements over exactly which products should be targeted in the system. Some consensus seems to exist over CPUs, computer monitors, and some peripherals, but exactly which peripherals to include and whether other electronics products should be in the agreement are points of debate. There are also discussions, with no resolution as yet, on whether and to what extent the group will try to address DfE.

It is interesting that in the EU, the WEEE directive clearly targets overall waste reduction from a broad class of electrical and electronic products. The toxic constituents of such products are addressed, but in a separate directive, the Directive on Restriction on the Use of Certain Hazardous Substances (RoHS) in electrical and electronic equipment. This directive bans the use of lead, mercury, cadmium, hexavalent chromium, and some flame retardants beginning in 2008. It remains to be seen whether policy instruments in EU member countries will be developed that are cost-effective, but at least the EU seems to be abiding by Maxim 2 in clarifying the environmental objectives and having multiple policies for multiple objectives.

5.4 *Maxim 4: policy difficulties*

At the same time that the complexity of products yields more potential for environmental product design, it also makes the job of the policymaker more difficult. Government officials, far removed from the product assembly line and the secondary materials processor, cannot be expected to know the ins and outs of designing a computer monitor, stereo, cell phone, or television. In many cases, it is difficult for producers themselves to know exactly what can be done to improve a product's recyclability. Clearly, advanced recycling of the plastics used in electronics, for example, is still in a fairly infant stage of development. Figuring out the optimal designs to address a multitude of safety, performance, quality, durability, *and* recycling concerns with those plastics is an exceedingly difficult job.

It is clear that any feasible and cost-effective policy that addresses DfE for electronics will have to count on market signals working, at least to some extent. So while poorly functioning recycling markets might present an argument for an EPR policy to spur DfE, as we explained above, this does not imply that government should try to devise policy that *replaces* markets. And almost any conceivable policy – even an individual take-back mandate with an accompanying recycling target – will still rely on market signals for the policy to work properly: signals from material suppliers to producers and vice-versa, signals from recyclers to producers, and signals from consumers to producers.

5.5 *Returning to Maxim 1 and policy recommendations for e-waste*

The above discussion might seem to suggest that feasible and cost-effective EPR policy alternatives for e-waste are limited, if not nonexistent. Although we need further study of incentive-based policies, such as tradable recycling credits, that have the potential to spur DfE, the author continues to believe that a UCTS holds much promise. The product tax, assessed on a per-pound basis, would lead to lighter-weight, less material-intensive products. The recycling subsidy could be paid to collectors of e-waste, with payment made after the materials are accepted by a certified processor and designated as “clean” and ready for recycling. Again, it is crucial that the subsidy be paid on a per-pound basis. Lump-sum grants to cover the costs of municipal collection programmes, as has been suggested in the United States, do not provide incentives, *at the margin*, for more recycling. It is essential that the recycling payments are greater, the greater the volume of materials recycled.

The UCTS, in combination with unit-based pricing of residential waste, should generate more e-waste diversion and has the possibility to cause some product design changes. These design changes will come about if, at some level of prices, recycling markets work properly, *i.e.* recyclers pay collectors prices for materials that vary with product recyclability and collectors, in turn, pass some portion of that price back to the original consumers who returned the products for recycling. Further study is warranted into how the government, through provision of information, can facilitate the functioning of these markets. Further study is also warranted into possible refinements of the UCTS instrument that might motivate more DfE – such as taxes that vary by material type – as well as the possibility of other kinds of financial incentives. In European and other countries that have espoused the take-back approach, more research is needed into the possibility of using tradable recycling credits in combination with take-back.

6. Concluding Remarks

Identifying, designing, and implementing cost-effective environmental policies is no small job. Accomplishing this goal when multiple environmental objectives are on the table, when it is vital that the policy spur DfE, and when some markets, such as recycling markets, function poorly is even more difficult. This paper outlines some maxims for policymakers: striving for cost-effectiveness and clearly defining policy objectives while doing so; using EPR-based instruments when either illegal disposal or poorly functioning recycling markets present themselves as problems; and recognizing and dealing with the fact that using policy to motivate DfE is always going to be difficult. With respect to the last maxim, it is important that policymakers not let the added cost of instituting a complex policy outweigh the added DfE benefits. Further research is needed on how to design incentive-based and low-cost policies that can generate more DfE.

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Chapter 2

Discussant Commentary on

EPR POLICY GOALS AND POLICY CHOICES: WHAT DOES ECONOMICS TELL US

by

François Lévêque, Professeur de Droit et Economie
Ecole des mines de Paris, France

Ms. Walls' paper offers guidelines on the choice of objectives and instruments of waste policies. It is based on economic theory and includes an interesting case study on electronic and electrical equipment waste. Guidelines are stated in a few short maxims addressed to policy-makers. The combination of environmental policy instruments is the core of the paper. I will, therefore, focus my discussion on two questions: Why is a single instrument not appropriate? What is the best mix of instruments?

Before addressing these questions, it is important to recap the general framework of environmental policy objectives and instruments. As far as the economic objective is concerned, there are two main options. One, the so-called first best option, is welfare maximizing. The instrument that may be used, a Pigovian tax for instance, corrects the misleading signal of the market in order to equalize the marginal abatement cost and the marginal external cost. The other objective, so-called second best *à la* Baumol, is more modest. It consists in cost minimizing. In such a case, the environmental policy instrument is chosen to achieve a given environmental target at least cost. To reach this goal, economic instruments (*e.g.*, taxes, subsidies) which provide incentives to abate pollution through price signals perform better than regulatory instruments (*e.g.* emission standards). Besides their cost-effectiveness, instruments may also

differ in terms of dynamic efficiency, public acceptance, environmental effectiveness, distributional effects, administrative costs, and so on. Finally, in the area of waste pollution, different specific environmental objectives may be chosen: reducing waste generated by consumption, reducing the toxicity of waste generated, facilitating re-use or recycling. As pointed out by Ms. Walls, it is of paramount importance to precisely specify the environmental objective EPR policy and programs are trying to achieve. It is a necessary condition to assess whether a policy has been effective. Within this framework, Ms. Walls' paper examines different instruments and combinations of instruments to reduce waste disposal as the environmental objective, and to minimize cost as the economic objective. Considered technologies are recycling and the use of less material intensive products.

The tradition in environmental economics is to consider the Pigovian tax as the first best instrument *par excellence*. This recommendation is, however, inappropriate in the case of waste reduction. Ms. Walls emphasizes two obstacles. Firstly, to be effective the tax rate must be high enough to induce change in the waste producer behavior that is, the final consumer. However, certain types of change are welfare detrimental, *e.g.* diverting waste in their neighbor's litter or illegal burning. Secondly, billing cost may be too high. For an effective tax scheme, recyclers must pay a price that varies with the degree of the products' recyclability. Such a billing system requires a lot of information. Measurement costs are likely to outweigh the gain of recycling for the environment.

Illegal disposal is certainly a real problem but my view is that it does not constitute a sufficient reason to reject the tax option. Each environmental policy instrument requires an enforcement scheme to ensure compliance. Following the maxim "one instrument, one objective", a penalty system has to be set to limit illegal dumping. The issue is to know whether such a system may be effective at a reasonable cost. As the problem lies in the difficulty to monitor individual behavior, a good candidate may be, for instance, a high penalty associated with low inspection efforts. Illegal dumping is a motive to reject the Pigovian solution only if an enforcement scheme cannot be designed. The cost of billing is a more convincing argument because it is more difficult to imagine an appropriate technical solution. Note that both arguments are similar in their very nature. They refer to transaction costs related to monitoring and enforcement. The underlying general point is thus that due to high transaction costs, a Pigovian tax is unlikely to be the least costly instrument.

A third and different argument, not mentioned in Walls' paper, is also interesting to mention as a drawback of a single Pigovian tax solution. A condition for a downstream Pigovian tax paid by consumers to have impacts

upstream on producers of, say packaging, is that all the consumers intervening on a given product market are subject to unit pricing. In practice, choosing unit pricing is of the responsibility of local governments. At the date of today, only a small minority of them has opted for this solution. This holds true even in countries promoting the approach; for instance, only 27 million US households or 4% of the Danish inhabitants are covered by such pricing solutions. We will probably wait for decades before the generalization of this option. In the meantime, the influence of households subject to unit pricing is de facto limited by their dilution among the vast majority of consumers facing flat rate waste collection and disposal charge.

In so far as the use of a single instrument is inappropriate, one must find the right pair of instruments. One possibility is a tax–subsidy scheme. It gives producers the incentive to make their product recyclable enough to get over the threshold at which recyclers who receive a subsidy from the government will accept the products. An example is the Upstream Combined Tax/Subsidy, or UCTS where the tax is based on a per-pound basis. The tax provides an incentive waste reduction at source. Another possible mix consists in coupling a tradable permit to boost recycling with an advance deposit fee (ADF). This second option is, however, not addressed by literature. It is therefore difficult to say in what circumstances it would be better to use a tax/subsidy scheme or a tradable permit/ADF scheme.

A point made by Ms. Walls is that the latter scheme provides incentives to design product for the environment (DfE). Because the costs of recycling an individual product are borne directly by the producer of that product, the producer has the incentive to redesign the product to bring those costs down. In order to ensure DfE with a tax-cum-subsidy scheme, Ms. Walls suggest adding a small disposal fee as a third instrument. This proposal is puzzling. The simplest way to correct insufficient signals for DfE with a UCTS is to set a differentiated tax according to materials and recyclability. Such a differentiated tax is feasible as shown by the tax, for instance, implemented in Germany (see Table 1).

Table 1: Material related fee for the Duales System Deutschland in 2002

Material	€ Cent/kg
Glass	7.60
Paper/carboard/carton	20.40
Tinplate	28.60
Aluminium, other metals	76.60
Plastic	150.80
Composite cartons for liquid or pasty contents	86.40
Other composites	107.30
Natural materials	10.20

As a conclusion, I would like to make two points. The first deals with the comparison between instruments. In the absence of transaction costs (*e.g.* costs to collect information, costs to monitor compliance), all instruments have similar performances. They are all able to achieve a first best solution. Instruments are only interesting to compare in an imperfect world. However, the performances of instruments, or of combinations of instruments, are very depending on detailed specifications of their components and the context in which they are used. For instance, as seen above, if a tax takes into account each product's recyclability, a third instrument is not required to boost DfE. Similarly, the impact on DfE of a downstream unit-based waste collection and disposal charge depends on whether unit based pricing is limited to a few municipalities or is generalised.

The second point concerns the balance between efforts in recycling and efforts in waste reduction at source. If recycling - or less material-intensive products (LMIP) - is the best alternative option, a single instrument would suffice. If recycling is the least costly option for one part of the set target of waste reduction, and LMIP the least costly option for the other part, it is required to choose two instruments. But, how can we fine-tune the tradeoff?

Chapter 3

Discussant Commentary on

EPR POLICY GOALS AND POLICY CHOICES: WHAT DOES ECONOMICS TELL US

by

Takashi Gunjima, Professor of Economics
Doshisha University, Japan

As Mrs. Walls mentioned in her paper, OECD defines extended producer responsibility as a concept in which producers should be made, partly or totally, physically and/or financially, responsible for the environmental impacts of their products at the end of the products life.

The goals or objectives of these EPR policies are:

- to relieve municipalities of some or all of the financial burden of waste management. Depending on the policy, some burden goes to producer or market (internalised to market perfectly) or some burden goes to the earth (externalised further to the earth). If the latter case occurs, additional instrument should be taken. This is the case of failure to internalise downstream externalities.
- for producers to internalise the environmental impacts that products have at one end of a product's life.

If we consider the product life cycle stages (from production and consumption to end of life or disposal), and divide those activities into two stages, that is, at the stage from production to consumption as economic

activities (upstream activities) and the other stage as treatment and disposal activities (downstream activities); then internalising the environmental impacts products have at the end of a product's life means internalising the environmental impacts product-disposal-activities have, into economic activities, or, internalising downstream externalities into upstream activities.

As a result, EPR policies motivate producers and provide incentives to undertake product design changes, to reduce resources, substitute materials for those more recyclable, use more secondary materials, and reduce waste. Nonetheless, if producers are motivated and are given appropriate incentives to undertake such product design changes, it does not always mean that they will take such actions right away. They have many options, some of which are options that policy makers intend to promote, and some of which are options which policy makers do not intend to promote. It should be emphasized that often producers prefer the unexpected and undesirable activities to the expected and desirable activities from the point of view of lightening the cost burden imposed on them. For example, a disposal charge or tax on waste at discard stage will not only reduce the weight or volume of waste as output reduction effect, but also increase recycling, illegal dumping, or *do-it-yourself* disposal.

Which action is promoted by the policy objectives depends on their marginal cost. Illegal dumping activities are activities to further externalise the downstream externalities that are undesirable. Internalising the downstream externalities at downstream stage sometimes does not internalise, but, in fact, externalises. There are some instruments that induce the externalisation of the externalities further. To avoid further externalisation of downstream externalities, some additional instruments and additional information are needed.

Summary

- One reason EPR policies are needed is to avoid the externalisation of downstream externalities.

Even if we can take the right activities policy makers intend to promote, some instruments do not work well or function at the downstream stage of a product's life. Under those situations, imperfect internalisation generates.

- A second reason EPR policies are needed is to respond to imperfect internalisation at downstream stage.

If we can not respond well to downstream externalities at the downstream stage due to the existence of the externalisation of downstream externalities and imperfect internalisation, internalising the downstream externalities into upstream activities can be a way to solve this.

- Failure of the internalisation of downstream externalities, perhaps due to the high transaction costs associated with applying policies downstream, necessitates EPR policies be targeted at the upstream stage.

It is important to consider whether EPR policies are appropriately targeted on internalising the environmental impacts of products at the end of life stage, or on internalising the environmental impacts throughout products life cycle. The latter is called *Full Producer Responsibility Policy*. If the goals or objectives of EPR policies are to internalise the downstream externalities and to maximise social welfare seeking environmentally-effective and cost-efficient solutions, EPR policies would be at a local social maximum. Meanwhile the goals or objectives of EPR policies are to internalise life cycle externalities and to maximise social welfare, EPR policies would then have a social maximum. Here the EPR-based policy model is a kind of policy mix model or policy assignment model. If so, Mrs. Walls model would be extended to the one under imperfect information.

Part 2: Evaluation of EPR Programmes

Chapter 1

ECONOMIC AND ENVIRONMENTAL PERFORMANCE OF ALBERTA'S USED OIL PROGRAMME

by

Michael Vanderpol

Environment Canada, Canada

SUMMARY

The Economic and Environmental Performance of Alberta's Used Oil Recycling Programme

Used oil is the largest single source of hazardous recyclable material in Alberta and poses a significant environmental problem if not managed effectively. One litre of used oil can contaminate up to one million litres of fresh water. Used oil filters and used plastic oil containers may also contain residual amounts of oil that are harmful to the environment.

In order to avert the potential damage to the environment that could be caused by the inappropriate disposal of used oil materials, a "Made in Alberta" programme was developed under the direction of the Alberta Used Oil Management Association (AUOMA). The purpose of the programme is to recover used oil materials (used oil, used oil filters and used plastic oil containers) in order to protect the environment. These materials include:

- Any petroleum or synthetic crankcase oil, engine oil, hydraulic fluid, transmission fluid, gear oil, heat transfer fluid or other fluid used for lubricating purposes in machinery or equipment.

- Any spin-on or element oil filter used in hydraulic, transmission or internal combustion engine applications - includes diesel fuel filters but does not include gasoline fuel filters.
- Any plastic container with a capacity of less than 30 litres that is manufactured to hold oil.

In addition to avoiding negative impacts on the environment, the used oil recycling programme in Alberta provides a vehicle for recovering materials from the filters and containers that have a residual value after their primary use.

This study was conducted to provide an account of the environmental and economic efficiency of a Canadian Extended Producer Responsibility (EPR) programme for presentation at the OECD Workshop on the Economics of EPR to be held at the Tokyo International Forum December 10-11, 2002 in Japan. The Alberta Used Oil programme was selected by Environment Canada as a case study for the following reasons:

- It is a relatively mature industry programme.
- The industry management association has a high degree of public transparency.
- The programme has a good historical record of data.
- The environmental and economic performance of this programme undergoes third-party verification.
- A high degree of environmental significance is associated with the product regime targeted.

Environment Canada contracted with The Corporate Link, Management Consultants, in St. Albert, Alberta to conduct a study, in cooperation with the Alberta Used Oil Management Association and the Alberta Government, Department of Environment, with the express objectives of reviewing and evaluating the programme's environmental performance, cost-effectiveness and other significant socio-economic impacts. To facilitate comprehension of performance results it was deemed necessary to include a brief description of how the programme works, an overview of the Alberta Used Oil Management Association and an account of challenges the programme will likely face in the future.

The review and evaluation consisted of assessing the actual programme performance against the goals and performance measures articulated in AUOMA's business plan. As stated in the business plan, the key goals to be accomplished by AUOMA are:

1. To increase the recycle rate (percentage of used oil materials generated, that are being recycled in an environmentally sound manner) of used oil, oil filters and oil containers in Alberta.
2. To ensure all areas of the province are achieving adequate recycle rates.
3. To encourage the development of a strong, competitive, private sector used oil materials collection and recycling industry in Alberta.
4. To encourage environmentally sound methods that reduce or eliminate used oil materials going to landfill, or other unacceptable disposal methods.
5. To maximize the flow-through of Environmental Handling Charge that is directed to programme costs.

Other significant socio-economic impacts were evaluated to assess the overall success of the programme including:

- Impact on Taxpayers
- Government Costs and Benefits
- Impact on Consumer Prices
- Regional Employment and Industry Development
- Impact on Second Level of Competition in Post-Consumer Waste Sector
- Impact on Production Efficiency
- Impact on Market Access
- Impact on Dynamic Efficiency
- Impact on Trade Activity

- Impact of Free-riders
- Impact on Design for Environment

The results of this study suggest that Alberta's Used Oil programme has been an extremely successful collaboration between government and industry and has produced a number of positive environmental and socio-economic impacts in a cost-effective manner.

The environmental performance of the programme shows a 5-year continuous improvement in return rates for used oil materials, as evidenced by the following 2001/2002 figures:

- 64,839,740 litres of used oil, a recovery rate of 71% of used oil available for recycling;
- 5,973,939 used oil filters, a recovery rate of 86%;
- 1,083,615 kg of used plastic oil containers, a recovery rate of 43%.

The number of collection facilities operating within the parameters of the programme has grown from 225 to 640 and is providing province wide access to all participants for recycling all used oil products.

The economic performance of the programme is highlighted by the following:

- Overall programme costs are consistent with pre-programme disposal costs of about \$13 million annually.
- The per unit cost of recycling used oil materials is decreasing over time.
- Administrative costs are being held in check at approximately 4% thereby maximizing the amount of Environmental Handling Charge that is available for direct programming.
- The overall cost of the programme is very small in comparison to the cost of remediating contaminated water supplies.

Other socio-economic impacts are highlighted by the following results:

- With less waste being disposed through the municipal waste management infrastructure, taxpayer costs have been reduced.

- Although the provincial government bears some costs for monitoring the programme the burden on government has been reduced with the programme responsibility being moved outside of government.
- Consumers are generally responsible for paying the Environmental Handling Charge associated with the programme.
- A strong and vibrant recycling industry is supported by results that show an increase in the number of collectors, transporters and processors involved with the programme, a significant increase in the number of collection facilities available and the emergence of new and innovative products being developed from the returned used oil materials.

The programme has also triggered the creation of a regional used oil programme across western Canada. In June 2001, the programme received the prestigious Emerald Award from the Emerald Foundation for Environmental Excellence for demonstrating leadership in addressing environmental issues in Alberta. This Alberta-based foundation recognizes organisations that show leadership in addressing Alberta's environmental issues.

Notwithstanding the successes to date, the biggest challenge facing the programme is improving the overall performance for recovering used plastic oil containers, which now have a return rate of 43%. A priority strategy for the programme this year is to conduct a comprehensive field study of sales and recycle/reuse rates of oil containers by major industry sector and selectively adjust awareness and return incentive (RI) programmes to increase recovery rates.

Other priorities for the programme in the short term will be:

- To increase public relations and communications activities to increase public awareness.
- To raise the bar on environmental standards and performance by collectors and processors by working with government to establish new compliance protocols.
- To continue to work with the remaining provinces in Canada to develop a consistent national programme that will create a Canada-wide used oil materials programme that is seamless across all provincial borders.

History of the Programme

Described as “government initiated and industry driven”, the AUOMA Programme began with a request made in 1988 by the Canadian Council of Ministers of Environment (CCME) to the Canadian Petroleum Products Institute (CPPI) for assistance in quantifying the environmental impact of used oil. In response to a “white paper” developed by the CPPI on this issue, the Government of Alberta decided to initiate action and established the necessary supporting framework and environment that would facilitate a coordination of efforts between industry, government and stakeholders.

An extensive consultation process involving over 100 different stakeholder groups was launched in June 1992, including members of the recycling industry.

Early in the consultation process stakeholders identified a need to first proceed with a pilot project to determine the feasibility of developing a programme to return used oil, filters and containers without the incentive of a deposit.

The pilot allowed for fine-tuning of the programme, and demonstrated the feasibility of a non-deposit return programme for used oil, oil filters and oil containers. The tangible results achieved also provided support to the earlier momentum achieved through the stakeholder consultation process, and supported subsequent approval of the Lubricating Oil Materials Recycling and Management Regulation in April 1997, which established the Alberta Used Oil Recycling Programme.

This regulation created a level playing field by ensuring that all “first sellers” of oil products must register and be part of the programme.

The Government of Alberta expected the programme to reduce the amount of waste going to landfills, preserve non-renewable resources through effective recycling programmes and remove hazardous materials from Alberta’s air, land and water while maintaining an arms length relationship with government.

How the Programme Works

The heart of the programme is a Return Incentive (RI) paid to private sector collectors, transporters and processors to recover used oil materials from the environment. The funding mechanism for this RI is an Environmental

Handling Charge (EHC) that must be remitted to AUOMA by the first sellers of lubricating oil materials, and which is generally applied at the point of sale.

Currently Alberta has 53 independent return depots, or EcoCentres, and 587 other collection facilities. This network of facilities is located throughout the province for the purpose of providing convenient access for individuals and organisations wishing to recycle used oil materials.

Return Incentives are paid on the basis of volume of oil, weight of filters, and weight of containers collected.

Alberta Used Oil Management Association (AUOMA)

The AUOMA is a not-for-profit organisation of wholesale suppliers of lubricating oil materials in Alberta created to develop and manage programmes that encourage responsible environmental handling and recycling of used oil materials (used oil, oil filters and oil containers) in all markets in Alberta. Partners and stakeholders include all first sellers of oil and oil filters, as well as collectors, transporters and processors of used oil materials. AUOMA is an entity outside of government and is referred to in Alberta as a Delegated Administrative Organization (DAO). AUOMA is accountable to the Alberta Minister of Environment, its members and all stakeholders.

AUOMA has established the following vision for their programme:

- Every litre of used oil and related materials that can effectively be collected are recycled or reused in an environmentally acceptable manner.
- The collection and recycling of used oil materials is done through private industry, operating without subsidization.
- Albertans are aware of the hazards of improper disposal of these used oil materials and cooperate fully in their recycling and reuse.

AUOMA has developed a three-year rolling business plan, which they are required to submit annually to the Alberta Minister of Environment.

On an annual basis the programme prepares a comprehensive Annual Report that highlights the performance of the programme.

1. Background

This study was conducted to provide an account of the environmental and economic efficiency of a Canadian EPR programme for presentation at the OECD Workshop on the Economics of EPR to be held at the Tokyo International Forum December 10-11, 2002 in Japan. The Alberta Used Oil programme was selected by Environment Canada as a case study for the following reasons:

- It is a relatively mature industry programme.
- The industry management association has a high degree of public transparency.
- The programme has a good historical record of data.
- The environmental and economic performance of this programme undergoes third-party verification.
- A high degree of environmental significance is associated with the product regime targeted.

1.1 *History of the Programme*

Used oil is the largest single source of hazardous recyclable material in Alberta and poses a significant environmental problem if not managed effectively. Currently, the private sector recovers and properly manages about 65 million litres of used oil each year. However, an estimated 26 million litres is disposed of improperly, along with millions of oil filters and containers. The potential damage is staggering – one litre of used oil can contaminate up to one million litres of fresh water.

In order to avert the potential damage to the environment that could be caused by the inappropriate disposal of used oil materials, a “Made in Alberta” programme was developed under the direction of the Alberta Used Oil Management Association. The purpose of the programme is to recover used oil materials (used oil, used oil filters and used plastic oil containers) in order to protect the environment. These materials include:

- Any petroleum or synthetic crankcase oil, engine oil, hydraulic fluid, transmission fluid, gear oil, heat transfer fluid or other fluid used for lubricating purposes in machinery or equipment.

- Any spin-on or element oil filter used in hydraulic, transmission or internal combustion engine applications - includes diesel fuel filters but does not include gasoline fuel filters.
- Any plastic container with a capacity of less than 30 litres that is manufactured to hold oil.

In addition to avoiding negative impacts on the environment, the used oil recycling programme in Alberta provides a vehicle for recovering materials from filters and containers that have a residual value after their primary use.

Described as “government initiated and industry driven”, the AUOMA Programme began with a request made in 1988 by the Canadian Council of Ministers of Environment (CCME) to the Canadian Petroleum Products Institute (CPPI) for assistance in quantifying the environmental impact of used oil. In response to a “white paper” developed by the CPPI on this issue, the Government of Alberta decided to initiate action coordinated between industry, government and stakeholders.

Consultation

At the outset, significant stakeholder consultation was considered to be critical to success. An extensive consultation process involving over 100 different stakeholder groups was launched in June 1992, commencing with one large meeting to first generate issues. This meeting included as many parties as could be identified as being either directly or indirectly connected with used oil, including governments, health authorities, and private sector companies in industries such as automotive services and those currently in the collection and recycling industry. As a result of this initial meeting, a Steering Committee and a number of working committees were established to build consensus within stakeholder groups and develop recommendations for programme implementation. The AUOMA Programme was consequently developed through a consultation process with Alberta stakeholders that involved municipalities, non-government organisations (such as the Recycling Council of Alberta and consumer associations), industry and members of the public in the development and testing of many innovative proposals. The consultation process and programme development is considered by those involved as a “model” for government/industry partnership.

The most significant risk that AUOMA faced during start-up was the potentially intrusive nature of the programme on the existing private sector, free market recycling industry. A vibrant recycling industry is critical to the success of this programme. While active in collection and recycling, this industry is still

relatively new. Significant apprehension existed within the industry, which viewed this organisation as “pseudo-government”, potentially holding significant power over the industry. To offset this apprehension, this industry sector was included as part of the stakeholder group from the beginning, and are now very satisfied with the role AUOMA is currently playing.

Pilot Project

Early in the consultation process stakeholders identified a need to first proceed with a pilot project to determine the feasibility of developing a programme to return used oil, filters and containers without the incentive of a return. In April 1993 the Alberta Used Oil Management Association was incorporated to facilitate construction and operation of an Alberta pilot project. This pilot project was jointly funded by government and industry. Funds were collected from industry partners on a voluntary basis, with gold, silver and bronze contribution levels identified based on volume of sales. While not all industry partners participated, 50% of the costs for the pilot project were funded in this manner. Industry partners were subsequently reimbursed for their contributions to the pilot project.

The pilot project consisted of design and construction of six recycle centers (or EcoCentres) that were set up at existing bottle depots in central Alberta (Red Deer, Sylvan Lake, Ponoka, Lacombe, Rocky Mountain House, Stettler). Clustered together within this centralized geographic location it was possible to utilize common newspapers and other media to promote the programme and truly determine the impact of the pilot project. Funds were used to buy the capital facilities and provide a retainer for participating depots. Collectors volunteered to pick up materials returned by consumers and businesses at no cost throughout the pilot project.

During the test period of just under two years, consumers returned over 128,000 litres of used oil, 23,000 used oil filters and the equivalent of 166,000 used one-litre containers. Returns increased dramatically as awareness of the programme and EcoCentres increased among consumers. The popularity of the pilot project created a demand by the communities to continue to run the depots beyond the original pilot project timelines.

The pilot allowed for fine-tuning of the programme, and demonstrated the feasibility of a non-deposit return programme for used oil, oil filters and oil containers. The tangible results achieved also provided support to the earlier momentum achieved through the stakeholder consultation process, and supported subsequent approval of the Lubricating Oil Materials Recycling and

Management Regulation in April 1997, which established the Alberta Used Oil Recycling Programme.

Government Expectations

The Alberta Used Oil Management Association carries out programmes that contribute directly to the Government of Alberta's Department of Environment's goals of reducing the amount of waste going to landfills, preserving non-renewable resources through effective recycling programmes and the removal of hazardous materials from Alberta air, land and water.

The Alberta Government believes that in order for the used oil programme to be successful AUOMA must take ownership of the performance measures that they adopt. As a result of this belief, the Government works cooperatively with AUOMA and other stakeholders to develop programme expectations that are articulated in the Association's annual business plan that is submitted to the Alberta Minister of Environment on an annual basis.

In addition to an annual business plan, the Association is required under legislation to submit an annual report to the Alberta Minister of Environment.¹ The government conducts an annual assessment and evaluation of the annual report within the parameters described under an Accountability Framework for Delegated Administrative Organizations that has been adopted by the Government of Alberta, and sets the standards for monitoring and evaluating all stewardship boards in Alberta.² Feedback on the results of their annual assessment is provided back to the Association to be used as part of its continual improvement process and subsequent strategy adjustment.

Within the broad goals established by the Alberta Department of Environment, officials of the department work closely with AUOMA to achieve progress in the following areas of concern to government:

- Ensuring that adequate recycle targets are being achieved.
- Ensuring that there is a high level of public awareness of the benefits of recycling used oil materials.

1. Government of Alberta. *Lubricating Oil Materials Recycling and Management Regulation*. April 1997.

2. Government of Alberta. *Accountability Framework for Delegated Administrative Organizations*. November 1998.

- Ensuring a high level of public and industry satisfaction with the programme.
- Ensuring that all Albertans have access to used oil material recycling locations.
- Ensuring that all wholesale suppliers of used oil materials are participating in the programme and are complying with standards set by the programme.
- Ensuring that the programme demonstrates fiscal responsibility in the handling of all financial resources.
- Ensuring that the recycling industry is sustainable over time while reducing or eliminating the EHC.
- Ensuring that the Association implements good governance practices.

The government facilitates and promotes its partnership with the programme by having a senior official in the Alberta Department of Environment sit on the Board of Directors of AUOMA. This provides ready access to government policy and direction and provides a very important link to the Alberta Minister of Environment in designing and delivering Association programmes.

1.2 *How the Programme Works*

Stakeholders considered several options including deposit refund programmes and mandatory return programmes for the return of used oil. The AUOMA programme as it is currently defined is designed to encourage responsible recycling, to increase the capture rate of used oil related waste materials and to further support the development of the private sector recycling industry in the province of Alberta.

Early consensus was reached by the stakeholders that enhancements to collection and recycling would occur through incentive programmes designed to expand the reprocessing infrastructure developed by the recycling industry and to address the market areas that had not been fully developed.

The heart of the current programme is a Return Incentive (RI) paid to private sector collectors and container processors to recover used oil materials from the environment. Previously, generators paid a fee to collectors for disposal of these materials. The AUOMA programme stimulates the return of

material by providing a RI to collectors and/or container processors at a level that allows the collectors to compensate return depots and large generators for their handling and storage activities. By converting products previously considered waste into commodities with a value, the programme provides an incentive to collectors to pick up materials, and to operators to save the materials rather than disposing them as a hazardous waste. While the RI level is fixed, it may not be the sole source of revenue for collectors. Collectors still operate in a free market system, and the actual amount paid and received for used oil materials is dependent upon market demand.

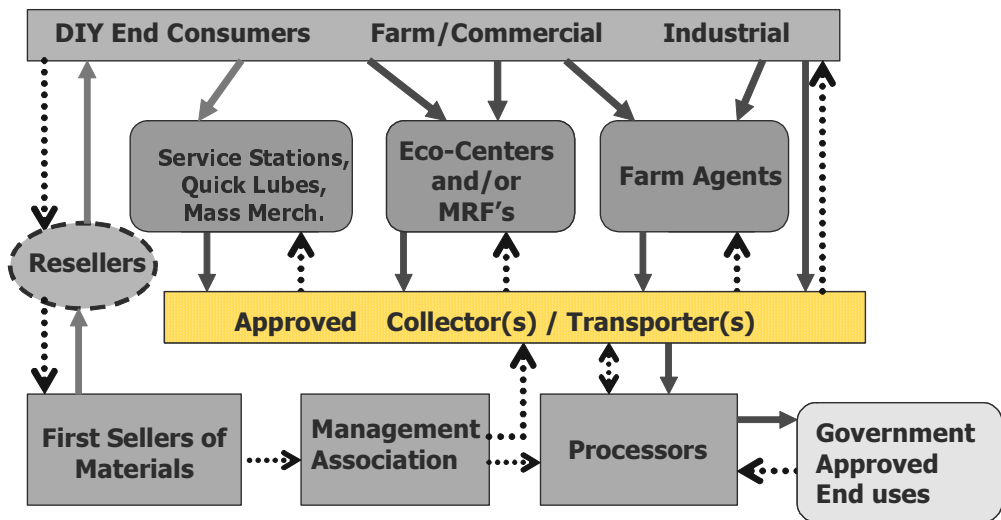
Careful consideration was given to the level of RI required to make the programme viable. To determine the appropriate level, a survey was first conducted of what the current charges to generators were in different zones. Input was also sought from collectors regarding what they thought the incentive should be in each zone, to ensure a viable business opportunity existed and that the programme did not negatively impact the existing recycling industry. All of this input was used to establish a baseline for the initial RI levels in each zone. Coverage across the diversity of the province is assured in all markets through Freight Equalized Zone Pricing for RIs.

The funding mechanism for this RI is an Environmental Handling Charge (EHC), which applies to most sales of new oil and filters. Previously, the cost of recycling used oil materials was incurred at the end of the cycle, when operators paid to have materials removed. Rather than increasing the overall costs to operators, the AUOMA programme has resulted in a change in the timing of these costs, in that they now occur at the front end of the transaction at the point of sale. Each litre of oil, each oil container, and each oil filter has an EHC applied to it by the “first seller” at either the manufacturer, wholesaler, major retailer or importer level. The EHC is fixed for all of Alberta and is currently set at 5 cents per litre for oil, 50 cents for a filters less than 203 mm (8”) in length and \$1 for a filter 203 mm or more in length, and 5 cents per litre of container size. The EHC has remained stable over the life of the programme and there is no immediate plan to change the rate.

The following diagram illustrates the flow of material and funds under this programme:³

³. Alberta Used Oil Management Association. *Programme Schematics*. 2002.

Figure 1. Flow of Materials and Funds in Alberta Used Oil Programme



Key Features of the Programme

Some key features of the management framework developed during the consultative process include the following:

- The AUOMA programme is based on a user pay concept. The programme ensures that a fair distribution of the costs associated with collection and recycling of used oil related materials are tied to the point of sale for the consumer/generator, rather than on the material return.
- AUOMA supports only those end uses that provide landfill diversion and environmentally sound recycle/reuse options. Road oiling and landfilling are not acceptable end uses under this programme.
- AUOMA is not a regulatory authority, nor will the Association become involved in or own collection and recycling facilities. The AUOMA will in practical terms represent an administrative function that will encourage increased collection and recycling activity within the province of Alberta through the administration of incentive based programmes.

Product Collection, Storage and Transport

Currently Alberta has 53 independent return depots, or EcoCentres, and 587 collection facilities. This network of facilities is located throughout the province for the purpose of providing convenient access to individuals wishing to recycle used oil materials. There has been a significant increase in the number of independent return depots since the programme began, as a result of the increased market demand and inherent value in used oil materials.

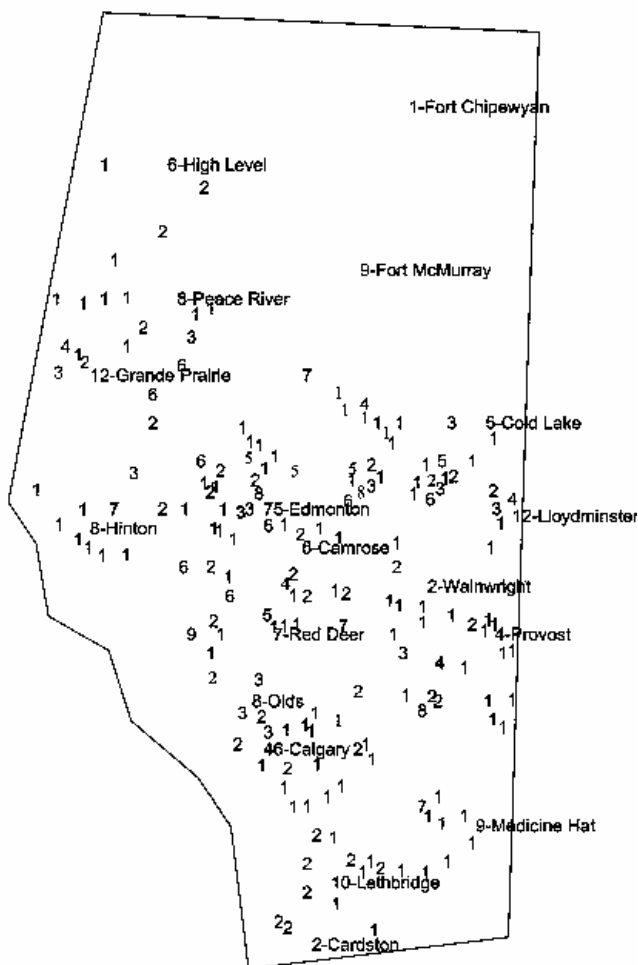
It is estimated that the cost of building an EcoCentre ranges from \$23,000 to \$25,000.

Under the terms of a collection facility agreement with the Alberta Used Oil Recovery Corporation (AUORC) and the Alberta Bottle Depot Association (ABDA), AUOMA is charged a fee for provision and management of the EcoCentre network. AUORC oversees 46 EcoCentres that are operated by ABDA members and seven that are operated by municipalities. The terms of the agreement allow AUOMA to set the standards of operations for the facilities. Since the independent return depots do not directly profit from the sale of the oil and filter products they require another economic drive to exist. As part of the agreement and to increase used oil material recycling, AUOMA has developed Supplemental Return Incentives (SRI) for collection facilities. Another important part of the agreement is that AUOMA provides funding for liability insurance for the 53 EcoCentres. At no time in the collection process does AUOMA take ownership of used oil materials. Therefore, product storage and transport is not the responsibility of this organisation.

The following Figure 2 illustrates the number and geographic distribution of total used oil material collection depots across the province:⁴

⁴. Alberta Used Oil Management Association. *Used Oil Material Depots*. 2002.

Figure 2. Map of Used Oil Material Collection Depots in Alberta, Canada



Reuse and Recycling of Materials

Used oil materials that are recovered are eventually reused and recycled into the following:

- Recycled oil is used extensively in the production of asphalt for roads and highways and can also be burned for energy.

- Oil filters are shredded, heated to a molten state and the metals re-used as material for other metal products such as rebar, nails and wire.
- Empty plastic oil containers can be recycled into new containers, plastic flowerpots, plastic pipe, fence posts and plastic patio furniture.

Programme Registration

The AUOMA requires that each participating collector and processor register with the Association by submitting the appropriate forms and providing documentation verifying that the company has the required government approvals with respect to their specific operations. Examples of such documentation for a collector would be copies of the company's Alberta Safety Fitness Certificate and verification that the company drivers maintain current transport of dangerous goods (TDG) training. Processing facilities could be required to provide a copy of their Alberta Environment Operating Approval if this was appropriate for their type of business, or copies of valid permits or licenses from other governing jurisdictions.

As indicated earlier, AUOMA is not a licensing or regulatory body. The Association relies on existing government approvals, licenses and permits to screen eligible industry participants under the AUOMA programme. AUOMA does undertake compliance audits of all registered collectors/transporters and processors to ensure external programme compliance and that each registrant complies with AUOMA regulations, bylaws and policies. This audit protocol also applies to out of province processors.

Remittance of EHC is mandatory in Alberta, and is applied at the first sale of oil materials in the province to a person or organisation not registered with AUOMA. First sellers then must make a determination as to whether they will absorb the EHC or whether they will apply a surcharge to the consumer of the product.

Under the authority of Regulations enacted by the Government of Alberta, wholesale suppliers failing to register or remit EHC may be subject to significant fines and removal of business licenses. It is the responsibility of the province to take such action as is deemed necessary in the event of violation of Regulations.

Public Awareness

A critical factor in AUOMA's success is being present in the community and sharing the used oil message with Albertans. Communications activities are

based upon the philosophy that more understanding equals more recycling, which in turn equals less waste. This is supported by research recently commissioned in partnership with the Saskatchewan Association for Resource Recovery Corporation (SARRC) and the Manitoba Association for Resource Recovery Corporation (MARRC) on public and target stakeholder awareness about used oil recycling. Key findings of this research stress the need to find ways of educating key stakeholders about the importance and ease of used oil material recycling.

Some of the key communication, education and awareness activities undertaken by AUOMA include the following:

- Management of a call centre and maintenance of a website.
- Participation in a province-wide EcoDay to increase public awareness and encourage used oil material recycling. This includes placing advertisements in every daily and weekly newspaper in Alberta, features on radio stations, and promotional activities via direct mail drop to farms and acreages.
- Partial sponsorship of a programme called “Recycling 101”, which travels to Alberta municipalities to teach municipal stakeholders about recycling options and ways to improve their individual recycling programmes.
- Development of a programme called “Let’s Recycle” as part of the grade four school curriculum. This programme, designed to reach a younger audience and educate children about the impact of used oil material recycling, was developed in partnership with the Recycling Council of Alberta (RCA) and Alberta Environment.
- AUOMA’s mascot, Mr. Oil Drop, appears throughout the year at several community events and parades around the province.
- Various pieces of literature have been produced to support communication activities at point of sale and collection facilities, as well as at a variety of industry trade shows.

Partners in this communication role include member companies; municipalities; schools; EcoCentres and other collection facilities; provincial government; media; and related used oil recycling associations in Saskatchewan and Manitoba (SARRC and MARRC).

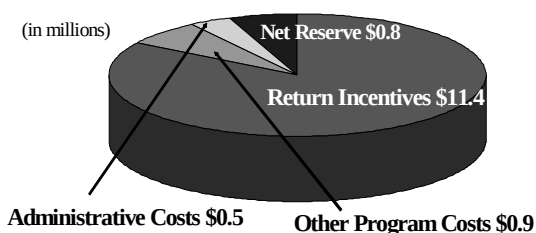
1.3 Sources of Revenue and Expenditure

Ongoing Financial Requirements

Figure 3 below summarizes revenue and expenditures for fiscal year 2001/2002. These figures are generally representative of the ongoing fiscal operations of the programme. Table 1 represents a more detailed account of fiscal year 2001/2002 revenues and expenditures.

Figure 3. Disposition of Revenue Collected

April 1, 2001 -- March 31, 2002



Revenue

EHC Collected = \$13.4 million

Interest and Other = \$ 0.2 million

Total Revenue \$13.6 million

Table 1. Statement of Revenue and Expenditures⁵ for Fiscal Year Ended March 31, 2002

	<u>(\$000's)</u>
Revenue:	
Environmental Handling Charge	13,372
Investment Income	254
Registration Fees	2
	<u>13,628</u>
Expenditures:	
Programme Costs:	
Return Incentives	11,443
Eco-Centre Service Contract	402
Communications and Public Relations	315
Management/Administration Contracts	50
Consulting	50
Compliance Reviews	36
Professional Fees	26
Eco-Centre Engineering and Training	3
	<u>12,324</u>
Administrative Costs:	
Management/Administration Contracts	328
Board Expenses	49
Office and General Expenses	44
Professional Fees	35
Amortization	34
Rent	34
	<u>525</u>
Total Expenditures	<u><u>12,848</u></u>
Current Year Revenue over Expenditures	<u><u>779</u></u>

5. Alberta Used Oil Management Association. *Annual Report 2001-2002*. Fall 2002.

Net Reserve

Figure 3 above indicates that a portion of the annual revenues collected is allocated as Net Reserve. AUOMA maintains a reserve fund to:

- Wind up the Association's programmes.
- Handle any unanticipated changes to the Association's programmes and mandate.
- Deal with any unforeseen claims or events.

The following are the major features of AUOMA's planned reserve fund:

- It is managed by AUOMA's Board of Directors.
- The Environmental Handling Charge (EHC) is the only source of funding.
- The Growth of Reserve Fund diminishes with the success of programme.
- The EHC is a form of advance disposal fee (ADF).
- The life cycle of products managed is six to nine months and therefore the ADF financial commitment is \$6 to \$9 million.
- Other uses of the fund are controlled by policy.
- The Business Plan projects that the fund will top out at \$7.0 million.
- AUOMA Bylaws call for this fund to be paid over to another non-profit recycling organisation if AUOMA is wound-up.

Payment of Return Incentives

As indicated in Figure 3, the majority of costs under this programme relate to payment of Return Incentives.

To receive payment of Return Incentives, collectors must submit recycle or summary dockets signed by the processor, and processors must be registered with AUOMA. Return Incentives are paid on the basis of volume of oil, number

of drums of filters, and weight of containers collected. The volume of oil collected is determined by tank gauging, and the rate paid is discounted by the amount of contamination by water and other solids. Originally RIs for filters were based on drum size, but this has recently changed to payment based on weight, as is the case for containers. This weight is verified through submission of a printed weight scale ticket.

It was decided early on in the programme to minimize disruption to the current recycling industry by maintaining historical measures. However, AUOMA found that measurement of filters based upon drum size was far too elastic, and had the potential to grow without verification.

Similarly, in hindsight, a weight measurement system that considers weight and specific gravity of used oil may provide for greater checks and balances, though no change to the current measure based on volume of oil is anticipated.

Although EHC's are fixed across the entire province, Return Incentives vary by region. Recognizing that transportation costs are a key component of used oil material collection, the AUOMA has established six freight-equalized zones within Alberta, and separate RI rates are set for each of these zones. The freight-equalized zones are based on primary and secondary road systems; the volume of used oil related materials available for collection; and provincial demographics. The freight-equalized zones are required to ensure that collectors are appropriately reimbursed for costs associated with collection, and to promote enhanced capture rates and recycling of used oil related materials in market segments which have historically not been fully developed.

Table 2 below shows the Return Incentives paid by zone and Figure 4 describes the six collection zones.

Table 2. Return Incentive Payment Schedule by Zone

Zone	Used Oil (\$/litre)	Used Oil Containers (\$/kg)	Used Oil Filters (\$/kg)
1	0.08	0.87	0.68
2	0.10	1.09	0.76
3	0.10	1.09	0.76
4	0.10	0.98	0.85
5	0.12	1.09	0.94
6	0.17	1.10	1.19

Figure 4. Collection Zones



The following guiding principles are used in the setting of RIs for all three products:

- Return Incentives are set to achieve collection objectives, and EHCs are set to provide the required funding.
- RIs will be paid for specific performance only.
- RIs paid to oil container processors will require reporting of inventory levels.
- Only one RI per product will be set for each zone for all participants.
- RIs will be adjusted in a timely fashion with the objective of causing minimal disruption to the normal course of business.

- All information provided by participants will be held in strictest confidence and will be released only in aggregate form.
- The AUOMA Board of Directors will make all final decisions relative to the RIs.

As this is a relatively new programme, the effectiveness of RI incentives is monitored very closely. Changes are made as required to meet AUOMA's objectives. The triggers of change are:

- Economic impacts to the private sector recycling industry;
- Used oil materials collected vs. plan;
- Dollars spent vs. plan;
- Changes in business economic fundamentals;
- Input from all stakeholders;
- Inflation and increased costs associated with collection and recycling operations.

The portion of the Return Incentive that flows back to generators can also be used as an indicator of programme maturity. Once all of the RI flows completely back to the generator, this will indicate that an incentive is no longer required to maintain the level of recycling of used oil material, and the AUOMA programme should then cease to exist.

1.4 *Programme Integration*

To make the programme as unobtrusive and as easy to follow as possible, AUOMA has developed procedures and forms for registration and remittance that are consistent with those used by programmes operated in Saskatchewan and Manitoba. This is especially useful to programme registrants operating in more than one province in Canada.

AUOMA is also currently working with the remaining provinces in Canada to develop a consistent national programme that will create a Canada-wide used oil materials programme that is seamless across all provincial borders.

2. Alberta Used Oil Management Association

2.1 Organisation Overview

AUOMA is a not-for-profit organisation of wholesale suppliers of lubricating oil materials in Alberta. The Association's mission is to develop and manage programmes that encourage responsible environmental handling and recycling of used oil materials (used oil, oil filters and oil containers) in all markets in Alberta. Partners and stakeholders include all first sellers of oil and oil filters, as well as collectors, transporters and processors of used oil materials.

Programme Vision

AUOMA has established the following vision for their programme:

- Every litre of used oil and related materials that can effectively be collected are recycled or reused in an environmentally acceptable manner.
- The collection and recycling of used oil materials is done through private industry, operating without subsidization.
- Albertans are aware of the hazards of improper disposal of these used oil materials and cooperate fully in their recycling and reuse.

This vision is supported by the following beliefs that direct the day-to-day operations of the programme:

- Used oil material collection performance will meet environmental expectations of society.
- Used oil material collection programmes will progressively eliminate indiscriminant disposal of used oil materials.
- Programme results are best achieved through the private sector recycling industry.
- Industry, government and the public will support fair programmes that are efficient, and cost-effective.
- Stakeholders value ongoing dialogue and active involvement.
- Sound environmental protection practices make good business sense.

- Measurement is necessary to evaluate our performance.

Although AUOMA does not directly fund research, technology and innovation, it exists to nurture an environment conducive to the advancement of technology and innovation by the private sector.

2.2 Governance

While industry was actively involved in developing this programme, a significant benefit was seen in having participation legislated to ensure equal involvement of all parties. This desire to ensure that a level playing field existed was the key driver for the Alberta Government to pass the Lubricating Oil Material Recycling and Management Regulation in 1997 for an initial five-year period. The legislation has been amended to extend the programme for an additional 7 years through 2009.

AUOMA is accountable to the Alberta Minister of Environment as well as to its members and all stakeholders. It is incorporated under the Societies Act of Alberta, managed by a board of directors drawn from its members, retailers, two levels of government and other non-government organisations.

AUOMA has developed comprehensive operational and Directors' manuals for use by board and staff members. The Director's manual includes policies and guidance on all matters of significance to Board members including:

- Incorporation and By-laws;
- Legislation;
- Business plans and annual reports;
- Code of Conduct;
- Conflict of Interest;
- Confidentiality;
- Investment Policies;
- Board Remuneration;
- Committees;

- Directors Insurance.

Association Management and Staffing

The Association is managed by an Executive Director supported by programme staff that provide financial, information technology, communications, public relations and other administrative services.

In order to maintain industry members and public confidence over the financial activities of the Association, a decision was made to contract the financial management of the organisation to an internationally recognized financial services group, BearingPoint, Inc., formerly KPMG Consulting, Inc. This provided members with the confidence associated with having a reputable international financial services company managing the accounting function, combined with a built-in oversight function by having programme staff report to a senior partner in BearingPoint, Inc. rather than to the Executive Director of AUOMA.

As required, other services are also obtained on a fee for services basis to meet emerging needs. Given that the programme required many competing companies to come together and to provide competitive information to the programme, one of the largest challenges facing the Association was to develop a highly professional organisation that was above reproach.

A key issue for AUOMA is the need to maintain the confidentiality of market share information. All information gathered is very sensitive, and must reach the public only in aggregate form. Confidentiality is key to addressing competition issues internally; each staff member is required to sign a confidentiality agreement, since information maintained by AUOMA could be used by both recyclers and suppliers to gain market intelligence that could give them an unfair competitive advantage. Maintaining the confidentiality of this information even from the Board itself (which includes as its members individuals working within the industry) is critical to maintaining the integrity of the programme.

To date there have been no breaches of confidentiality and Association members consider the staff to be of the highest professional quality.

2.3 *Operations*

Planning

AUOMA has developed a three-year rolling business plan, which they are required to submit annually to the Alberta Minister of Environment. As a result of this business planning process, AUOMA has developed the following core businesses and goals:

Core Businesses

- Programme Management - AUOMA develops and implements programmes that encourage the private sector to collect and process used oil materials in an environmentally acceptable manner.
- Communications - AUOMA informs stakeholders in all market sectors of the need and benefit of returning used oil materials for recycling.
- Funds Management - AUOMA effectively manages Environmental Handling Charge (EHC) and Return Incentive (RI) funds to fulfil its mandate.

Goals and Performance Measures

The following goals define AUOMA's priorities and provide a basis to measure programme performance:

Goal	Performance Measures
1. To increase the recycle rate (percentage of used oil materials generated, that are being recycled in an environmentally sound manner) of used oil, oil filters and oil containers in Alberta.	• Projected volumes and percentages to be recycled based on volumes available.
2. To ensure all areas of the province are achieving adequate recycle rates.	• Province wide recycle rates <i>versus</i> objective set in Goal 1. • Rural recycle rates as a percentage of the total compared to long-term objective.
3. To encourage the development of a strong, competitive, private sector used oil materials collection and recycling industry in Alberta.	• Volume of used oil materials collected, by product. • Number of Collectors and Processors registered. • Amount of Return Incentives paid to collectors and transporters. • Number of collection facilities providing a no-charge service in the province.
4. To encourage environmentally sound methods that reduce or eliminate used oil materials going to landfill, or other unacceptable disposal methods.	• Increase in the percentage of used oil materials that are recycled.
5. To maximize the flow-through of EHC that is directed to programme costs.	• Administrative costs as a percentage of Environmental Handling Charge (EHC) should not exceed 6% of EHC collected.

Monitoring, Evaluating and Reporting

Detailed data is collected and maintained on the volumes of used oil material collected, the amount of EHC collected and the Return Incentives paid. This information is critical to monitor the results of the programme. In order to be able to respond as quickly as possible to programme performance, monthly monitoring reports are prepared and presented to the Board of Directors. This

information is used to evaluate performance and make adjustments to programme strategies as required.

As part of the ongoing programme operations, AUOMA undertakes the following activities to ensure external programme compliance:

- Perform compliance audits of all registered suppliers of lubricating oil materials. Procedures performed to ensure that EHC collected and remitted is complete.
- Complete procedures to ensure all suppliers of lubricating oil materials have been identified and are registered with AUOMA.
- Perform compliance audits of all registered collectors/transporters and processors. Procedures performed to ensure that each registrant complies with AUOMA regulations, by-laws and policies.

On an annual basis the programme prepares a comprehensive Annual Report that highlights the performance of the programme. This report is submitted to the Alberta Minister of Environment and AUOMA's membership. The report is tabled by the Minister in the Legislative Assembly and becomes public information available to all citizens in the Province of Alberta.

Annual financial statements, as prepared by an independent audit, of the revenues received and the expenditures incurred by the stewardship programme are included in the annual report required by the Minister.

As well as ensuring an audit is completed on revenues received and expenditures incurred, an independent audit is also conducted on AUOMA's key performance indicator (volume of used oil materials collected) as part of ensuring accountability to its stakeholders. This audit includes examining, on a test basis, evidence supporting the information, and evaluating the overall presentation of the information. The Auditors' Report on Schedule of Used Oil Materials Collected is included in AUOMA's annual report.

An annual assessment of the internal operations of the programme is conducted by ensuring that the administrative costs of the programme do not exceed 6% of the EHC collected and a formal review of the Executive Director's performance in leading the association and its programmes is conducted by the Board of Directors.

The annual report contributes significantly to an environment of open and transparent communication between the programme, its members and the public, which has been deemed essential to the success of the programme.

Review and Improvement

Based upon monthly and annual performance monitoring and evaluation activities undertaken by the programme and the Board of Directors the Association has created an environment of continual improvement.

Each and every year strategies are updated and adapted to improve upon performance from the previous evaluation and reporting cycle. Performance measures are also reviewed and updated if required. These updated strategies and performance measures are developed and approved by the Board of Directors and included in the upcoming three-year Business Plan. Programme staff then design new programmes to be implemented.

In response to the evaluation of current programme, a number of new strategies are being implemented over the next three fiscal years for AUOMA including:

- Conduct a comprehensive field study of sales and recycle/reuse rates of oil containers by major industry sector and selectively adjust awareness and return incentive (RI) programmes to increase recovery rates.
- Evaluate the cost and benefit of oil container only facilities at bottle depots by means of a pilot test.
- Increase public awareness of all collection facilities through targeted advertising in daily and weekly newspapers.
- Fine tune new weight based collection reconciliation system for filters while maintaining recovery rate in 80% range.
- Improve public awareness through continued advertising with increased emphasis on partnerships and outreach programmes.
- Use growing database of collections by zone to analyze geographic performance and tie to known events key indicators and urban/rural split objectives.

- Finalise AUOMA involvement in Regulatory Compliance and present as a model for programme expansion across Canada.
- Maintain close ties with stakeholders through the use of a toll free hot-line, website, survey and questionnaires and encouraging input in all communications.

2.4 Risk Management

Risk management has emerged as a very significant issue for all Extended Producer Responsibility Organizations. In particular, dealing with a hazardous waste such as used oil, created a number of sensitive issues to be dealt with early on in the programme.

The number one issue was how to handle potential oil spills and the resultant contamination.

This issue was primarily resolved by making a decision early on that the Association would not implement any programmes whereby they took possession of the product. Instead, the Association designed programmes that promoted the collection and processing of used oil materials by the recycling industry. As such, the existing private sector collectors and processors were in the best position to utilize their experience and expertise to minimize the threat of spills, including obtaining necessary insurance to cover the possibility of a spill. Effectively, under the programmes designed by AUOMA the risk for spills continues to be a responsibility of the private sector generators, collectors (both EcoCentre and other collection facilities) and processors.

Further risks for the Association are being addressed by maintaining a reserve fund to assist with:

- Winding up the Association's programmes;
- Any unanticipated changes to the Association's programmes and mandate;
- Any unforeseen claims or events.

Directors' insurance is also maintained to protect Board members from potential claims against them as a result of carrying out their duties as Board members.

AUOMA conducts board training for all of its Directors on an annual basis to keep the Board current on its ongoing responsibilities and emerging issues. Recently the Board examined the risks that Directors face in the boardroom, which has led to a review of the appropriate level of “due diligence” to ensure that anyone who receives funds from the programme is in regulatory compliance with standards set by the government. This may include the requirement for a letter of compliance from a regulatory environmental auditor.

3. Performance Evaluation of Alberta Used Oil Programme

3.1 *Environmental Issues*

As previously indicated, used oil is the largest single source of hazardous recyclable material in Alberta and poses a significant environmental problem if not managed effectively. Improperly discarding used oil materials in fields, ditches, sewage drains, on roadsides or simply thrown in the garbage to end up in landfills contributes to environmental pollution and wastes non-renewable natural resources.

Used oil materials contain small quantities of substances that could contaminate air, soil and ground water. They may contain trace metals, chlorinated solvents, gasoline, polynuclear aromatic hydrocarbons, glycols and PCBs. An undrained oil filter can contain between 250 millilitres (1 cup) to 1 litre of recyclable used oil and residual amounts of oil cling to the plastic and remain inside used oil containers.

What are the negative effects on the environment if used oil materials are not properly disposed of?

- One litre of used oil can contaminate up to one million litres of fresh water.
- Improperly discarded used oil can contaminate ground and surface water and reduce soil productivity, impacting our agricultural production of plants and livestock.
- Oil in sewers can disrupt treatment plants and contaminate waterways.
- Related materials such as plastic oil containers and used oil filters are not biodegradable and take up valuable landfill space.

- More than 40 million litres of used oil that could be recycled goes missing in Western Canada each year. That's enough to fill an ocean-going supertanker. This could produce enough energy to heat and light 60,000 homes each year, or could provide close to 39 million litres of high-quality motor oil.
- On the other hand, if used oil materials are properly disposed of and recycled the following positive outcomes can occur:
- Recycling used oil extends the life of a non-renewable natural resource.
- Re-refining used oil completely restores the original lubricating properties of the oil and takes about one-third of the energy of refining crude oil to lubricating quality.
- A litre of used oil contains up to two-thirds of the energy equivalent of a litre of new oil, making it a readily available source of heating fuel. Using proper methods, contaminants in used oil can be destroyed during combustion and not released into the air.
- Recycled oil is also used extensively in the production of asphalt for roads and highways.
- It can also be recycled to produce new oil for cars.
- Approximately 85% of a used oil filter is steel. Oil filters are shredded, heated to a molten state and the metals re-used as material for other metal products such as rebar, nails and wire.
- Empty plastic oil bottles can be recycled into new containers, plastic flowerpots, plastic pipe, guardrails, fence posts and plastic patio furniture.

3.2 *Methodology*

The AUOMA maintains a very comprehensive data management system that collects and tracks a variety of programme information including product sales, environmental handling charges collected, volumes of product collections and return incentives paid. The Association produces audited financial statements that account for its financial activities and are included in its annual report. The Association also produces an audited Schedule of Used Oil

Materials Collected that provides independent, third party verification of the volumes of used oil materials collected.

The above noted data and information sources were used to verify and create the various figures and tables presented in this study.

The trends that were identified through examination of this data were used to analyze, evaluate and draw conclusions as to the environmental and economic success of the programme.

Where specific data did not exist or could not be obtained, such as with many of the socio-economic impacts, anecdotal information from the professional programme staff and Government of Alberta environmental representatives were used to draw conclusions.

3.3 *Environmental Performance*

How effectively the programme is performing is measured by the following major performance measures:

- Percentage of used oil recovered;
- Percentage of used oil filters recovered;
- Percentage of used plastic oil containers recovered;
- Performance targets for used oil and used oil filters are expected to reach levels in excess of 80% when the programme reaches maturity.

Unlike used oil and used oil filters, targets for used plastic oil containers have been more difficult to establish due to a lack of specific information available regarding sales and recycle/reuse practices for used oil containers.

Used Oil

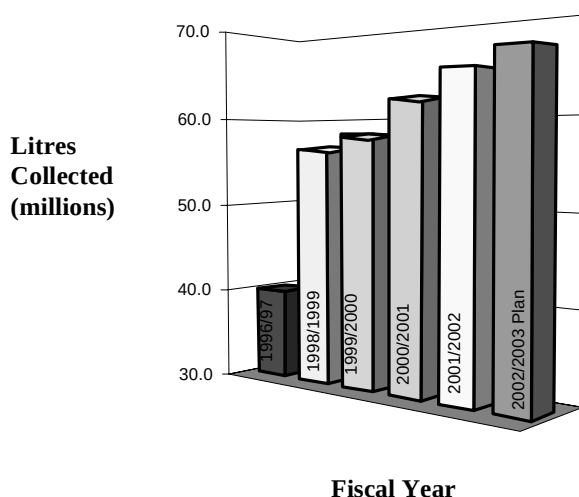
In calculating the percentage of used oil collected, it must be noted that not all oil that is sold can be collected. In Alberta, based upon industry experience and expertise, it is estimated that 35% of all oil that is sold will be consumed during its normal usage. As a result, only the remaining 65% is available for collection.

Table 3 below and Figure 5 on the following page illustrate the trends in the collection of used oil over the life of the programme.

Table 3. Historical and Planned Programme Recovery of Used Oil

Year	Available for Collection (millions of litres)	Actual Quantity Collected (millions of litres)	Recovery Rate (%)
1996/97 pre-programme estimates	Not available	40.0	Not available
1997/1998 (annualized)*	90.8	47.4	52
1998/1999	83.2	54.9	66
1999/2000	87.6	58.7	67
2000/2001	91.2	61.1	67
2001/2002	91.0	64.8	71
2002/2003	91.4 (plan)	66.7 (estimate)	73 (estimate)
2003/2004	91.6 (plan)	68.7 (estimate)	75 (estimate)
2004/2005	93.0 (plan)	70.7 (estimate)	76 (estimate)

* Programme began October 1, 1997 and operated for only 6 months (October 1, 1997 to March 31, 1998) in the first fiscal year. Figures have been annualized to provide for ease of comparison with pre-programme estimates and subsequent yearly actuals.

Figure 5. Volume of Used Oil Recycled

Each year since the beginning of the programme, the volume and percentage of used oil collected has increased. However, a number of challenges exist to improving recovery rates as used oil nears product maturity under the programme. These challenges include:

- The remaining used oil is located in more remote locations and is more difficult to find. Transporters and processors first pick up used oil that is in convenient locations.
- The remaining oil is generally of lower quality. Transporters and processors are economically motivated to pick up the highest quality oil first.
- Developing improved communications and public relations programmes to improve public awareness. The cost of these programmes can be a significant portion of the overall programme budget and in some cases may be cost prohibitive.

Used Oil filters

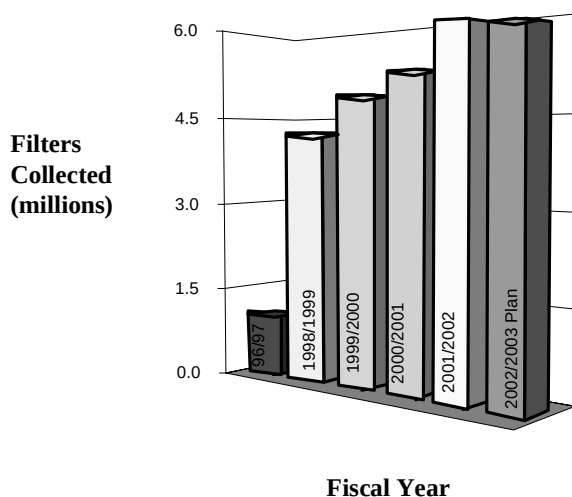
Table 4 and Figure 6 on the following page illustrate the trends in the collection of used oil filters over the life of the programme.

Table 4. Historical and Planned Programme Recovery of Used Oil Filters

Year	Available for Collection (millions)	Actual Quantity Collected (millions)	Recovery Rate (%)
1996/97 pre-programme estimates	Not available	1.00	Not available
1997/1998 (annualized)*	5.41	3.14	58
1998/1999	6.11	4.28	70
1999/2000	6.42	5.01	78
2000/2001	6.86	5.35	78
2001/2002	6.94	5.97	86
2002/2003	6.82 (plan)	5.80 (estimate)	85 (estimate)
2003/2004	6.94 (plan)	5.90 (estimate)	85 (estimate)
2004/2005	6.94 (plan)	5.90 (estimate)	85 (estimate)

* Programme began October 1, 1997 and operated for only 6 months (October 1, 1997 to March 31, 1998) in the first fiscal year. Figures have been annualized to provide for ease of comparison with pre-programme estimates and subsequent yearly actuals.

Figure 6. Volumes of Used Oil Filters Recycled



The volume and recovery rates for used oil filters have increased each year and this product stream is now considered a mature product line within the programme.

Communication, awareness and education campaigns will continue to be used to ensure that recovery rates are maintained.

Used Plastic Oil Containers

Pre-programme data indicates that the historical collection of used plastic oil containers was extremely low, with estimates of only 200,000 kilograms (the equivalent of 3,000,000 one litre used oil containers) being collected.

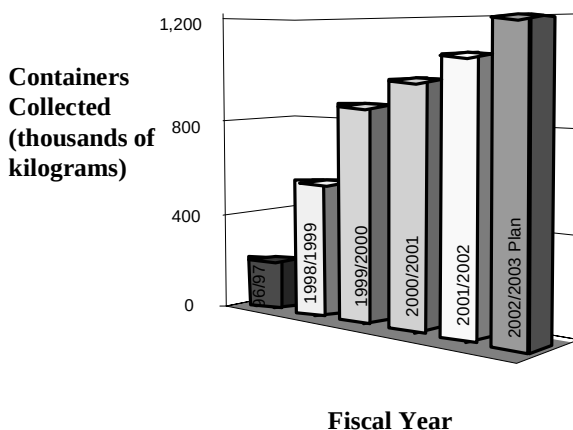
Table 5 and Figure 7 below illustrate the trends in the collection of used plastic oil containers over the life of the programme.

Table 5. Historical and Planned Programme Recovery of Used Plastic Oil Containers

Year	Available for Collection (millions of kilograms)	Actual Quantity Collected (millions of kilograms)	Recovery Rate (%)
1996/97 pre-programme estimates	Not available	0.20	Not available
1997/1998 (annualized)*	3.37	0.40	12
1998/1999	3.00	0.57	19
1999/2000	2.59	0.88	34
2000/2001	2.61	0.99	38
2001/2002	2.51	1.08	43
2002/2003	2.67 (plan)	1.20 (estimate)	45 (estimate)
2003/2004	2.60 (plan)	1.30 (estimate)	50 (estimate)
2004/2005	2.59 (plan)	1.40 (estimate)	54 (estimate)

* Programme began October 1, 1997 and operated for only 6 months (October 1, 1997 to March 31, 1998) in the first fiscal year. Figures have been annualized to provide for ease of comparison with pre-programme estimates and subsequent yearly actuals.

Figure 7. Volume of Used Plastic Oil Containers Recycled



With the inception of the programme, collection of used plastic oil containers doubled in year one and have increased in both volume and rate each

year thereafter. However, the recovery of used plastic oil containers continues to be a major challenge for the programme in Alberta. Although few benchmarks exist for comparative purposes, collection of used oil containers in Saskatchewan and Manitoba are averaging between 18% and 20% and in California, recovery rates for used plastic oil containers are mandated at 25%. Alberta currently exceeds these rates and is considered a world leader in the recovery of plastic oil containers.

The major obstacle in improving recovery rates appears to be that there is no inherent call to action with used plastic oil containers. Unlike used oil and used oil filters, plastic containers do not look hazardous. There may also be a lack of understanding as to the recyclable nature of the plastic.

Number of Collectors, Transporters and Processors

The number of professional collectors, transporters and processors increased from 34 in 1997/98 to 87 by the end of fiscal year 1998/99, and currently stands at 94.

To date none of the registrants have left the programme, indicating a strong and viable used oil material industry in Alberta.

Number of Collection Facilities

The number of collection facilities in Alberta has grown from 225 in 1997 to 640 in 2002. Of the 640 facilities, 53 are EcoCentres and 587 other collection facilities. These facilities are spread across the entire province and provide easy access for all programme participants.

Public Awareness and Perception

AUOMA recognized early on that a high level of public awareness was essential for the programme to be successful. AUOMA continues to develop promotional programmes that are aimed at increasing public awareness. Some of the results of these programmes include:

- Over 1.3 million visits to the web site in 2001/2002 and the average time for each visit is increasing.
- Over 1300 calls in 2001/2002 for information were made to the AUOMA call center.

- Eco-Day promotions and festivities in a number of Alberta communities have resulted in an increased number of visits to the web site and an increased duration in the length of visits.
- An enthusiastic response by young people to the new “Eco School” component of the web site that was introduced in 2000/2001.
- 400,000 people attended trade shows and community events that the programmes Recycling Ambassadors were in attendance
- Over 200,000 farms and acreages in Alberta in 2001/2002 received a direct mailing in an effort to promote the used oil recycling programme.

A survey conducted in 2001/2002 found that 66% of the Alberta target audience (comprised of farmers, small commercial businesses and *do-it-yourselfers*) were aware of the programme to recycle used oil in their areas, and that over 99% of all those surveyed indicated that they felt it was important to recycle used oil products.

The public’s satisfaction with access to collection facilities is monitored by the number of complaints received. To date no complaints have been received that have not been satisfactorily resolved.

Overall, the environmental performance of the used oil programme in Alberta can be summarized as being very successful as illustrated by the following:

- The programme has experienced 5 years of continuous growth in recovery volumes and rates for all product streams.
- Numbers of collectors, transporters and processors continue to increase.
- The number of collection facilities has grown from 225 to over 600.
- Stakeholder awareness and perception of the value of the programme are high.
- The programme earned an Emerald Award from the Emerald Foundation for Environmental Excellence in June 2001. This Alberta-based foundation recognizes organisations that show leadership in addressing Alberta’s environmental issues.

3.4 *Economic Performance*

The overall economic performance of the programme was looked at from the following perspectives:

- Overall programme costs;
- Recovery costs per unit of product;
- Administrative costs as a percentage of revenues collected;
- Disposition of revenues collected.

Overall Programme Costs

One of the objectives of the AUOMA programme was to ensure that the overall programme costs associated with the post regulation time-frame were no greater than those costs before the introduction of the programme for those generators who were already involved in the collection and recycling of used oil materials. For those generators who were now required to be part of the programme and had not previously paid for the disposal of the used oil materials in an appropriate fashion, the Environmental Handling Charge is a new cost to them.

Prior to the programme, generators paid to have the hazardous waste removed. Not only was there a cost to remove the waste, the cost of collection and storage was a disincentive for generators to responsibly handle used oil materials. However, now with the EHC applied at the front end of the programme there is an opportunity for generators to earn some small revenues by collecting and storing used oil materials and being paid more for the used oil materials by collectors and processors than the upfront cost of the EHC.

Industry estimates placed the pre-programme costs of removing used oil materials at roughly \$13 million. This cost was being borne by the generators of the waste. Under the current programme, the costs of the programme are being paid from the revenues generated by the EHC, which is generally included in the product cost or absorbed by generators.

Table 6 below illustrates the trends in revenues being collected through the EHC that are used to fund the programme.

Table 6. Revenues from the Environmental Handling Charge

Fiscal Year	EHC Collected (\$)
1997/1998*	6,875,845
1998/1999	12,696,211
1999/2000	12,947,763
2000/2001	13,425,382
2001/2002	13,371,889

* Figures are for a six-month period only

As can be seen from this summary of EHC revenues, the overall costs to generators in the form of EHC's have remained relatively constant at approximately \$13 million dollars per year. This is comparable to the annual pre-programme cost to generators to dispose of the waste.

Recovery Costs per Unit of Product

One of the principles that the Alberta Used Oil programme is built upon is that there will be no cross-subsidization of costs across product streams. As a result, specific financial information is maintained by product type and programmes are designed and adjusted to ensure that each product stream is self-sufficient.

Table 7 represents the cost per unit for used oil collected under the programme:

Table 7. Costs per Unit of Used Oil Collected

Fiscal Year	Volumes Collected (litres)	Return Incentives Paid (\$)	Share of Programme and Admin costs (\$)	Total Costs (\$)	Cost per litre (\$)
1997/1998*	23,532,178	2,181,597	286,126	2,467,723	0.105
1998/1999	54,911,957	5,065,088	294,547	5,359,635	0.098
1999/2000	58,672,383	5,681,385	418,313	6,099,698	0.104
2000/2001	61,066,329	5,759,396	487,498	6,246,894	0.102
2001/2002	64,839,740	6,108,527	468,666	6,577,193	0.101

* Although previous tables have shown 1997/98 figures annualized, these figures are actuals.

The cost of recovering used oil has remained constant at around 10 cents per litre of used oil.

Table 8 represents the cost per unit for used oil filters collected under the programme:

Table 8. Costs per Unit of Used Oil Filters Collected

Fiscal Year	Volumes Collected (number of filters)	Return Incentives Paid (\$)	Share of Programme and Admin costs (\$)	Total Costs (\$)	Cost per filter (\$)
1997/1998*	1,552,980	1,290,410	286,126	1,576,536	1.015
1998/1999	4,279,730	3,560,276	294,547	3,854,823	0.901
1999/2000	5,009,294	4,176,619	418,313	4,594,932	0.917
2000/2001	5,351,624	4,493,730	487,498	4,981,228	0.930
2001/2002	5,973,939	4,037,401	468,667	4,506,068	0.754

*Although previous tables have shown 1997/98 figures annualized, these figures are actuals.

The costs of collecting used oil filters have decreased significantly (approximately 25%) over time as the programme has evolved due increased economies of scale.

Table 9 represents the cost per unit for used plastic oil containers collected under the programme:

Table 9. Costs per Unit of Used Plastic Oil Containers Collected

Fiscal Year	Volumes Collected (kg)	Equivalent 1 litre Containers* (number of containers)	Return Incentives Paid (\$)	Share of Programme and Admin Costs (\$)	Total Costs (\$)	Cost per 1 litre Equivalent Container (\$)
1997/1998 **	201,863	3,027,945	195,449	286,126	481,575	0.159
1998/1999	569,721	8,545,815	601,913	294,547	896,460	0.105
1999/2000	882,281	13,234,215	1,035,758	418,313	1,454,071	0.110
2000/2001	992,062	14,880,930	1,167,816	487,498	1,655,314	0.111
2001/2002	1,083,615	16,254,225	1,297,258	468,667	1,765,925	0.109

* Note: One kilogram of plastic is equivalent to 15 one litre plastic oil containers.

**Although previous tables have shown 1997/98 figures annualized, these figures are actuals.

The per unit cost of recovering used plastic oil containers has decreased by almost 5 cents per 1 litre equivalent container as a result of increased economies of scale.

Administrative Costs

In order to maximize the flow-through of Environmental Handling Charge (EHC) that is directed to programme costs, AUOMA attempts to minimize its administrative costs. Original targets for administrative costs were pegged at 9% of the Environmental Handling Charge (slightly less than the 10% forecast for similarly run recycling and not for profit programmes in Alberta). This target has been subsequently reduced to 6%.

Table 10 below illustrates the trends in the expenditures for administration that have occurred over the life of the programme.

Table 10. Administration Costs as a Percentage of Environmental Handling Charge

Fiscal Year	Administration Costs (\$)	EHC Collected (\$)	Admin. Costs as Percentage of EHC
1997/1998*	449,230	6,875,845	6.53
1998/1999	485,419	12,696,211	3.82
1999/2000	493,657	12,947,763	3.81
2000/2001	562,500	13,425,382	4.19
2001/2002	524,636	13,371,889	3.92

*Although previous tables have shown 1997/98 figures annualized, these figures are actuals.

Administrative costs in year one totalled 6.5% of the EHC. This represents about a 2% higher cost for administration over ongoing administration costs as a result of a number of one time legal and consulting costs to develop policies, procedures, protocols and templates. These policies, procedures and protocols have subsequently been used as models for other jurisdictions resulting in lower start-up costs for these jurisdictions.

Disposition of Revenues Collected

The following table is a summary of disposition of revenue for each full year of operations.

Table 11. Disposition of Revenues by Fiscal Year

Description	1997 / 1998* (\$000's)	1998 / 1999 (\$000's)	1999 / 2000 (\$000's)	2000 / 2001 (\$000's)	2001 / 2002 (\$000's)
Return Incentives	3,667	9,227	10,894	11,420	11,443
Programme Costs	410	399	761	900	881
Admin Costs	449	485	494	563	525
Net Reserve	2,404	2,713	1,021	852	779
Total	6,930	12,824	13,170	13,735	13,628

* Although previous tables have shown 1997/98 figures annualized, these figures are actuals.

This table identifies that programme and administrative costs are being contained to allow for a reserve fund to be established to mitigate risks associated with the programme and to allow for the successful wind-up of the programme if required.

The overall economic performance of the programme has maintained overall systems costs while generally decreasing individual per unit product costs.

Efficiencies are being realized as a result of easier access to materials through more collection facilities, more competition in the market place and continuing high demand for used oil and metals from filters. The current suppressed market for plastic continues to negatively impact the recovery rate for used plastic oil containers.

The administrative cost burden as a result of implementing this programme is extremely low and much below similar not for profit programmes that are averaging 9% - 10% administrative costs.

Although specific data is not available, the costs of recovering used oil materials is very small compared to the potential costs of remediating contaminated water supplies, which could run into the hundreds of thousands of dollars.

Other economic benefits achieved as a result of having adequate fresh water supplies include:

- Improved agricultural products and livestock;
- Improved visitor and tourism trade;
- Improved recreational opportunities such as swimming, fishing and boating.

3.5 Other Socio-Economic Performance Measures

Other socio-economic impacts can be measured as follows:

Impact on Taxpayers

- As a result of the programme's implementation, less used oil, containers and filters are being disposed of through the municipal waste

management infrastructure or directly into the environment. This has reduced the costs borne by taxpayers.

- The programme is now fully self-funded and receives no revenue from any level of government.

Government Costs and Benefits

- The successful creation and implementation of a used oil materials recycling programme in Alberta under the auspices of the Alberta Used Oil Management Association has moved the responsibility for recycling used oil materials outside of government.
- Although AUOMA works closely with all levels of government to ensure the success of the programme, industry has effectively taken full responsibility for recycling used oil materials.
- The provincial government bears some of the monitoring costs associated with the programme's operations.

Impact on Consumer Prices

- Most retailers recoup the Environmental Handling Charge at the point of purchase.
- In general, consumers are responsible for paying the Environmental Handling Charge.

Regional Employment and Industry Development

- There is no official quantitative data that delineates the employment opportunities made available by this programme. However, it is evident that it has a beneficial impact. As the need for recycling rises, staffing levels in the processing and recycling industry increase to handle the larger volumes of materials.
- Although a private sector recycling industry for used oil materials existed in Alberta prior to the implementation of AUOMA's programmes, the programmes that have been put into place have encouraged industry to enhance the collection system infrastructure and have provided an environment for maintaining and improving recycling opportunities for used oil materials. This is evidenced by an Alberta

“first” - the development of plastic highway guardrails made from used oil materials.

- Recycled oil is used extensively in the production of asphalt for roads and highways and can also be burned for energy.
- Oil filters are shredded, heated to a molten state and the metals re-used as material for other metal products such as rebar, nails and wire.
- Empty plastic oil containers can be recycled into new containers, plastic flowerpots, plastic pipe, fence posts and plastic patio furniture.
- A stable and strong used oil materials recycling industry means continued regional employment in the face of other economic downturns.
- The location of depots and EcoCentres to handle used oil products complements and supports other recycling initiatives such as the beverage container recycling programme.

Impact on Second Level of Competition in Post-Consumer Waste Sector

- Collected oil can be recycled into an oil with the same quality level as the original. The used oil that is collected supports Canada's two re-refining businesses (Safety-Kleen in Ontario and Mohawk in British Columbia). Newalta in Alberta produces a No. 4 diesel fuel. The collection of containers has also created new recycling opportunities for plastic recycling companies in western Canada.⁶

Impact on Production Efficiency

- Production efficiency is defined as the efficiency with which inputs (of material, labour and capital) are allocated to produce the desired output (also known as technical efficiency). The programme has had no measurable impact on the efficiency of production. However, the programme may impact the use of plastic for containers (for example, some producers are choosing to use post-consumer resin in the

⁶. Environment Canada. *An Inventory of Waste Diversion Programmes in Canada*. 2001.

manufacturing of their bottles). This may be a result of the programme, but there is no direct evidence to support it.⁷

Impact on Market Access

- By changing the conditions for market entry, environmental stewardship programmes can impose barriers to entry. For example, if a small jurisdiction imposes take-back requirements that effectively favour one type of container (*e.g.*, glass bottles *versus* aluminium cans), the increased costs of complying with different requirements may prevent foreign producers from entering the market as well as limit consumer choice. This can be a particular problem for small and medium sized enterprises. Since participation in the programme is mandatory under the Lubricating Oil Material Recycling and Management Regulation, there is no impact on market access.⁸

Impact on Dynamic Efficiency

- Dynamic efficiency refers to the development of new technologies or processes (*e.g.*, to enhance productivity, reduce the resource intensity or products, etc.). The impact of this programme is viewed as minimal. However, there may be an increased use of post consumer resin in oil containers and a shift to bulk packaging.⁹

Impact on Trade Activity

- There is no known impact on trade activity.

Impact of Free-riders

- Although it may be possible for cross-border shipments of used oil materials to take place in order to receive a return incentive for materials collected in other jurisdictions, collusion and fraud would have to take place between the generator and a collector to produce a recycle docket that would be reimbursed from the programme. There has been no evidence to date that this is happening.

7. Environment Canada. *An Inventory of Waste Diversion Programmes in Canada*. 2001.

8. *Ibid.*

9. *Ibid.*

- It might also be possible for sales of original product to take place by sellers who are not registered in the programme. However, other sellers would quickly become aware of the competitive price advantage and lower selling prices that could be offered as a result of not paying the EHC. There has been no evidence of an issue with this in Alberta.

Impact on Design for Environment

- Although there has been no evidence of design for environment initiatives, the programme is able to heavily penalize anyone that designs products that would negatively impact the success of the programme. An example would be the introduction of a new product that would require additional sorting or processing that increased the overall costs of the programme.

4. Conclusions

The used oil material recycling programme in Alberta has been highly successful in contributing to a healthy and safe environment for all Albertans and reducing waste from landfill.

The programme has been a successful collaboration of government, the lubricating oil industry and the recycling industry.

The programme has had many significant impacts in terms of environmental, economic and other socio-economic performance indicators.

Environmental Performance

- For five consecutive years, the programme has improved its performance by collecting and recycling more used oil, oil filters and plastic oil containers highlighted by 2001/2002 recovery rates of 86% for filters, 71% for used oil and 43% for used plastic oil containers.
- The number of professional collectors, transporters and processors of used oil materials continues to grow and provide a strong base for the used oil material recycling industry in Alberta.
- The number of collection facilities in Alberta has grown from 225 in 1997 to 640 in 2002. These facilities are spread across the entire province and provide easy access for all programme participants.

- Through the use of a website, call center and various promotional, communications and public relations activities, a 2001/2002 survey found that 66% of target audiences were aware of the programme and over 99% of all those surveyed indicated that they felt it was important to recycle used oil products.

Economic Performance

- Overall the programme is self-sufficient and cost-effective. Total programme costs have not increased and have maintained a desired level of stability in the industry.
- Individual per unit product costs for filters and containers have decreased as a result of overall programme efficiencies and economies of scale.
- Administrative costs for the programme continue to be low, therefore maximizing the amount of funding available for programme costs.
- Overall programme costs are being contained, resulting in the ability to build an adequate reserve fund to offset potential future costs associated with programme risks and to provide for a successful wind-up of the programme if required.
- Total programme costs are relatively insignificant compared to the potential cost of remediating contamination that could be caused by used oil materials.

Other Socio-Economic Performance

- As a result of the programme's implementation, less used oil, containers and filters are being disposed of through the municipal waste management infrastructure or directly into the environment. This has reduced the costs borne by taxpayers.
- The successful creation and implementation of a used oil materials recycling programme in Alberta under the auspices of the Alberta Used Oil Management Association has moved the responsibility for recycling used oil materials outside of government.
- In general, consumers are responsible for paying the Environmental Handling Charge.

- A vibrant and stable recycling industry that has developed new ways of processing and cleaning plastic containers and introduction of new recycle products including plastic highway guardrails.
- Used oil can be recycled into an oil with the same quality level as the original.
- A series of checks and balances inherent in the programme protects against free-riders from both a products sales and a collection perspective.
- The success of this programme is further demonstrated by the fact that in June 2001 AUOMA received an Emerald Award from the Emerald Foundation for Environmental Excellence. This Alberta-based Foundation recognizes organisations that demonstrate leadership in addressing Alberta's environmental issues.

5. **Future Directions**

- The Alberta Used Oil Programme continues to grow and improve and is leading the way as a model for other used oil materials recycling programmes across Canada. Other jurisdictions are now inquiring about the programme, and this may lead to use of the model in other global markets.
- Many of the start up issues facing the programme have now been taken care of. With two of the product streams having or nearly reached maturity levels, and while maintaining the programme's view towards continual improvement, the focus of the programme is moving to address new and emerging programme needs.

Over the next few years the priority focus for the programme will be on the following:

- The recovery of plastic oil containers continues to improve each year but remains the greatest single challenge for the programme. Conducting a comprehensive study of sales and recycle/reuse rates of oil containers by major industry sector, and adjusting awareness and return incentive programmes will be the first step in increasing the return rates for used oil containers. This study will identify where containers are used, recycling habits, impediments to recycling and strategies to tailor programmes to address issues identified.

- Now that the growing pains of establishing the programme are complete, the continuing improvement in recovery of used oil and filters will be dependent upon a priority focus on awareness and communication activities. AUOMA's business plan for 2002/2003 identifies an ongoing need to improve public awareness through partnering with key stakeholders including sister associations across the prairie regions.
- In light of the fact that the remaining uncollected used oil is located in more remote locations and is difficult to find and of a lower quality, the programme may need to be revised to provide additional incentives to reach higher levels of collection.
- Raising the bar on environmental standards and performance by collectors and processors by working with government to establish new compliance protocols.
- Examining the viability of expanding the product streams within the programme to include products such as windshield washer fluid containers and anti-freeze.
- The programme triggered the creation of a regional used oil programme across western Canada. AUOMA will continue to work with the remaining provinces in Canada to develop a consistent national programme that will create a Canada-wide used oil materials programme that is seamless across all provincial borders.
- Working with other interested global jurisdictions such as Australia and New Zealand to develop and implement used oil material recycling programmes.

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GLOSSARY OF TERMS

Term	Definition
<i>Accountability</i>	An obligation to explain or account for one's actions to a variety of audiences, including members, stakeholders and the public.
<i>Annual Report</i>	An annual summary of results achieved produced for use of stakeholders in assessing the performance of a PRO.
<i>Benchmarking</i>	Developed in such areas as Total Quality Management (TQM), benchmarking involves the comparison, ranking or rating of different business processes, units or companies against standards. The aim: to identify ways of improving the performance of operations, systems, processes.
<i>Business Plan</i>	A plan that communicates the direction being followed by a PRO to its various audiences and provides day-to-day direction to the management and staff of the PRO itself. Components may include: organisational history; mandate; vision statement; mission statement; organisational principles; core businesses; strategies; outcomes; resource plan; performance measurement criteria and targets.
<i>Eco-fees</i>	Fees charged to support the recycling programme. Also referred to as an "Environmental Handling Charge".
<i>EcoCentres</i>	Places that accept materials for recycling.
<i>Extended Producer Responsibility</i>	An environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle. There are two key features of EPR policy: (1) the shifting of responsibility (physically and/or economically, fully or partially) upstream to the producer and away from municipalities, and (2) to provide incentives to producers to take environmental considerations into the design of the product.
<i>Stakeholders</i>	The broadest definition of 'stakeholder' brings in anyone who affects or is affected by a company's operations. The key new perception is that companies need to expand the range of interests considered in any new development from customers, shareholders, management and employees to such people as suppliers, local communities and pressure groups.
<i>Stewardship</i>	The act of entrusting the careful and responsible management of the environment and natural resources to one's care for the benefit of the general community.

LIST OF ACRONYMS

Acronym	Description
ABDA	Alberta Bottle Depot Association
AUOMA	Alberta Used Oil Management Association
AUORC	Alberta Used Oil Recovery Corporation
CCME	Canadian Council of Ministers of the Environment
CEO	Chief Executive Officer
CPPI	Canadian Petroleum Products Institute
DAO	Delegated Administrative Organization (may be used interchangeably with PRO)
DIY	Do-it-yourselfers
EHC	Environmental handling charge
ELC	Equivalent litre container
ENGO	Environmental non-governmental organisation
EPR	Extended Producer Responsibility
FOIP	Freedom of Information and Protection of Privacy
MARRC	Manitoba Association for Resource Recovery Corp.
MLA	Member of the Legislative Assembly
MOU	Memorandum of Understanding
NGO	Non-governmental organisation
OECD	Organisation for Economic Co-operation and Development
PRO	Producer Responsibility Organization
RCA	Recycling Council of Alberta
RI	Return Incentive
SARRC	Saskatchewan Association for Resource Recovery Corp.
TDG	Transport of Dangerous Goods

Chapter 2

EFFECTS OF THE INTRODUCTION OF AN EPR MANAGEMENT SYSTEM ON THE ECONOMY

by

Joachim Quoden

Duales Systeme Deutschland; PRO EUROPE, Germany

1. Introduction

The following paper is divided into three parts. First, the impact of the implementation of an extended producer responsibility system on the collection and use of household packaging on the environment. Second, how the system has developed since it was introduced and, related to this, describe all of the enterprises involved in the system and the technologies and markets related to it. Finally it will examine the extent to which the system has an impact on other areas such as, *e.g.* the creation of new markets, the rise of a new awareness among consumers and the companies involved and international development since the system was launched in Germany.

The paper will end by providing an outlook on what you can expect some economic sectors in Europe to look in the future. Before focusing on the details, it is important to note that so far no comprehensive academic study has been carried out on the economic impact of the implementation of an Extended Producer Responsibility System for packaging. The Austrian system intends to initiate a study and would like to present the results in 2003, during its 10th year of existence. Unfortunately, we have not yet received any preliminary results. Therefore, without such data, there are limitations on what can be said about the performance of the packaging programmes in Europe.

2. Effects on the environment

2.1 *Packaging on the market*

As you all know, there was an extremely sharp increase in household packaging in Germany at the end of the eighties, while landfill capacities began running out and incineration capacities could not be created in sufficient capacity, as there was a so-called nimby effect among the population. Nimby means “not in my backyard”. The policy arena thus had to seek new alternatives and under Prof. Dr. Töpfer developed the German Packaging Regulation, with which Extended Producer Responsibility was introduced for the first time.

One of the main objectives of the Packaging Regulation was to reverse the positive correlation between gross domestic product and use of packaging so that economic growth would not automatically lead to a rise in the amount of packaging consumption. The institution of the Packaging Regulation put a stop to this trend. The fact that a material and weight-related fee had to be paid per packaging unit to the self-help organisation for the economy, the Dual System, led the amount of packaging material used to become a price and thus competitive factor. This once again led to a direct elimination of packaging which was not necessarily needed, such as, for instance, wrapping (Phase 2). In spite of a constant growth in GNP and in particular an enormous rise in the number of households from approximately 35 million to around 38 million, the use of packaging stagnated at the same level. When one compares the actual amount of packaging used from 1991 to 2000 with a hypothetical trend in the absence of the Dual System, we find that 1.6 million tons of packaging material was avoided in 2000, which corresponds to 18% less (Prognos AG).

Thus, one can with confidence assert that this goal behind the Packaging Regulation has been achieved on a sustained basis.

The packaging regulations in France and Austria also had the same objectives. In France, the amount of household packaging was kept stable over the last 8 years at 4.7 million tons, and this even though at the same time the population grew by about 2 million, the gross national product rose and the number of individual packagings used was up by about 10%.

In Austria, the reduction of the amount put in landfills was the highest priority. For this reason there was a specific borderline defined in the regulation as to how much packaging - depending upon the material - would still be allowed to be put in landfills in 2001. This chart demonstrates how the packaging laws and the Austrian economy's self-help organisation, Altstoff Recycling Austria AG (ARA), was successful in drastically reducing the

amount of packaging put in landfills; all the targets were exceeded and the quantity of packaging put in landfills declined by well over 75%.

In summary it can thus be stated that a rational legal framework has been created providing the economy appropriate budgetary possibilities to involve the economic actors acting together while taking advantage of financial incentive models such as the “Green Dot” to completely meet expectations. Unfortunately, it is relatively difficult to make any statements as regards what monetary savings have been made by this system by enterprises, citizens and society as a whole in order to be able to subtract this from the - often hidden - costs of the system. Only a few licensees of DSD have made any statements of interest here, which I will be examining later.

3. Recycled amounts of packaging

Besides prevention, the other goal in the packaging legislation was “recycling instead of disposal“.

This was also a huge success. Taking the example of the Dual System, you can see how we were successful in establishing recycling capacities; from 880,000 tons in the first year of operation up to the present, in which approximately 5,500,000 tons have been recycled. If one adds the 1,600,000 tons which have been avoided on top of this, you can see what quantities have not had to be eliminated each year by putting them in landfills.

In the plastics area even more significant efforts have been. Between 10,000 and 25,000 tons of packaging were recycled before DSD (around 3% of the market). Now this figure hovers around 600,000 tons (around 68%), although the main capacity had to be established in the years 1993 and 1994 in order to meet the extremely high requirements set by German lawmakers. I will come back to the issue of costs and plastic markets later.

For this reason it can basically be noted that this objective has also been met by industrial systems, as similar developments can be seen with all Green Dot systems, even if these may in some instances be slower.

3.1 Savings by recycling regarding energy consumption and emissions

In addition to the aforementioned objectives of prevention and recycling, however, additional effects were achieved which underscore the environmental advantages of these systems (and result in macro-economic savings. These savings are, however, difficult to quantify).

The Dual System attempted for the first time to project a balance on the effects of the Dual System in the area of energy consumption and emissions in 2001. This initial study was limited to light weight packaging; the resource balance sheet is to be expanded to paper and glass next year.

Recycling of approximately 2.3 million tons of light weight packaging made of aluminium, tin, composite material and plastics allowed the equivalent of about 400,000 tons of carbon dioxide to be saved in Germany in 2001. This reduction in greenhouse gases is commensurate with the quantity of carbon dioxide which 64,000 average households produce each year each burning 2,000 litres of heating oil, respectively.

At the same time the recycling of light weight packaging has allowed 33 billion mega joules in energy to be saved. Especially studies such as these are of tremendous importance to the technological and strategic orientation of the Dual System. The optimization of existing collection, sorting and recycling technologies will achieve significant progress especially in these areas in the coming years, the reason being that not every optimization which attains economic progress at first glance leads to results which are equally useful when examining the environment and economics.

ARA attempted as far back as 1998 to quantify savings. The recycling of plastic packaging alone as well as composite material in 1998 was estimated to have saved 74 million litres of oil, 50% of energy compared to the new production of the plastics and 63,000 tons less in CO₂ emissions. As ARA has made both qualitative and quantitative progress over the past 4 years in the area of collection, sorting and recycling, savings at present are probably far above the 1998 figures.

The situation is similar with regard to glass recycling. The recycling of 184,000 tons of glass in 1998 allowed major efforts on the environment to be avoided in Austria through mining of quartz sand, limestone, dolomite and soda. 203,000 tons of primary raw material, 470,000 m³ in mining volume and the energy equivalent of approximately 175 million KWh, 4.7 million m³ of natural gas through the use of recycled glass in glass-melting kilns and 56 million m³ of air contaminated with used glass were avoided. And here as well, the figures achieved in 2002 will probably be considerably higher.

In summary it can also be stated here as well that the systems can benefit the environment on a considerable scale, including in areas which were not the primary targets in the passage of the packaging regulations. Moreover, the systems in this area have passed the initial set-up phase and are currently in the

optimization phase, which means that one can expect an extremely strong reinforcement of these positive effects in the coming years.

4. Development of sorting and recycling

4.1 *Investments in recycling and sorting capacities*

You have just seen that immense recycling capacities have been created over the past 10 years, especially in Germany, Austria, France and of course in other countries in which recovery organisations run by industry operate.

Major financial efforts were necessary. In France it is assumed that a total investment of € 10 billion (source: Eco Emballages) was made over the past 10 years, while in Germany this sum was € 20 billion. Almost € 177 million alone was spent over the past 4 years in Portugal to establish a collection infrastructure and sorting facilities by the economy's self-help organisation, Sociedade Ponto Verde, which has been in operation since 1998.

- Minimum € 290,000,000 have been invested by the Spanish self-help-organisation Eco Embalajes in the last four years.
- Of this, not only new sorting and recycling facilities have been established - approximately 250 sorting facilities for household packaging in France, 20 new sorting facilities in Portugal and 52 in Spain - new technical procedures are also being developed.
- € 13 million has been invested in 4 bottle-processing facilities in Germany alone this year, which means that 80,000 tons in capacity are available for the processing of PET bottles.
- The Corenso United paper factory in Finland has invested around € 17 million in a facility for recovering aluminium by recycling beverage cans.

4.2 *Technical innovations*

There were very few sorting facilities available during the start-up phase of the Dual System in 1990-1991. Conveyor belts and simple devices such as vibration and drum sieves were used to process debris from building sites and paper recycling was used to sort light weight packaging at many locations. Sorting was performed almost exclusively manually.

The first magnets for collecting tin and automatic sac-openers have been in use for yellow bags since 1993. The latter have been in use throughout Germany since 1997.

Sorting facilities have been increasingly using blow devices (blow engines or suction machines) to sort out light foil and paper packaging since 1994. The first eddy current cutters were used this year for aluminium packaging.

- 1996: An automatic sorting technology was used for beverage cans on a near infrared basis (optical sorting) for the first time in a sorting facility of the Dual System in 1996.
- Skein openers, blow devices, magnetic and eddy current cutters became the technical standard at the end of the 1990s. The optical sorting of beverage cans is coming into increasing use. Optical recognition systems will increasingly be used for various types of plastics in the future.

The KAKTUS pilot facility in Eschweiler near Aachen was presented to the public in September 1997. Under this sophisticated new, fully-automatic concept, packaging is no longer sorted according to type and size. Rather, it is sorted according to material. The sorted products are for the most part sorted according to pure materials, cleaned and in some cases refined.

The further development of the KAKTUS pilot facility led to SORTECnology 3.0 (SORTEC). The first large facility of this type was opened in Hanover on November 19, 1999 and went into operation at the beginning of the world EXPO 2000 in June 2000. Using fully automated technology throughout Germany could reduce the costs of sorting all light weight packaging by 30%.

In addition to SORTEC, additional sorting facilities from the newest generation went into operation in 2000. These include, for example, the facilities of A.R.T. Abfallberatungs- und Verwertungsgesellschaft mbH in Trier and ATG and Rosendahl GmbH in Wülfrath and a sorting plant in Leipzig with an annual capacity of 60,000 tons.

This made it possible to raise the output of a sorting facility with 8 staff members from 1 ton per hour to 8 tons per hour per shift.

The latest in new developments in the area of sorting is a facility from a U.S. company named Aladdin, which combines NIR technology with high-resolution color resolution systems, allowing it to sort with 80% to 90% purity

levels per hour for bottles. It was found out that the different plastic materials react in a different way if shot with light. A computer is able to analyse these different reactions and to blow then the packaging items into different containers.

This technology is presently used not only for the sorting of plastic packaging into the different fractions PS, PP, PE, PET and PVC but also to sort out drinking cartons, to sort paper automatically and to sort plastics from old cars and batteries; probably it will be used for the sorting of electro- and electronic-waste as well.

This technology is used worldwide for the different applications of sorting collected materials from Europe to the US and to Japan.

In the recycling area as well, new ways need to be found to recycle large quantities of plastics and beverage cans. In the plastics area in particular, solutions particularly needed to be found for mixed plastics, as a material recycling for this material was not economical or possible.

One solution for mixed plastics was discovered with the so-called feedstock recycling. When recovering steel from iron in a blast furnace, oil is usually blown in order to remove oxygen from the iron. If one turns the mixed plastics into a so-called agglomeration in a process which is also protected by a patent, it can then be blown in instead of oil into a blast furnace. In addition, there are various so-called chemical processes where mixed plastics are gasified or turned back into petroleum.

The focus of recycling activity and capacities over the past few years has turned to P.E.T. bottles, as these have seen enormous increases in sales over time. The first German recycling facility which recovers the basic material for new beverage bottles from used PET bottles with the Green Dot was inaugurated in February 2002. Thereby, the cycle “from bottle to bottle” was closed. 6,000 tons of PET per year have been recycled from the Green Dot containers containing recoverable material in the facility of Cleanaway Deutschland Plastic Recycling GmbH and Co. using the URRC process. The process has been dubbed after the U.S. company, United Resources Recovery Corporation (URRC), which holds the patent.

In the URRC process, the clear PET bottles are first ground up, washed and the labels and caps are removed. After the initial treatment additional chemical cleaning processes ensure that the surface of the material as well as dirt at a lower level is removed. The material which is then ground up is suited for contact with food products.

High priority has been assigned to chemical recycling processes for color PET bottles at present in order to allow the quantities disposed of to be recycled in an environmentally friendly, economical manner. The manufactures involved have developed an amazing recycling process together with the paper industry for beverage cans. After collecting the beverage cans with the yellow bag or the yellow bin, the beverage cans are now separated with automated systems in over half of the sorting system. At the same time the cans are recognized by an infrared camera, a computer calculates their position and air jets blow the case into a container. The shredded cartons are then shot into a standard pulper for used paper or in a dissolving drum, a sort of washing machine. The paper-content is dissolved from the foil in this manner and can be reused once again as used paper. The rest of the foil is either used in the cement industry or the aluminium is recovered in the said facility in Finland by putting the polymer in a gas form by heating it to a temperature of 400 degrees. The aluminium remains in the solid state, however, is separated and resold as secondary aluminium. The plastic in the gaseous state is used to produce steam and energy which is not only sufficient for the recycling facility, but which is also sold to a paper factory in the vicinity.

4.3 *New markets for used plastic packaging*

Incredible progress has been made, especially in the area of plastic recycling. At the beginning of the operations of Dual Systems there were scarcely any ways to use used plastic - even forgetting park benches for a second - and scarcely any recycling capacity in Germany, which meant that a good portion had to be exported. This picture has changed fundamentally on both sides. A new brochure of the DKR, guarantor for plastic packaging in Germany, with around 100 pages showing what can be made out of all the various plastic packaging today. Even if the brochures are in German, the pictures speak for themselves.

Last year for the first time more than half of all plastic packaging collected was materially recycled.

First of all an inquiry must be generated, as there are now enough companies which can produce marketable products from the whole range of plastic packaging. Secondly the technical refinements in the sorting area described in the foregoing have made it possible to sort out much higher quality material from the waste. This trend will be reinforced in the coming years, as over the medium term recycling into special material inputs will offer more potential for savings than recycling into raw material.

In addition you can see from the charts that only 5% of the collected plastic packaging is exported abroad for recycling even though there is a huge demand there. Something that nobody would have considered possible ten years ago has come to pass: There is more recycling capacity than the amount of plastic collected.

4.4 *Recycling costs of plastic packaging*

These developments of course have meant that the recycling of plastic packaging has become cheaper over the last few years, even if there is no recycling for zero. This development is not only limited to Germany. The same trends can also be seen in Austria. The following two charts also illustrate this, although it should be noted that in Austria used plastic packaging is partly used to produce energy (lower curve).

Both systems achieved high percentages in the area of plastic recycling at the beginning; *i.e.* they had to recycle large quantities without there being sufficient quantities for such. This of course led to very high costs which then had to be reduced in the ensuing years through the creation of new capacities, new technologies and new markets.

In an ideal case a law should then stipulate a reasonable period of time for a system to be established to ensure that supply and demand can be kept in balance to avoid extreme cost explosions.

5. *Other general effects*

5.1 *Jobs and markets*

Before the comprehensive waste-management system was introduced, waste management primarily meant that household waste was picked up once a week and put into a landfill.

The introduction of the recycling economy and the revamping of the entire waste economy as a result, followed by the implementation of separate collection of packaging waste, the establishment and operation of sorting facilities and the creation of recycling capacities created an entirely new economic sector, which in Germany turns over approximately € 33 billion per year. No exact figures are available for before 1990 but I have been told that it was less than half.

Especially in Germany, where the economy has to bear the entire costs of collecting, sorting and recycling the used packaging, a second, and hence dual, system has been established in addition to local waste removal.

Around 17,000 people work for the Dual System in Germany alone, while the continued growth of the recycling economy is also creating additional jobs in other areas such as batteries, electronic junk, old cars, tires, etc.

The same goes for France, where about 10,000 people work directly for the system. It is estimated that the same number again have received jobs as an indirect result of the system. In Portugal as well, where the system did not start until 1998, approximately 1,330 people are already working within the recovery organisation. 1,500 jobs have been created in Austria within the ARA-system and 2,500 employees are working within the Spanish self-help-organisation EcoEmbes.

The starting gun for the revamping of the recycling economy sounded at the latest with the introduction of the principles involving Extended Producer Responsibility. This constituted a move away from pure disposal with the main objectives being preservation of public safety and health, in the direction of an integrated waste management system in which waste is viewed as a “normal” economic good and then handled accordingly. At present we are moving to the next stage of development - a management system which also includes resources, adapting and optimizing strategies accordingly.

5.2 *Consumer awareness*

The most important element in any system is individual citizens because it is only when they are actively involved in the system, that they actively separate packaging and place it in the (right) container for the respective system that the system can function and work effectively economically and environmentally speaking.

That is why one main task of any system is to inform people about it and to motivate them to participate. For this reason all systems emphasizing public relations work and use PR campaigns such as *e.g.* the European recycling days, which were carried out for the first time in 13 countries in September 2001 and which will be repeated in about 17 countries in September 2004. The recycling days culminated in the first congress held by PRO EUROPE, the umbrella organisation of all 15 Green Dot schemes, in Madrid, where 600 experts from around the world discussed recycling of packaging. The next recycling days will conclude with the 2nd congress of PRO EUROPE in Berlin, where I hope to be able to greet many of you.

Many million people in these 13 countries have taken advantage of the opportunity offered by these recycling days to go to sorting and recycling facilities in their vicinity to see why their efforts to separate packaging are useful and what actually happens to the packaging afterwards.

In addition, citizens are the ones who actively influence the use of packaging through their behaviour. They can decide, for instance, whether they need a new plastic bag each time they go shopping or whether they can perhaps bring a durable bag with them. So there are ways here of furthering awareness among citizens of their consumption of packaging.

The fact that this is no easy task is indicated by the results of surveys conducted over the years 1992 to 2000. A lot of information and public relations work was carried out in Germany through the Dual System, its waste disposal partners and local governments to convince citizens that the separate collection of packaging makes sense. Approval of the system thus rose from 27% in 1992 to 58% in 2000. This statistic indicates as well, however, that there is still enough room for improvement, which means that the public relations work of the Dual System continues to be promoted.

Public relations work had to be performed in Austria as well, and this is now reflected in excellent statistics indicating public approval. 90% of the population is now prepared to at least properly separate packaging waste.

After 4 years of work in Portugal, the Portuguese economy's self-help organisation, SPV, has already been successful in getting approximately half of the population to get involved, although it has been found that a house-to-house collection raises willingness more than the bring system.

The motivational reasons for sorting in the first place differ very greatly. It appears, however, that the population is aware that the separate collection helps save resources and reduce the amount put in landfills.

The main reasons given by those people who do not participate are in particular the insufficiency of the collection systems offered, lack of information and problems collecting used packaging within a household. With bring systems the collection containers must not be located more than 300 meters from homes - otherwise willingness to participate in the system among the population declines drastically.

A comparison of conditions in Belgium, Spain and Portugal once again indicates very clearly, however, that the population is generally very open to such systems. Most people know that positive effects can be obtained for the

environment; the main reasons for not participating are the lack of collection systems and difficulties adapting peoples' habits to the requirements of separate collection.

5.3 *Industry awareness*

Companies which are subject to packaging legislation have also done a lot. First of all, 19,000 enterprises in Germany alone have met the obligation to take back and recycle packaging by taking part in the Dual System and paying a financial contribution to the operation of the collection, sorting and recycling systems.

This alone, however, would not have implemented the ideas behind Extended Producer Responsibility. Enterprises have used the Packaging Regulation and membership in the Dual System as an occasion to think about the packaging they use, even if this is only to reduce the financial strain.

Many enterprises thus began to optimize their packaging so that it continues to fulfil its function (product safety, to transport the product to the consumer, etc.), but have done away with unnecessary parts of the packaging, with the necessary parts being made smaller, thinner or adapted in some manner.

The Beiersdorf company has been able to do away with almost its entire packaging by attaching a loop on an adhesive pin, thus allowing the product to be presented in a reasonable manner in stores. This alone has saved 4 tons of material per year. The GEKA company first of all reduced the size of its packaging and eliminated the plastic window showing the product inside by printing a photograph of the product on the packaging. McDonalds changed its burger packaging from poly styrofoam to a normal cardboard packaging.

In general studies in Germany have shown that between 1991 and 2000 the average weight of foils have been reduced by 36% and of plastic bottles by 21%.

Identical developments can be seen in other countries where Green Dot organisations are operating as well. Thus a French company has been able to reduce its washing powder packaging weight by 1/3 by optimization and comparable success has been attained in Portugal as well by optimization alone.

One major accusation levied especially against DSD in Germany is the high costs. This led the Allensbach Institute to issue a survey on the topic at 526 companies selected in a representative sample on costs and EPR.

The first question on the survey was: Extended Producer Responsibility requires measures to avoid, reduce and dispose of packaging material. How about your company: did these measures result in higher costs overall, or cost savings, or did they cancel out?

Only 35% of the enterprises surveyed stated that their costs rose as a result of the packaging regulation. 39% stated that savings effects and costs were in balance and 14% were even able to achieve greater cost advantages than the license fees which have to be paid to DSD by optimizing their packaging. This is in my opinion an outstanding example of the fact that regulations like these offer a major opportunity which enterprises can use to their own advantage and to improve their competitiveness.

The survey then asked: *what the attitude of enterprises was towards EPR*. Only 7% stated that they considered EPR to not be a good idea. 77% said that they were in favour of EPR.

Product responsibility within the enterprise was also surveyed, comparing the situation now with 5 years later. 57% of those surveyed consider the topic to be important or very important to the enterprise and 69% believe that the topic will be either important or very important to the enterprise in five years' time. 80% of the enterprises surveyed view EPR to be an important or very important way to protect the environment. 73% believe that the implementation of EPR can satisfy consumer needs and that this can be used to help the image of the enterprise (68%).

In summary it can be said that it has become clear that enterprises have accepted the EPR tool as a way to solve problems.

6. International developments

The fact that the problem of increasing quantities of waste and declining waste disposal capacities has become a current problem not only in Germany but in many other European countries as well has led to respective laws and regulations being discussed and/or issued, after Germany, in France, Belgium and Austria. This once again resulted in a European Packaging and Packaging Waste Directive being issued in December 1994, thus causing packaging laws to be instituted in all 15 member countries of the European Union by December 1996. Corresponding collection systems have also been established.

A total of 13 additional states have applied for entry into the European Union in the next few years, which means that these countries will also be forced to implement the European packaging directive into national law in the

coming years. Thus, collection and recycling systems will have to be established in these countries as well.

This has now led to self-help organisations being established by the respective economic sectors in 15 European countries, which are using the Green Dot as the financing symbol for the operation of their system. Last year approximately 400 billion packaging were labelled with the Green Dot, around 87,000 enterprises have concluded a license agreement for the use of the Green Dot with one of the 15 Green Dot systems and more than 200 million people have already received access to the separate collection systems for packaging in the Green Dot systems. More than 12 million tons of used packaging underwent recovery in 2001, more than 1 million tons of which was recycled into used plastic packaging.

There is also a similar system in Finland and Italy as well as systems for collecting transport packaging in the Netherlands and Great Britain. Since four candidate countries (Poland, Lithuania, Hungary and the Czech Republic) became members of PRO EUROPE, the umbrella organisation of all 15 Green Dot Schemes. The self-help organisations from Turkey, Slovenia, Slovakia and from Lithuania and Estonia have also filed applications for membership in PRO EUROPE. Romania and Bulgaria are close to establishing respective industrial organisations.

The Parliament and the Senate in Russia are currently thinking about issuing comparable packaging legislation. A law along these lines has recently been issued in Ontario, a federal state in Canada. There has been a collaboration agreement between the members of PRO EUROPE and the Ontario economy's self-help organisation, CSR, for some time now.

7. Outlook

After all the economy's self-help organisations were initially preoccupied with setting up the respective systems in their countries over the past few years, the early systems have now in particular turned to the task of optimizing their systems and adjusting them to conform with current developments. At the same time, the question is increasingly coming to the forefront as to whether it really makes sense for a company with 15 different national systems to have to sign a licensing agreement with each of them. Recently the chairman of the board of Metro, one of the biggest food retailers in the world, called for the systems to grow together in this regard in order to meet the demands placed by globalization. All systems have thus been working together to find adequate solutions to the new challenges in order to be able to offer an optimum solution

to both the paying industry as well as governments both in environmental and economic terms.

In closing, it is important to note that business and industry have solved the problem posed to it. At the same time, it should be added that one should not forget that this paper concerns the topic of “packaging”. Packaging is itself not a toxic material. It performs a necessary task so that products can be consumed in the first place. If one overdoes things with regard to efforts to avoid packaging, for example, transport damage multiplies with products, and the negative impact on the environment is much greater.

Costs should always compare incurred the benefits when calling for an additional increase in quotas, when mandatory deposit systems are to be launched for a small part of the overall packaging waste or when prevention quotas of 10% or more are arbitrarily called for.

Chapter 3

REVISED STANCE ON PRODUCER RESPONSIBILITY IN WASTE POLICY IN THE NETHERLANDS

by

Kees Veerman

Ministry of Environment, Netherlands

1. Introduction

The responsibility, or co-responsibility, of producers and importers for the management of their products at the end-of-life stage, referred to as producer responsibility, is one of the departure points of waste policy.¹ Producer responsibility was introduced in the Netherlands in 1990 as an instrument for encouraging the prevention and reuse of waste.² Its principal aim was seen at the time as being to encourage prevention and reuse and the internalisation of environmental costs in the product price, thereby doing justice to “the polluter pays” principle.

The experience since acquired in the use of the producer responsibility instrument is evaluated in this present memorandum. The conclusion is that the introduction of producer responsibility has had a big impact on the increase in collection and recovery of the relevant waste streams. A further conclusion is that the introduction of producer responsibility does not result in waste prevention. The results of the evaluation constitute the basis for the

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1. National Waste Management Plan 2002-2012, par. 5.8 [Environment Ministry (VROM), 2002].
 2. Letter from the Environment Minister to the lower house of the Dutch Parliament dated 19 October 1990.

recommendations incorporated in this memorandum on how the instrument should be employed in the future.

The memorandum is based on the evaluation study of decrees governing producer responsibility,³ a study of the possibilities for internalising waste costs in the product price⁴ and discussions within the Environment Ministry (VROM) and other fora, *e.g.* the OECD.

2. Features of the current systems of producer responsibility

2.1 *Product groups for which producer responsibility has been introduced*

In 1989 the Memorandum on the prevention and recycling of waste was published.⁵ This memorandum designates 29 priority waste streams, for which targets for prevention and reuse have been formulated. In the years following publication of the memorandum programmes were introduced under which the said waste streams were tackled. Negotiations were conducted with the parties concerned on the use of instruments to achieve the targets. For various waste streams, this resulted in the principle of producer responsibility being introduced on a voluntary basis. Examples include the Packaging Covenant I and the Implementation Plan for End-of-life Vehicles.

If it was impossible to reach agreement, as in the case of white and brown goods, car tyres and batteries, this sometimes resulted in rules and regulations based on Section 10.17 of the Netherlands Environmental Management Act. Under this Section a duty can be imposed on producers and importers to organise and finance at the end-of-life stage the collection and treatment of the products they have put on the market. In a number of cases the introduction of systems of producer responsibility was backed up by an order declaring an agreement on a waste disposal levy universally binding.

This kind of agreement can mean that for each product they put on the market producers and importers pay a given amount to an organisation that organises the collection and treatment of the discarded products. Declaring this

3. Decrees governing producer responsibility. Research for Policy, 22 May 2001.

4. Internalising waste costs: study of expanding and deepening. ERM, TME, June 2000.

5. Memorandum on the prevention and recycling of waste; Parliamentary papers II, 1988-1989, no. 2.

agreement universally binding on the basis of Section 15.36 of the Environmental Management Act forces "free-riders" also to participate in the system.

The table below gives an overview of the product groups for which producer responsibility has been introduced.

Waste (year)	Instrument	Details of instrument	Implementing organisation
Packaging (1991)	Rules and regulations	Regulations governing packaging and packaging waste	SVM/Pact
Passenger cars (1996)	"	Decree governing management of passenger cars	ARN
Car tyres (1996)	"	Decree governing management of car tyres	Band en Milieu
White and Brown Goods (1998)	"	Decree governing management of white and brown goods	NVMP; ICT-milieu
Agricultural/horticultural plastic film (APF) (1997)	"	Decree governing management of agricultural/horticultural plastic film	Folined
Batteries (1995)	"	Decree governing management of batteries	Stibat, Battrex
Packaging (1991)	Covenant	Packaging Covenant II	SVM/Pact
Passenger cars	Order declaring agreement universally binding	Agreement on the waste disposal levy for passenger cars 2000	ARN
Waste paper/cardboard (1997)	"	Agreement on the waste disposal levy for paper and cardboard 1997	PRN
Agricultural/horticultural plastic film	"	Agreement on the waste disposal levy for agricultural plastic film 1999-2002	Folined
Plastic cladding units (1997)	"	Agreement on the waste disposal levy for plastic cladding units 2000-2005	SRVKG
Sheet glass (2002)	"	Agreement on the waste disposal levy for sheet glass 2002-2005	VRN
Plastic piping systems (1993)	No rules and regulations or covenant	Voluntary take-back system	FKS

2.2 *Organisation of collection and treatment*

For all the product groups listed, producers and importers have set up one or more collective systems with the task of organising and funding the logistics and treatment. In virtually every case, these are systems without excessively high admission requirements that people can join. Only for ICT products is the system largely linked to a mandatory affiliation to the branch association.

Although it is technically possible to set up individual systems for product groups subject to statutory regulations, only one producer (batteries) has done so. This is partially due to the fact that it is often impracticable for individual producers to organise collection and treatment themselves. Added to this, the relevant statutory rules often contain incentives that render it difficult to set up individual systems.

Apart from the question of whether it is possible under the law to prescribe collective systems, it is probably not advisable to render only collective systems possible. Individual producers and importers have to be granted the opportunity to set up their own systems. Consequently, as practice has proved, pressure is maintained on the collective systems to perform to the optimum. Initial steps were taken in several cases to set up individual systems, incidentally, but these plans were never realised. From the competition point of view as well, the Netherlands Competition Authority (NMa) and the EC attach great value to the possibility of establishing individual systems.

To implement collective systems, special organisations are usually set up. Examples include ARN, Stibat, Folined, RSVKG and the NVMP. These implementing organisations are in practice the contact point for the government.

From the point of view of communication to the “disposers”, collective collection and treatment systems have clear advantages.

2.3 *Funding producer responsibility systems*

Most systems are funded by a contribution levied on new products placed on the market, the waste disposal levy as it is known. This levy, which may or may not be charged to the end user, is paid by the producers to the various implementing organisations. This is the case as regards cars, consumer electronics, batteries, paper and sheet glass. In the case of car tyres, the disposer is required to pay when discarding them. Mixed funding, which includes a charge levied on the new product as well as when it is discarded, applies to plastic films and plastic cladding units. In the case of ICT equipment, the manufacturers fund the cost of managing their own returned and treated

products as well as a proportion of “orphaned products” from their own resources. These costs are considered to be part of the cost price of the new product. Consequently, the disposer is not required to pay on discarding the product.

2.4 *Internalising or externalising the waste disposal levy*

In some systems (*e.g.* for cars, some white and brown goods, sheet glass) the waste disposal levy is presented as a separate item on the bill for the end user. In the case of the said systems, a duty was initially imposed on the participants by means of a “perpetual condition” to ensure that the waste disposal levy was visible on the bill throughout the entire chain from producer to consumer. The Netherlands Competition Authority (NMa) decided that this conflicted with competition laws. A legal battle on this point is ongoing. As a result of the NMa's rulings in this respect, the duty on the said organisations to roll on the charge visibly has lapsed. It is now frequently done on a voluntary basis.

Experience has shown that establishing a visible waste disposal levy has in the Netherlands had a positive impact on the willingness of producers to establish collection and treatment systems that also clear away the products put on the market in the past, the historical stock as it is known. Passing on the cost direct to the consumer means that the producers' competitive position is not affected. In that case, a larger market share in the past does not result in higher costs (for example, Philips had a market share in televisions of more than 70% in the past, at present it is around 30%. The appliances from the era of its large market share are currently being discarded).

A side effect of putting the waste disposal levy on the bill is that it has had a clear educational effect on consumers.

2.5 *Differentiation of waste disposal levy according to recyclability*

In none of the systems that have come into being in the Netherlands does the waste disposal levy differentiate according to the recyclability of the product, the reason being that they largely employ pay-as-you-go systems. The levy on the new products is spent on the management of the products discarded in that same year. Besides this, producers consider setting up such systems very complicated (see prevention below).

Forms of differentiation that *are* applied are applied according to type of product, *e.g.* type of battery or type of white or brown good. In the case of vehicles, no differentiation whatsoever is made. A further differentiation made

is that in the system for ICT equipment. In this case, financing is based on actual cost: the treatment facility sends the bill for the quantities (the weight of) treated products to the brand proprietors. This requires detailed records, but it has proved workable. Refining according to recyclability is not such a big step, but does require even more records. It may in the future be possible to further simplify this by using “intelligent electronic labels”.

Studies of comparisons of the recyclability of televisions has shown, however, that the differences in recyclability between the same “generations” of televisions are marginal. For instance, the dismantling time differs at most from 2 to 4 minutes.⁶⁷ If these differences were to be incorporated through differentiation in the charge, the effect on the ultimate consumer price of the product would be virtually nil. Consequently, this as such would provide hardly any incentive to design for recycling. However, it is the experience of the Consumer Association that manufacturers are more sensitive to a low rating on environmental aspects in comparative goods tests. Assessing recyclability by this means therefore appears to have a greater influence on product design.

2.6 *The level of the waste disposal levies*

The waste disposal levy varies from 0% (small household appliances), via 0.3% (vehicles) to 6% (refrigerators) of the average selling price.

Waste stream	Waste disposal levy (2002)
White and brown goods	€ 0 – 17
Vehicles	€ 45
Agricultural plastic film	€ 0.03/kg
Plastic cladding units	€ 0.08/kg
Paper, cardboard	€ 0.004/kg
Batteries	€ 0.004 – 0.53

6. “Back to the start”, Ploos van Amstel 1997 (Apparettour project).

7. “Recyclability of large- and wide-screen televisions”, Consumer Association, Research Dept. 2000.

2.7 *Pay-as-you-go system and fund creation*

In virtually every system the costs are financed on a pay-as-you-go system in which the proceeds cover the costs incurred in that same year. In every case the producers also bear responsibility for the management of those appliances for which they are not actually liable, namely those products whose original manufacturer is no longer on the market or is no longer identifiable (the orphans as they are known).

In not a single case is a pure system of forming a reserve employed. In a system of this kind the consumer pays the costs that will be incurred at the time a product is discarded when he buys that product.

In various systems money is set aside with a view to possible discontinuities in income or expenditure patterns. In the case of cars, for example, allowance is made for the fact that sales may suddenly dip sharply or the number of end-of-life vehicles for treatment may increase sharply. Money is sometimes also set aside to cushion an expected rise in costs without having the waste disposal levy increase.

As calculations are often conservative, there is in practice frequently an accumulation of considerable reserves. In a number of cases the reserve accumulated over a few years has been 2 or 3 times the annual expenditure. Some time ago politicians demanded that these reserves be looked at and the media focused a great deal of attention on the subject. The reserves are formed by consumers, while they have no influence on how high the levy should be or how it should be spent. Moreover, the visible levies form no part of competition. Many are under the impression, though, that the waste disposal levy is a measure (tax) imposed by the Environment Ministry (VROM). Every collective system in which the government is involved (rules and regulations or universally binding order) incorporates guarantees that the reserves cannot be spent for purposes other than those for which they have been formed. The government is meanwhile watching the size of the reserves and, where necessary, tying them to a maximum.

The government does not get involved in the efficiency of the spending of the waste disposal levy nor in the choices made in this expenditure. This might mean that, for example, more money is spent on furnishing information than on the treatment of a given waste stream, or that large contracts are awarded for which only one tender is invited. The principle of producer responsibility is not compatible with government interference in these choices.

2.8 *Order declaring waste disposal levy universally binding*

In the Netherlands it is possible to declare an agreement on a waste disposal levy universally binding (AVV), so that all producers and importers are required to participate in the funding system. The principal aim of this is to avoid *free riders* undermining a collective system through the creation of a competitive advantage by not participating. It is therefore mainly an instrument of support for voluntary initiatives. A producer can be exempted from an AVV if it can demonstrate it has established a system that works equally well.

There are universally binding orders for vehicles, plastic film, plastic cladding units, sheet glass and waste paper and cardboard.

Although in the case of statutory rules and regulations there is, strictly speaking, no need to declare an agreement on a waste disposal levy universally binding (as everyone is duty bound to comply with the obligations anyway), the combination of statutory rules and regulations and universally binding orders does occur (end-of-life vehicles and plastic films). The reason for this is that the collective organisation can consequently act as “enforcing authority” itself (civil proceedings) and is not simply dependent on the enforcing activities of the authorities.

One aspect that has a delaying and hampering effect on declaring a waste disposal levy universally binding is that AVVs have to be reported to the European Commission for examination for state support. So far the Commission has not found a single case of state support. Reporting to the Commission does take a great deal of time and effort, however.

2.9 *“Discarding free of charge” and “old for new” obligation*

A number of statutory regulations provide that the last owner must be able to discard his product free of charge [end-of-life vehicles, white and brown goods (some)]. This “free of charge” provision can also apply to passing on products to subsequent links in the chain (*e.g.* a shopkeeper can return free of charge to his supplier the products he has taken back). This reduces the risk of illegal dumping. In order to avoid abuse, *e.g.* through the import of discarded products, this “free of charge” provision is linked to a so-called old for new regulation. In that case, at most the same number of products can be taken back as are put onto the market new.

One note to the “free of charge” provision is that it is impossible to implement, or more difficult to implement, if the discarded product is very polluted. In the case of plastic films from the agricultural or horticultural sector,

for example, a “free of charge” provision can result in the disposer being less than critical with regard to attached dirt. After all, he does not have to pay for it. On the other hand, if he does have to pay when handing in the film, the disposer will remove adhering dirt as otherwise he will have to pay for it himself. With “cleaner” products the possibilities for recycling are greater.

The drawback to paying on handing over is the risk of an increase in illegal conduct. This has proved the case especially with car tyres. The decree governing the management of car tyres does not contain a free of charge provision, and the duty for producers to take back the product is not clearly regulated. Consequently, garages have to pay to get rid of the old tyres they have taken back. Disreputable collectors of discarded tyres take the tyres back at a lower price than that charged by reputable collectors. Several times, large quantities of car tyres have as a result been left abandoned. The problem of too little control throughout the chain occurs in the horticultural plastic film sector also; there is too little money for proper treatment, with the result that various, disreputable, treatment facilities have abandoned large batches of untreated plastic film.

3. Distribution of roles for collection

The producers' responsibility for collecting discarded products is not clearly set out in the various orders in council (AMvB). Under the order in council for white and brown goods, the responsibility of producers and importers does not commence until after collection by the local authorities and retailers. In the case of car tyres, responsibilities have not been clearly demarcated. This is currently being rectified in the new order governing the management of car tyres. In the case of packaging, local authorities are responsible for collection, but to achieve targets, however, producers are dependent on the collection results, a situation that results in one party being left holding the baby.

The order governing the management of batteries states clearly that producers are also responsible for achieving the collection percentages, and great efforts are made to achieve these targets. The budget for educating the public accounts for a large part of the cost of the management system.

4. Evaluation

4.1 Prevention

When the principle of producer responsibility was introduced in the early 1990s, it was thought it would lead to internalisation of the cost of waste

management in the product price and, hence, to prevention, as producers and importers would endeavour through internalisation to design products that would produce less and more easily recycled waste, resulting in lower waste management costs. These effects did not materialise in practice because:

- Producer responsibility is mostly funded by a waste disposal levy, visible or invisible. In every instance, producers have opted for a uniform charge per product category and not for differentiation by recyclability.
- Differentiation in waste disposal levies by recyclability is in practice difficult. It requires brand-related collection or sorting and involves a relatively expensive registration system. In addition, the differences in recyclability of the same products are often marginal.
- The cost of waste management generally makes up only a very small percentage of the cost price of the product. Reducing waste management costs through prevention and design for recycling has little impact on the price of a product and, from the point of view of cost, is therefore not an aspect of competition.

4.2 *Recovery*

For the various waste streams for which producer responsibility has been introduced, there has been a sharp increase in collection and recycling in recent years.

- 75% of batteries are collected and subsequently almost entirely recycled, whereas they used to be dumped or incinerated.
- For end-of-life vehicles, recycling has increased within seven years from 70% to more than 86%. This has almost halved the quantity of shredder waste from vehicles that has to be disposed of at landfills.
- At present, an average of 4.6 kg of white and brown goods are collected and treated per resident. The level of recovery in particular for discarded televisions, computers and small white and brown goods has thus risen within four years from nothing to relatively high.

A number of reasons can be identified for the success in this area. The introduction of producer responsibility has resulted in most cases in recovery no longer being an ambiguous instruction for many but a concrete duty for a clear standard addressee. For example, before the order in council governing batteries

came into force, all local authorities were in principle responsible for the separate collection of batteries and for providing treatment facilities. At the same time, no single individual local authority was “held to account” on the results. This changed with the order in council on batteries. A clear standard addressee was designated (the producers/importers, who set up a collective organisation for this purpose).

Another major factor in this success is that producer responsibility systems provide a solution for any life-cycle deficit. Often, the reuse of waste such as refrigerators, batteries, etc. is more expensive than simply disposing of them with the ordinary waste. Hence, there is a financial obstacle to top-quality waste management. Producer responsibility systems in practice provide a solution to the life-cycle deficit by imposing a waste disposal levy. This renders payment on purchase superfluous and removes an obstacle to separate collection and reuse.

A third reason for the success of the introduction of producer responsibility is that the size and market force of the collective organisations enable the separate collection and treatment of products at the end-of-life stage to be organised efficiently. For example, the NVMP was able to negotiate substantially lower rates for the transport and treatment of white and brown goods than local authorities were required to pay before the order governing the management of white and brown goods came into force. The collective organisations have also emerged as the foundation on which new recycling technologies are developed.

A further reason for the success is that many of the collective implementing organisations that have been created are gaining a momentum of their own: their own targets and methods which, although an extension of the targets of the companies behind them, often go much further than the individual producers and importers would have gone.

4.3 *Design of producer responsibility orders in council (AMvB)*

The evaluation study has shown that each waste stream requires a specific approach. There is no template for a successful approach, although it is possible to draw up a checklist, based on the evaluation, of elements that need to be taken into consideration when drawing up regulations for producer responsibility (see attachment 1). This type of checklist promotes the uniformity of orders in council. When existing decrees are revised and new ones drawn up, this list will need to be taken into account. It was used when drawing up the new decree on the management of passenger cars required to implement the EC directive.

5. Conclusions and recommendations

1. *Producer responsibility has had a big impact on increasing the collection and recovery of the relevant waste streams*

If producer responsibility had not been introduced, the present level of collection and recovery of these waste streams would not have been achieved at a relatively minor increase in cost.

2. *Producer responsibility useful instrument in certain situations*

The producer responsibility instrument can make a major contribution towards achieving a more desirable method of managing specific products at the end-of-life stage. Briefly, the products in question are those

- that leave much to be desired as regards present management in the environmental hygiene sense.
- that frequently involve a life-cycle deficit which forms an obstacle to achieving the desired method of management.
- for which ambiguity concerning responsibility for achieving the desired management frustrates adequate measures.
- for which fragmentation in the supply of the waste results in high costs and an inadequate basis for developing new treatment technologies.

3. *A clear assignment of responsibilities is important for success*

Ambiguity in this respect results in discussion about who is required to do what. Added to this, ambiguity in assigning responsibilities means that no-one can be held to account on failure to achieve the targets.

4. *Preference for collective pay-as-you-go system*

The advantages of a collective pay-as-you-go system for financing are that:

- It provides a basis for financing the treatment of both the historical stock and orphaned appliances as well as the new stock.
- With a collective pay-as-you-go system the uncertainties about income and expenditure are cut and dried. It is not necessary to create large

reserves as only marginal resources need to be set aside for future expenditure.

- With a collective pay-as-you-go system it is also not necessary to make provision for a producer disappearing from the market in the future and no longer being able to assume responsibility for clearing away the appliances it has put on the market.

5. Doubts about the combination of statutory regulations for producer responsibility and universally binding orders

The added value of a universally binding order combined with statutory rules and regulations governing producer responsibility is limited. From the point of view of lightning the government's workload, it is advisable to scrap the possibility of combining the two instruments.

6. No prevention as result of producer responsibility

Producer responsibility in its present form is not an instrument for encouraging the prevention of waste. Other instruments, *e.g.* national or European product policy or immediately effective regulations as contained in the EU directives on packaging, end-of-life vehicles and electrical appliances, are more suitable for this purpose.

Annex

Elements of a checklist for drawing up rules and regulations on producer responsibility

- Prevention provision yes/no (usually no, sometimes possible/worthwhile, sometimes mandatory under EU directive)?
- Designate one or several standard addressees? (make good market / life-cycle analysis)
- Addressing requirement for producer/importer
- Addressing requirements for other links Role of local authority?
- Lower limit yes/no?
- Only professional producers/importers or private individuals and parallel importers as well?
- Collection (household waste) covered by producer responsibility yes/no?
- Free of charge provision? At one point in the life-cycle or throughout entire life- cycle?
- Old for new provision?
- Target for collection/take-back?
- Target for recovery?
- Target for product reuse?
- Target for material reuse (recycling)?
- Target for use primarily as fuel?
- Concrete results obligations preferable
- Provision for interim revision of target yes/no?
- Duty to notify yes/no?
- Duty to notify procedure?
- Duty to report yes/no?
- Duty to report procedure?
- Collective notification option?

- Conditions attached?
- Conditions for funding (*e.g.* limit on fund creation in AMvB or mandatory internalisation or leave to producers/importers?)
- Duty to monitor and report yes/no? Decide usefulness and need for monitoring and reporting
- Duties in the sphere of consumer information yes/no?
- Analyse and regulate overlap with other orders
- Tools for enforcement

Chapter 4

EVALUATION OF EPR PROGRAMMES IN JAPAN

by

Eiji Hosoda, Professor of Economics

Keio University, Japan

1. Introduction

The recent socio-economic advances in Japan resulted in the rich life styles of the people on one hand, and a variety of serious social problems on the other hand. Those problems include increasing volume of waste discharge, the diminishing capacity of final disposal sites, hazardous substances generated by waste incineration facilities, and growing concerns over environmental pollution such as heavy metals at final disposal sites, and increasing illegal dumping.

Those problems have increased loads to air, water and soil, posing serious threats to the material cycles in the natural world.

These problems are rooted in the society of mass production, mass consumption and mass waste discharge. For the fundamental solution of such problems, it is essential to form an economic society with less environmental loads, by reviewing conventional social structures and life styles of the people; that is, a “recycling-based society” where environmental loads are reduced by restraining the consumption of natural resources and securing material cycles in the society.

In order to deal with the problems, numbers of recycling-related laws have been enacted.

2. Overview of Waste Discharge

2.1 Municipal waste

The total volume of discharge of municipal waste in FY 1999 was about 51.45 million tons. The volume of discharge tends to flatten or to increase only slightly in recent years. The volume of per capita daily discharge is about 1 kg.

It is expected that the final disposal sites for municipal waste will be filled up in about 12 years unless additional final disposal sites are newly built. Nevertheless, the volume of waste must be reduced in the future. Hence it is necessary to review our life styles and to control waste discharge as much as possible, by voluntarily restraining the use of disposable products and selecting products packed in a returnable container. Further it is necessary to change our society into a recycling-based society where 3R (reduction, reuse, and recycling) are promoted.

Figure 1: Volume of discharge of municipal waste

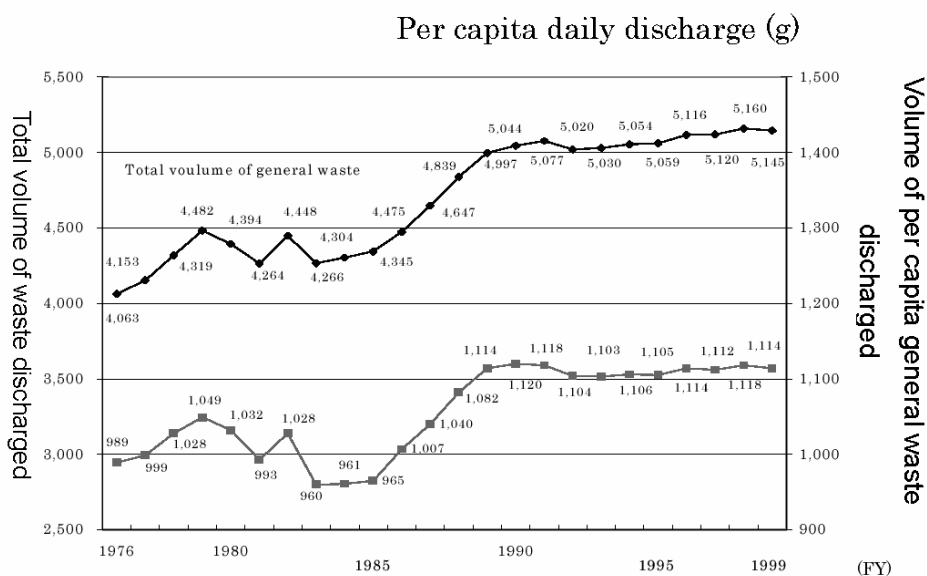


**Table 1: No. of years of remaining service life and capacity of final disposal sites:
Municipal waste**

	FY 1996	FY 1997	FY 1998	FY 1999
Remaining capacity (million m ³)	151	164	171	164
No. of years of remaining service life (Japan) (years)	9.4	11.2	12.3	12.3

Source: Ministry of the Environment.

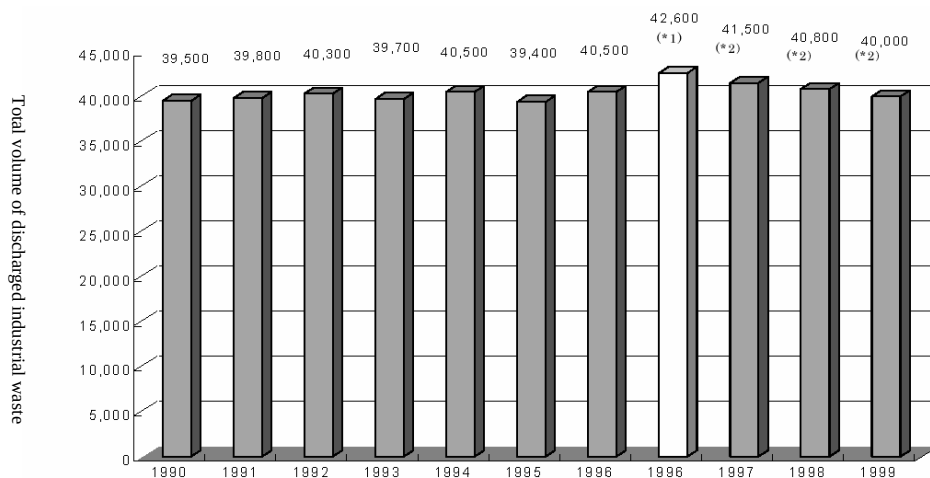
2.2 Industrial waste

The total volume of nation-wide industrial waste in FY 1999 was about 400 million tons. The volume of waste discharge after FY 1990 is around 400 million tons, remaining almost unchanged and levelling off after the collapse of the bubble economy.

The remaining years of the final disposal sites for industrial waste available are less than four years, thus, a decrease in the discharge of industrial waste and increasing recycling is very important.

Figure 2: Trend in the volume of discharges of industrial waste

(FY)



*1: Based on basic standards for formulating policies for dioxins decided on at a meeting of the Ministerial Council on Dioxin Policy, the volume of discharged waste in FY1996 in the "target volume for reducing waste" whose target year is 2010 (decided on by the government on September 28, 1999) is shown above.

*2: The volume of discharged waste in the year 1997 and later years is calculated using the same method as in *1.

Table 2: Number of years of remaining service life and capacity of final disposal sites for industrial waste

	FY199	FY199	FY199	FY199
Remaining capacity (million 3、	208	211	190	184
No. of years for remaining service life (all Japan) (years)	3.1	3.2	3.3	3.7

3. The Legal and Regulatory Framework for Waste

“The Waste Disposal and Public Cleansing Law” (Law on Waste Disposal) (1970) prescribes the definition of waste, responsibility for the treatment of waste(the municipalities are responsible for municipal waste, and businesses which generate for industrial waste), standards for the method of waste treatment and waste treatment facilities, etc.

In addition, “The Law for Promotion of Effective Utilization of Resources” (1991) was enacted in order to promote businesses’ voluntary involvement in the recycling activities in 1991. In response to the public opinion demanding reduction of municipal and industrial waste discharge or volume of waste treated in the final treatment sites, as explained in the previous section, the following laws were established one after another.

“The Container and Packaging Recycling Law” in 1995, “The Electric Household Appliance Recycling Law” in 1998, and “The Motor Vehicle Recycling Law” in 2002 have given shape to the concept of the Extended Producer Responsibility, and prescribe the obligation that producers etc. of the goods (containers, 4 types of household electric appliances, and motor vehicles) will be responsible for the recycling of the products which the consumers discharge.

In 2000, a number of laws were enacted for recycling wastes. They are “The Law for Promotion of Effective Utilization of Resources”, “The Construction Material Recycling Act”, “The Food Recycling Law”, “The Law on Promoting Green Purchasing”, and “The Basic Law for Establishing the Recycling-based Society”.

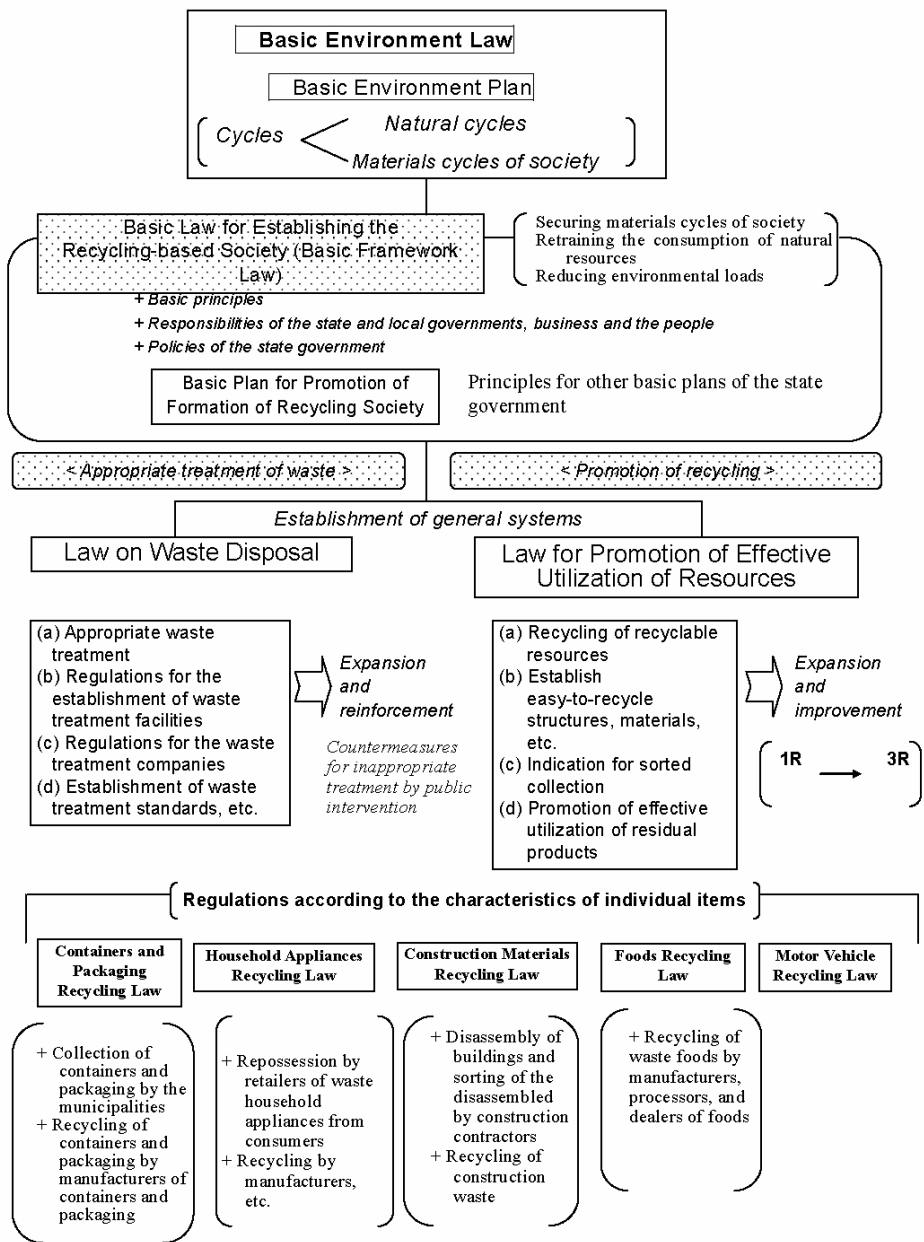
- “The Law for Promotion of Effective Utilization of Resources” stipulates the voluntary commitment on the part of the businesses to 3Rs, Reduce, Reuse, and Recycle, while “The Law for the Promotion of Utilization of Recycled Resources” focused only on recycling. As

one of the diversified provisions, the Law prescribes that PC manufacturers collect the used PCs on a voluntary basis.

- “The Construction Material Recycling Law” obligates owners of buildings to be responsible for sorted dismantling and recycling when the buildings are dismantled.
- “The Food Recycling Law”, similarly, obligates businesses who discharge a large volume of waste food to be responsible for recycling the bulk food waste.
- “The Green Purchasing Law” prescribes the Government’s leading role to promote to purchase the environment friendly goods including recycled goods.
- “The Basic Law for Establishing the Recycling-based Society” stipulates the comprehensive promotion of the recycling-based society where consumption of natural resources are controlled and environmental loads are reduced, with a smooth implementation of measures for waste and recycling. The Law stipulates the Government’s obligation to set up the Basic Plan for establishing the recycling-based society.

The basis of environmental policies are given by the “Basic Environment Law”, but as far as waste management and recycling are concerned, its basis is found in the “Basic Law for Establishing Recycling-based Society” now. The following figure presents the laws, in which the EPR concept is found.

Figure 3: Legal and regulatory framework of waste management and recycling



4. Individual Recycling Laws and EPR

4.1 Containers and Packaging Recycling Law

“The Containers and Packaging Recycling Law” was enacted in 1995 for the purpose of reducing waste and effectively utilizing resources by recycling container packaging wastes collected after sorting, such as bottles, cans, and wrapping papers, which account for about 50 to 60%, in terms of the capacity ratio, of the waste mainly generated from households.

In this law, consumers sort and discharge bottles, cans, and wrapping paper, and the municipalities collect them separately. Manufacturers of those products are obligated to recycle container and packaging wastes sorted and collected by the municipalities.

Containers and packaging wastes to be covered by this law are bottles, cans, plastic products which are containers and packaging for goods discarded after consumption. When the law was enforced in 1997, two kinds of containers, glass containers and PET bottles (for beverages and soy sauces), became subject to the obligation of recycling. In April 2000, paper and plastic container packaging were added to the law.

Figure 4: Outline of the Containers and Packaging Recycling Law

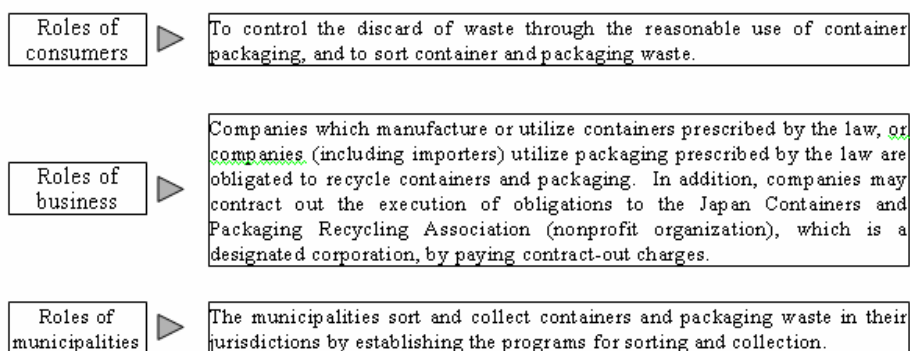


Figure 5: Containers and packaging waste as a proportion of household waste

Fiscal year 2000

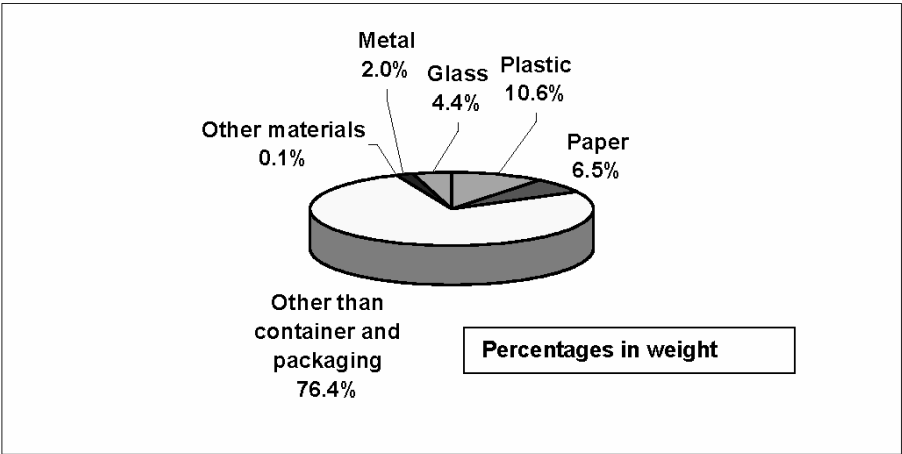
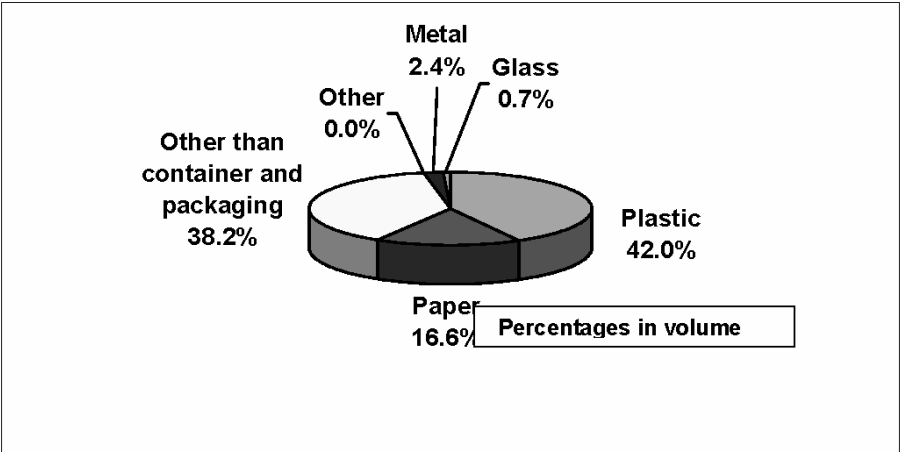
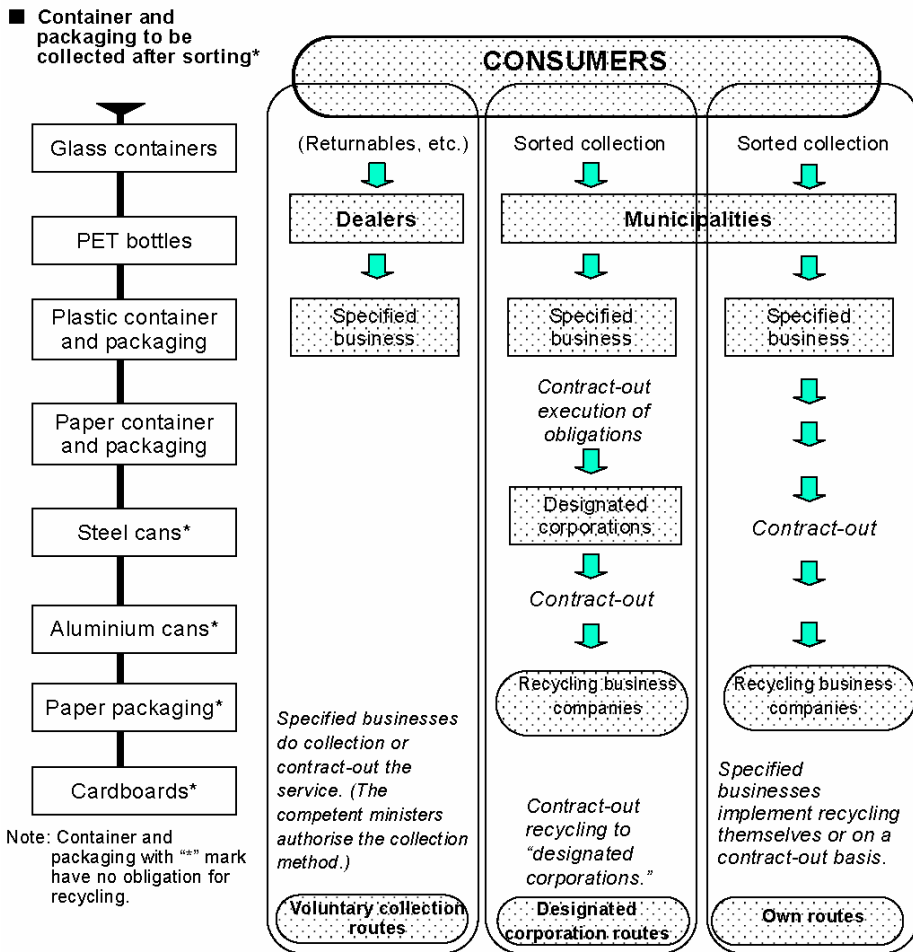


Figure 6



Source: 2000 version of "Containers and Packaging Recycling Law" of the Ministry of International Trade and Industry

Note*: The law covers waste discharged by general consumers and collected by the municipalities.

4.1.1 Plans for recycle

In order to promote sorted collection and effective recovery, the government decides upon the sorted collection plan and the recovery plan, and it is adjusting so that recycling may be promoted efficiently.

Table 3: The recycling plan

(Unit: 1,000 tons)

Classification	FY2000	FY 2001	FY 2002	FY 2003	FY 2004
Non-colored glass	270	270	270	270	2700
Brown glass	200	200	200	200	200
Other types of glass	140	150	160	180	220
Paper containers and packaging	66	133	133	133	133
PET bottles	101.8	155.4	247.1	247.1	247.1
Plastic containers and packaging	153	261	336	401	406

Table 4: The sorted collection plan

(Unit: 1,000 tons)

Classification	FY 2000	FY 2001	FY 2002	FY 2003	FY 2004
Non-colored	459 (352)	484	505	525	537
Brown glass	369 (313)	388	406	420	431
Other types of glass	180 (165)	190	198	205	211
Paper containers and packaging	87 (35)	120	153	197	213
PET bottles	103 (125)	173	199	217	231
Plastic containers and packaging	239 (101)	389	487	636	701

Note: Numbers in parentheses indicate the actual results.

4.1.2 Enforcement

With respect to enforcement, the amount of recovery and enforcement by municipalities are increasing. While the PET bottle and the amount of recovery of PET bottles and plastic container packages are increasing, however the amount of recoveries of paper container packages is not increasing.

Based on “The Law for Promotion of Effective Utilization of Resources”, manufacturers are imposed to display recycle marks.



Steel Cans



Plastic Containers
& Steel Cans



Aluminum Cans



Plastic Containers
& Steel Cans



PET Bottles

Recycling symbols designated for display on the container or packaging

**Table 5. Results of sorted collection and recycling based on
“The Containers and Packaging Recycling Law”**

Classification		Estimated amount obtainable through separate collection (t)	Actual amount obtained through separate collection (t)	Recycled amount (t)	Municipalities requiring separate collection		
					Number	Percentage	Percentage of the population covered
Non-colored glass containers	1997	406,133	292,775	275,119	1,610	49.5	76.8
	1998	486,025	322,284	303,240	1,862	57.2	84.6
	1999	542,451	326,110	307,237	1,991	61.2	86.3
	2000	458,559	352,386	334,549	2,618	81.1	92.6
	2001	483,879	355,157	339,443	2,725	83.9	93.8
Brown glass containers	1997	299,536	243,916	228,170	1,610	49.5	77.0
	1998	358,012	274,374	256,227	1,866	57.3	84.6
	1999	369,894	290,127	272,559	1,992	61.3	86.4
	2000	369,346	312,539	294,959	2,631	81.5	92.7
	2001	388,351	311,993	298,785	2,737	84.3	93.8
Other colored glass containers	1997	118,536	107,533	95,190	1,535	47.2	74.1
	1998	140,443	136,953	123,227	1,784	54.8	81.9
	1999	155,603	149,332	134,084	1,915	58.9	83.9
	2000	180,459	164,551	150,139	2,566	79.5	91.1
	2001	189,620	162,481	152,965	2,706	83.4	93.8
Paper containers and packaging	2000	86,724	34,537	26,310	343	10.6	13.0
	2001	120,308	49,723	44,675	404	12.4	16.8
PET bottles	1997	21,180	21,361	19,330	631	19.4	41.8
	1998	44,590	47,620	45,192	1,011	31.1	62.0
	1999	59,263	75,811	70,783	1,214	37.3	67.4
	2000	103,491	124,873	117,877	2,340	72.5	86.9
	2001	172,605	161,651	155,837	2,617	80.6	91.8
Plastic containers and packaging	2000	239,174	100,810	77,568	881	27.3	30.7
	2001	389,272	197,273	180,306	1,121	34.5	43.6
Steel cans	1997	526,701	464,662	443,506	2,411	74.1	86.4
	1998	590,858	471,638	461,347	2,572	79.0	91.4
	1999	636,099	471,127	456,892	2,625	80.7	91.8
	2000	576,461	484,752	476,177	3,065	94.9	96.9
	2001	598,648	461,357	450,229	3,104	95.6	97.3
Aluminum cans	1997	148,885	112,527	107,455	2,420	74.3	86.7
	1998	170,535	121,214	117,315	2,587	79.5	91.7
	1999	187,025	128,541	124,690	2,647	81.4	92.0
	2000	172,889	135,910	132,386	3,078	95.3	97.0
	2001	181,111	141,408	137,753	3,112	95.9	97.4
Cardboard	2000	434,888	380,290	372,576	1,728	53.5	61.0
	2001	458,519	448,855	438,598	1,942	59.8	67.1
Paper cartons	1997	23,028	6,644	6,419	993	30.5	43.4
	1998	30,072	8,939	8,670	1,111	34.1	54.7
	1999	36,626	9,574	9,416	1,176	36.2	54.9
	2000	28,065	12,565	12,071	1,599	49.5	69.1
	2001	31,514	13,136	12,435	1,756	54.1	70.9

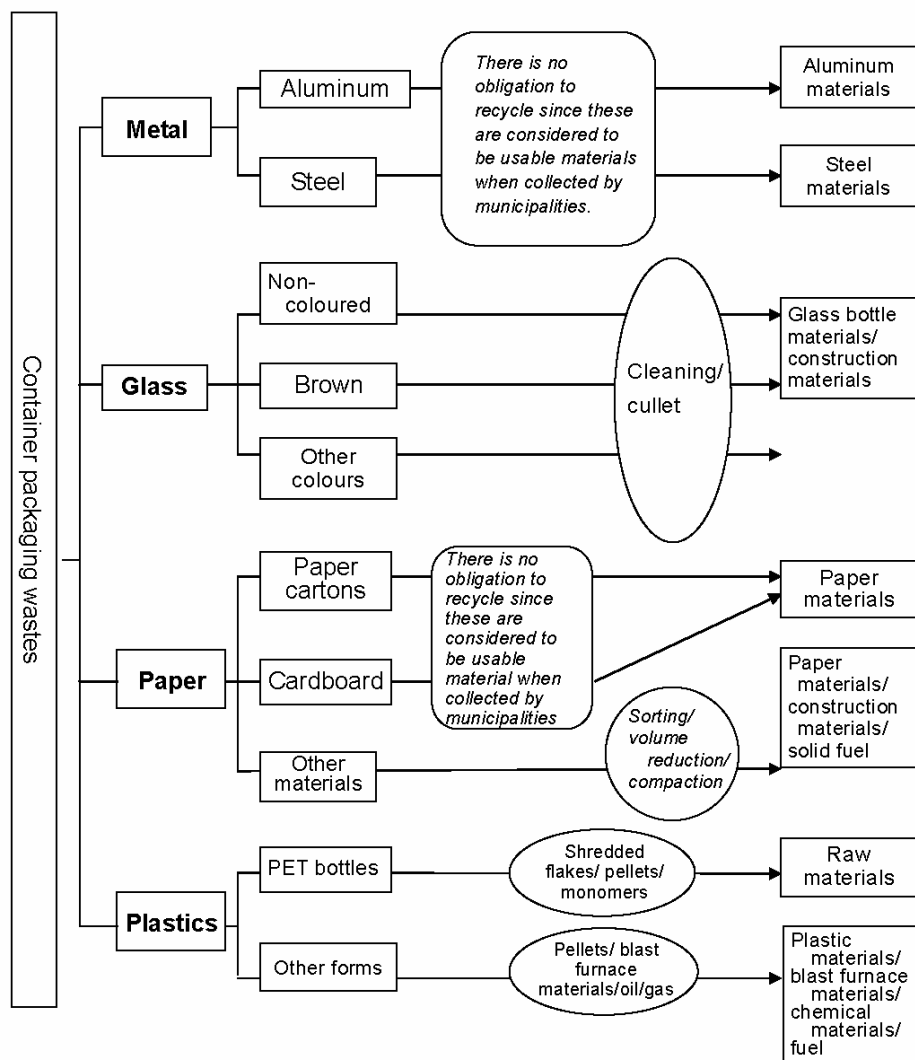
(Source: Ministry of the Environment)

Notes: The total number of municipalities in Japan is 3,229 as of March 2001.

The population of Japan is 12,675 million as of April 1, 2000

Flow of the recycling of containers and packaging

Containers and packaging waste collected separately are recycled as raw materials in the following way.



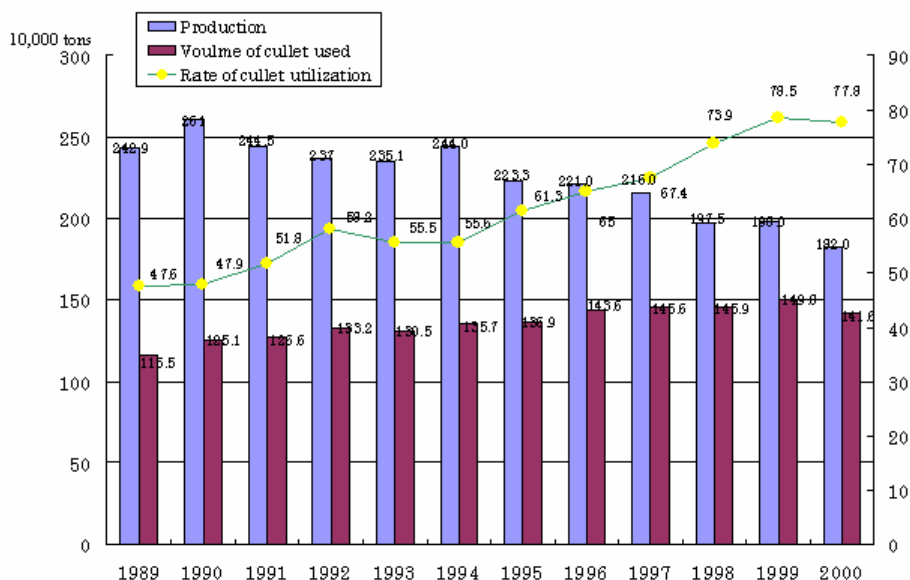
4.1.3 Present state of recycling

Glass bottles

Glass bottles are classified into two categories: one-way bottles manufactured for one-time use, and returnable bottles for repeated use after cleaning.

One-way bottles are pulverized into cullet and used as raw materials to manufacture new bottles. Cullet means pulverized glass, and the rate of cullet utilization means the ratio of the volume of cullet used, to the volume of new bottles manufactured.

Figure 7: Change in the volume of newly manufactured bottles and the volume of cullet used



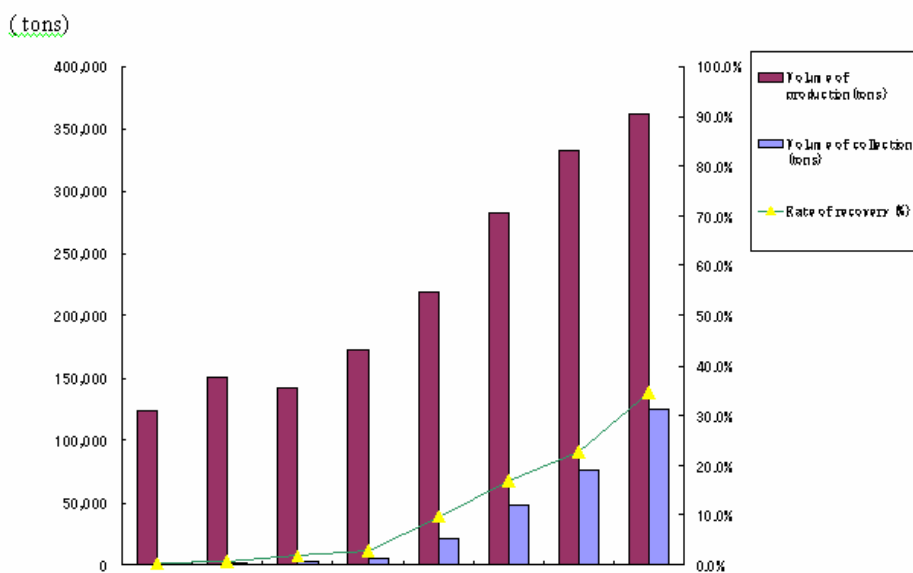
$$\text{Rate of cullet utilization} = \frac{\text{Volume of cullet used (including cullet generated within the factory)}}{\text{Volume of new bottles manufactured}}$$

PET bottles

The production of PET bottles, which are used extensively as a container for beverages, has been increasing every year, reaching about 360,000 tons in 2000. Since the “Containers and Packaging Recycling Law” entered into force in April 1997, the rate of collection has substantially increased: from 9.8% in 1997 to 34.5% in 2000. As the sorted collection by the municipalities has also increased, it is estimated that about 120,000 tons of waste will be collected on a sorted collection basis in 2000. Both the production and recovered bottles have increased, but for the first time in 2000, the volume of discarded bottles decreased.

Recovered of PET bottles are used for materials of fiber or sheet. The recent technological advance has made it possible to recycle them into PET bottles again.

Figure 8: Change in the production of PET bottles in Japan



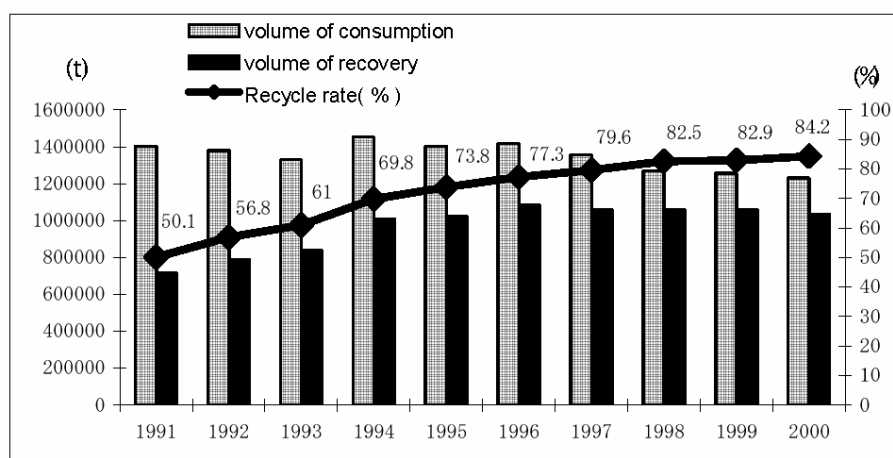
	1993	1994	1995	1996	1997	1998	1999	2000
Production	123,798	150,282	142,110	172,902	218,806	281,927	332,202	361,944
Collection vol (t)	528	1,368	2,594	5,094	21,361	47,820	75,811	124,873
Recover rate (%)	0.4%	0.9%	1.8%	2.9%	9.8%	16.9%	22.8%	34.5%

Steel cans

The production of steel cans used as a container for beverages and foods has been levelling off since 1990, and was about 1.2 million tons in 2000. On the other hand, the rate of steel cans collected and recycled as scrap metals has been increasing every year, reaching 84.2% in 2000.

The improvement of the recycling rate is due to: the increased volume of sorted collection by the municipalities due to the enforcement of the “Containers and Packaging Recycling Law”, the increased treatment capacity for recycling due to the improvement of recycling facilities, and the increased volume of utilization by steel manufacturers based on the improved quality of scrap metals as raw materials due to the progress of technology.

Figure 9: Change in the production and recycling of steel cans (calendar year)



$$\begin{aligned} &\text{Recycling rate for steel cans (\%)} \\ &= \frac{\text{Volume of recovery (tons)}}{\text{Volume of consumption (tons)}} \end{aligned}$$

Note: “Production” was used instead of “consumption,” and “recycling” instead of “recovery” in FY1998 or before.

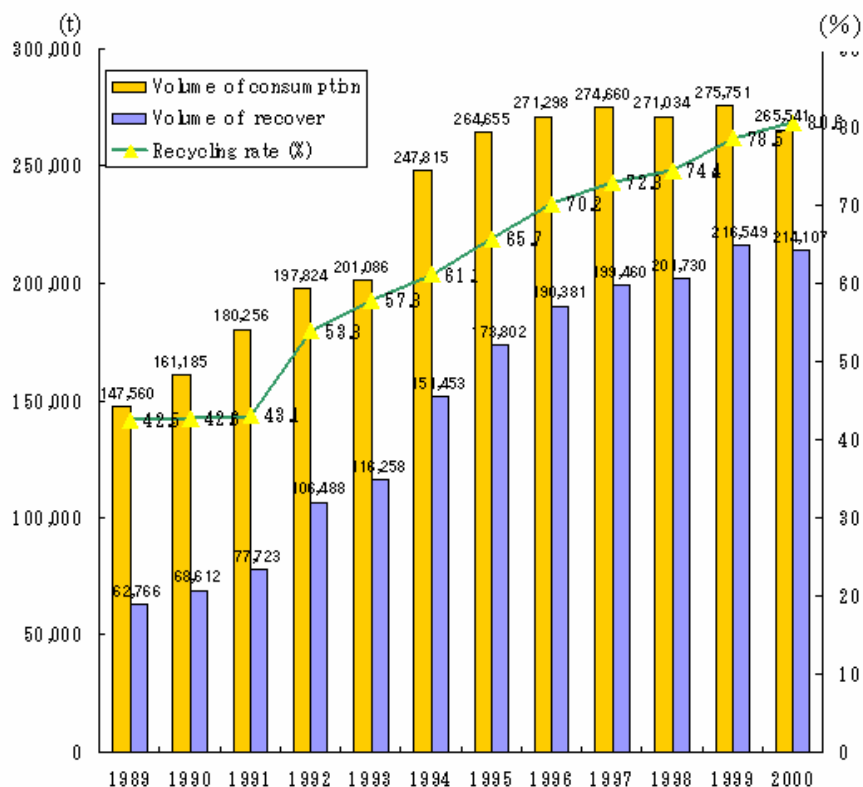
Source: Japan Steel Can Recycling Association

Aluminium cans

The recycling rate of aluminium cans reached to 80.6% in 2000. The percentage of “Can to Can” recycling, in which aluminium cans recovered are recycled into aluminium cans again, accounted for about 75% of the volume of recovery in 2000. The number of manufacturers utilizing aluminium cans

recovered has been stably secured. The promotion of “Can to Can” recycling is important, because energy can be saved by as much as 97% by recycling aluminium scrap into aluminium cans, rather than producing ground metals from bauxite.

Figure 10: Change in the gross sales and the recycling volume of aluminium cans
(Fiscal year)



4.1.4 Qualitative change

Before the law was promulgated, manufacturers did not take into consideration the design of containers and packaging from the perspective of environmental effects of their products.

Example 1: PET bottle design changes

i) Colored bottle

There were green-colored PET bottles for Japanese “Green Tea”. In order to recycle them, the municipalities and recycler had to separate them from other clear PET bottles. This was some burden at the recovery station and municipalities. The tea companies stopped using colored PET bottles and started to use colored plastic film as a label instead of colored bottle now. This improvement can save the cost of separation and costs of that process.

ii) Thinner bottle

Recently some PET bottles use thinner film as a body. This is an achievement coming from the technical innovation of manufacturing and design. As a result, the total amount of PET resin used for a bottle is reduced, which means that the PET bottle waste is minimised in weight.

iii) Design of the Mouth of bottle

The PET bottles in the beginning used white composite plastic mouth. But these composite plastic mouths are difficult to remove from the bottles. There are a few composite plastic mouths now, because the design of the bottle mouth was improved. This improvement can save both the manufacturing cost and the recycling cost.

iv) Monomer

The solution proposed for PET bottle recycling at first was to use pet bottles as the resin for textiles. But this usage is very limited and makes the price of recovered resin lower. Then another solution was innovated. The new method is to convert the recovered PET bottles to monomer. This method enlarged the scope of use for the recovered materials.

v) Reused material as fuel and reductant

Recently the Chemical and Steel industries started to accept the plastic wastes as the reductant in blast furnace and the alternatives of cokes. Gasification of plastic waste is also induced and the recovered gas is used in the chemical processes at some factories.

Example 2: Plastic film sheet labels

Most of the labels on PET bottles use shrink plastic film now. In order to remove the film sheets from the bottle easily, there is a dotted line on the plastic sheet. This change enables consumers to remove the label easily from bottle, when they discard the PET bottles.

Example 3: Metal bottles

The value of PET bottles as a material is recycling is cheaper than steel can and aluminium. Because the price of recovered bottles is very cheap, the revenue of recycling of PET bottles is much lower than metal can recovery. By the improvement of manufacturing process of metal products, cans which look like a bottle with screw cap came on the market. These metal bottles are made of one metal material. It will become the incentives for recyclers to recover these bottles, because they do not need any separation of the parts like other composite C&P.

Example 4: Plastic container and packaging waste used at factories

Not only PET bottles but also other plastic wastes are used as fuel and reductant in factories in order to produce chemical products now. [See also Ex. 1 (v)].

4.1.5 Use of container and Packaging waste

The technical innovation has improved the scope of use of the wastes and given value added to the recycled products, which encouraged companies to enter into the recycling business. The following table shows the results.

Table 6: Breakdown of Usage

(tons)

	Usage	1997	1998	1999	2000	2001
Glass bottle	Glass Bottle	97,806	138,383	144,485	161,988	180,083
	Others(Construction)	20,005	42,764	66,821	102,700	124,681
PET Bottle	Fabric(Clothes, Carpet)	6,077	16,895	25,188	38,317	48,659
	Sheet (Egg Container)	1,112	5,218	11,450	23,407	37,510
	Molded Container(Plastic Pot)	366	1,265	2,530	3,802	5,330
	Bottles for Detergent	756	211	179	326	381
	Others(Tying Band)	87	320	258	2,723	3,032
Paper Container, Packaging material	Raw Materials for Paper				4,546	15,301
	Paper Container				2,566	1,197
	Solid Fuel				3,118	4,295
Plastic Container, Packaging material	Plastic Container				5,402	10,023
	Extract Oil				3,361	7,981
	Furnace Reductant				24,656	42,306
	Coke Alternative				9,771	50,631
	Gasification				638	7,529

4.1.6 Future Projection

The Law imposes the recycling cost on the container and packaging producers and the re-fillers who use them. The greater cost to collect the used containers is still borne by the municipalities. Promotion of the sorted collection has placed an additional financial burden on the municipalities, and some of them have been complaining of its heaviness. Consumers, in contrast, are not asked to bear their share in this system, which generated a criticism that the Law does not serve to keep them from generating wastes.

Although the container producers and re-fillers are criticised as not fulfilling their due responsibilities, the system as a whole has brought about technical innovations and attracted companies to join the recycling businesses. Given such situations, a careful discussion is under way to seek for the best way to shoulder each party's fair share.

4.2 *Law for Recycling of Specific Household Appliances*

In 1998, the specific recycling system was established in the field of household appliances as well. This system has been established under the “Law for Recycling of Specific Household Appliances” (Household Appliances Recycling Law), which clarifies the manufacturers and outlet stores of responsibilities for the collection, transportation and recycling of household appliances, such as televisions and refrigerators.

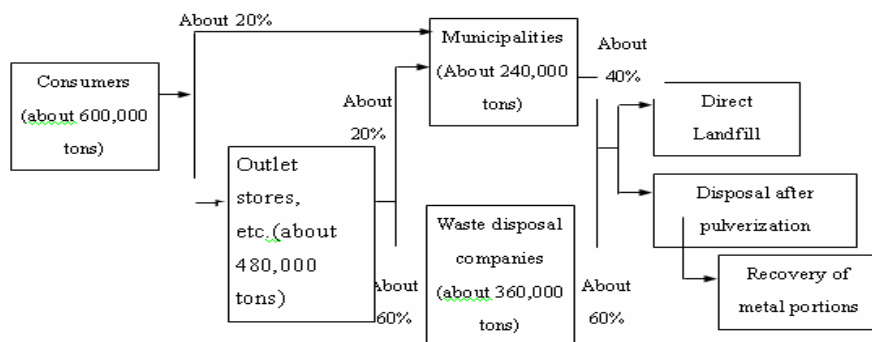
Household appliances covered by this law are four items including television, refrigerator, washing machine, and air-conditioner. “The Household Appliance Recycling Law” was enforced in April 2001.

Table 7: Composition of materials for household appliances

Model	Fiscal Year	Total	Iron	Copper	Aluminum	Plastic	Glass	Others
Color Television	1983 model	100	8.9	2.0	1.0	9.9	45.5	32.7
	1993 model	100	12.0	3.0	1.0	26.0	53.0	5.0
Electric refrigerator	1983 model	100	59.6	2.0	4.0	30.3	0.0	4.0
	1993 model	100	49.0	4.0	1.0	43.0	0.0	3.0
Washing Machine	1983 model	100	52.0	3.0	2.0	37.0	0.0	6.0
	1993 model	100	52.0	2.0	4.0	33.0	0.0	9.0
Air Conditioner	1983 model	100	53.6	19.2	9.1	14.1	0.0	4.0
	1993 model	100	54.0	18.0	9.0	16.0	0.0	3.0

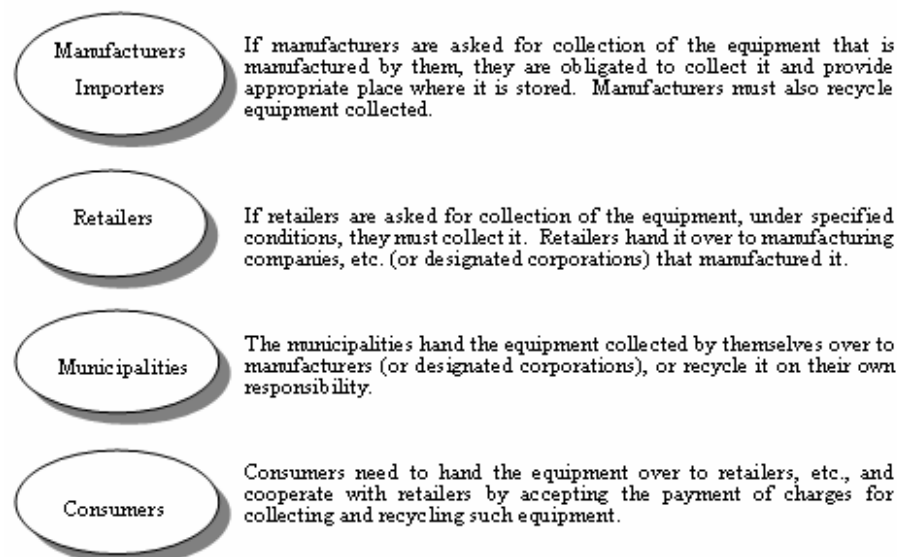
Source: Comprehensive Handbook of Environment, Association for Electric Household Appliances of Japan, March 1998.

**Figure 11: Flow of household appliances disposal before law enforcement
(Television refrigerator, air-conditioner, washing machine)**



Source: Surveys conducted by the Ministry of the Environment and the Ministry of International Trade and Industry in June 1998.

Figure 12

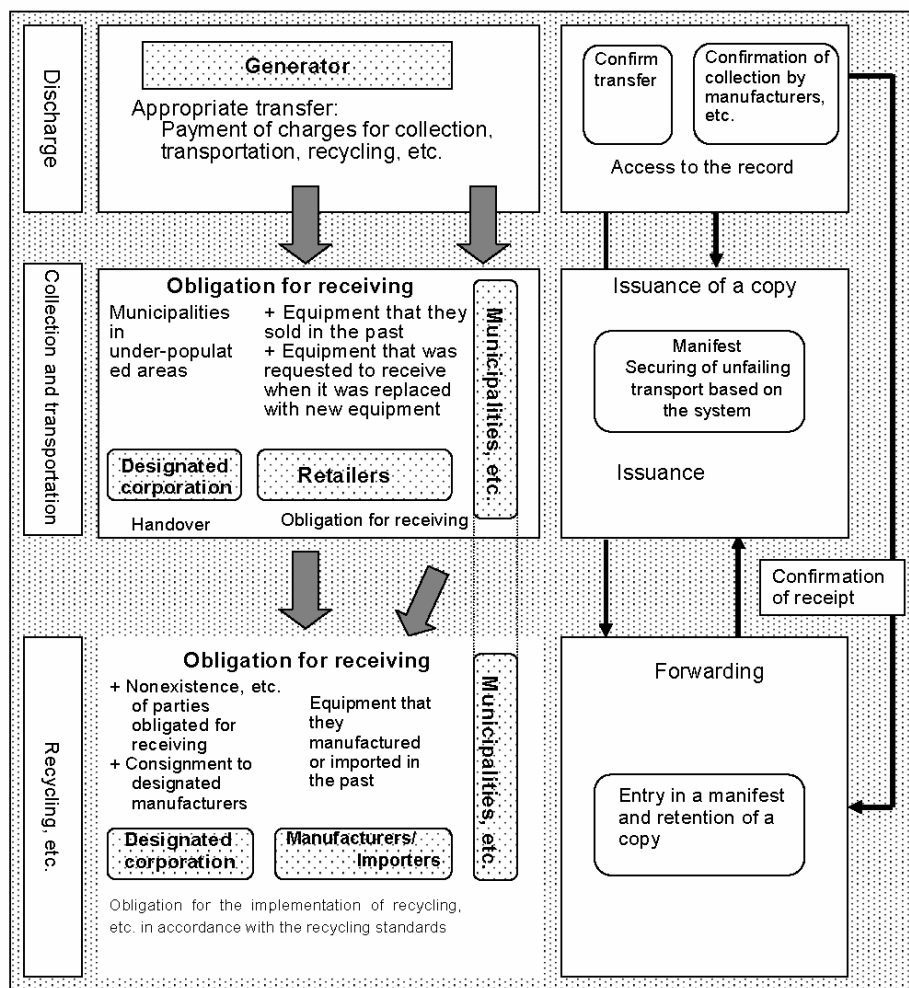


■ Standards for recycling household appliances (recycling rate of parts and materials)

Air-conditioner:	Over 60%
Television with CRT:	Over 55%
Refrigerator:	Over 50%
Washing machine :	Over 50%

(Enforcement Regulations for Recycling of Specific Household Appliances, May 25, 1999)

Figure 13: Description of the implementation of the Law for Recycling Specific Household Appliances



(Source: Japan Small and Medium Enterprise Corporation, "Law for Recycling of Specific Household Appliances")

4.2.2 *Situation regarding enforcement of the law*

Collection charges and recycling charges

Collection charges

About 60 to 70% of retailers set charges for the four items at 500 to 2,500 yen. As for collection by the municipalities, 2,200 to 2,400 yen is an average charge.

Recycling charges

Air-conditioners: 3,500 yen Refrigerators: 4,600 yen

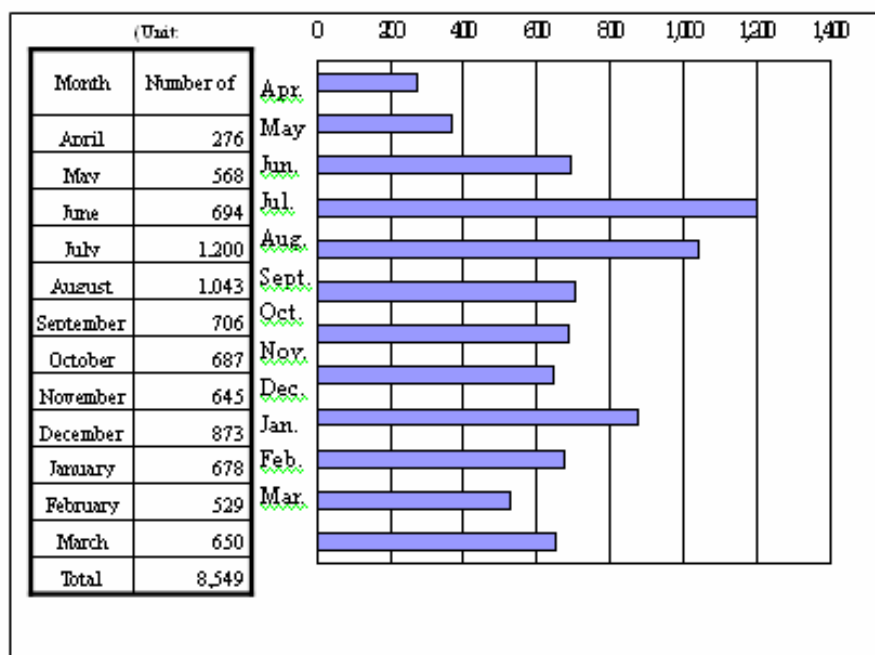
Televisions: 2,700 yen Washing machines: 2,400 yen

Take back of used appliances

Implementation of the Law on Specific Household Appliances started without problems. In FY2000, 8.5 million units of household electrical appliances were collected. Almost all the HEAs collected by the municipalities are now on collected on this system.

The very small number of appliances in April is explained by the fact that consumers rushed to buy appliances before the Law was enforced which prescribes that consumers bear the collection and recycling charges.

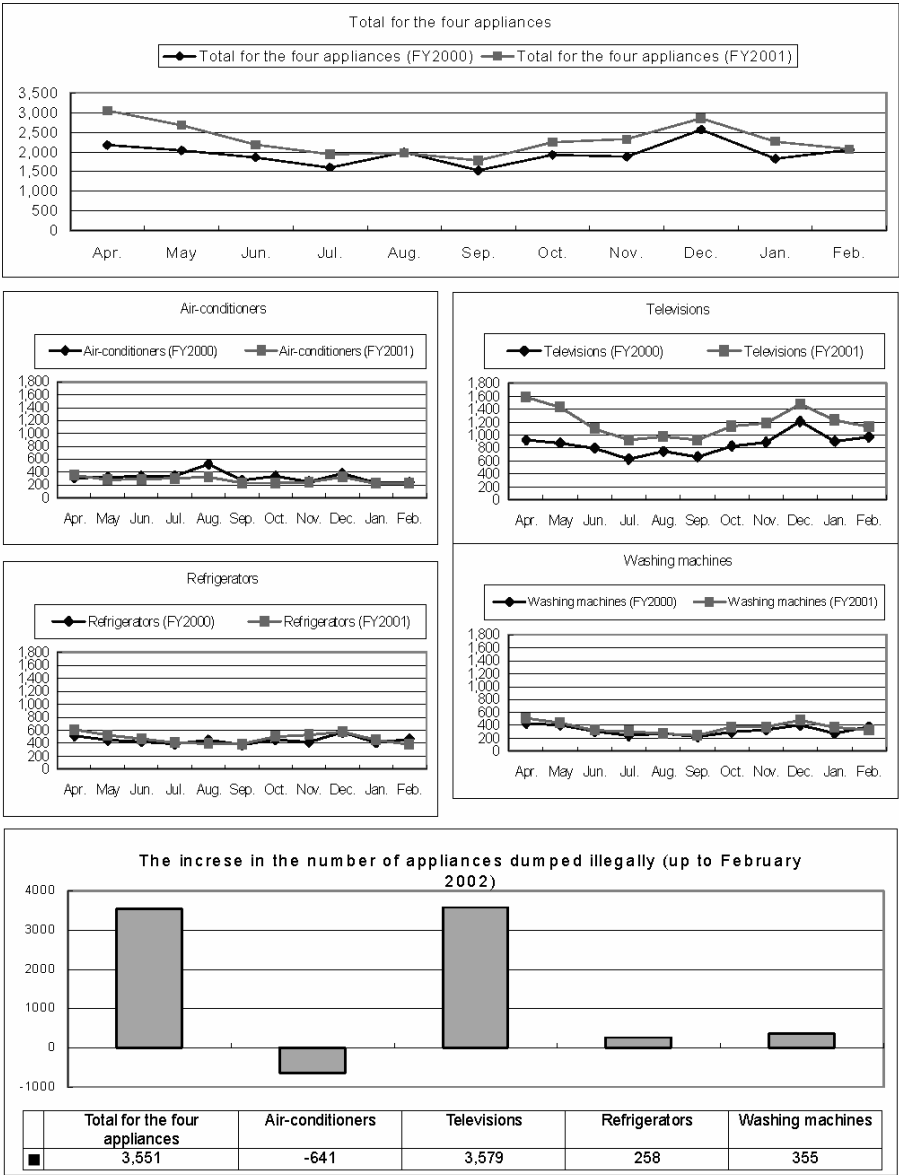
Figure 14: Take-back programme performances
(Number of municipalities surveyed: 276)



Illegal dumping of used appliances

The number of illegal dumping of used appliances in 2001 is estimated 125,000, accounting for 1.5% against the total number of collected appliances, which stands at 8,550,000. Compared to the number in 2000, the illegally dumped items, 125,000, increased by 6,500 units, namely by 5.5%.

Figure 15: Illegal dumping: Comparison of the number of appliances dumped illegally between April 2000 and February 2001, and between April 2001 and February 2002 (Number of municipalities surveyed: 276)



4.2.3 Relevant Parties

There are several relevant parties involved:

- Manufacturers of the electric appliances;
- Retailers of these appliances;
- Consumers;
- Municipalities.

Regarding the HEAs stream, the manufactures' influences are very strong. Five or six manufactures account for more than 70% of markets. Especially six manufacturers account for about 99% of market of Electric Refrigerator and Washing Machines. This means that the number of manufacturers relevant to the HEAs is limited.

Table 8: Market share of household electrical appliances (1999)

Item	Amount of shipment (Million sets)	Maker share
Air-conditioner	6.469	Matsushita(16.5%), Mitsubishi(14.1%), Toshiba-carrier(12.3%), Hitachi(11.9%), Daikin(10.4%), Sanyo(10.2), the others(24.6%)
Color television	9.597	Matsushita(18.1%), Sony(18.0%), Toshiba(12.8%), Sharp(12.4%), Aiwa(8.0%), the others(30.7%)
Electric Refrigerator	4.789	Matsushita(22.5%), Toshiba(16.9%), Sanyo(16.4%), Hitachi(16.1%), Sharp(14.4%), Mitsubishi(11.5%), the others(1.3%)
Washing machine	4.281	Hitachi(22.5%), Matsushita(22.0%), Toshiba(20.2%), Sanyo(14.0%), Sharp(13.2%), Mitsubishi(7.8%), the others(0.3%)

Source: "Shijo senyu ritsu 2001" (Nikkei Sangyo Shinbun).

4.2.4 Result/Outcome

In this section, any events observed after the enforcement of the law are summarized from the aspect of actual performance of recycling and economic event.

Performances of recovery/recycling

The actual performances of recycling exceed the standards. Actual performances of the recovery of household electrical appliances (HEAs) are shown below.

Table 9: Recycling status of HEAs in FY2001

		Air-conditioner	Television	Refrigerator	Washing machine	Total
Collected item	in 1,000	1,334	3,083	2,191	1,930	8,538
Recycled item	in 1,000	1,301	2,981	2,143	1,882	8,307
Treated	ton	57,634	79,978	127,596	54,041	
Recycled	ton	45,019	58,814	76,359	30,783	
Actual	%	78	73	59	56	
Standards	%	60	55	50	50	

Economic Data - Investments for recovery/recycling canterers

Based on the law, 39 recovery/recycling canterers were established. Out of them, 16 sites were newly constructed for which the total investment amounted to 4,980 Million JPY. The rest 23 sites were improvements of the existing facilities.

4.2.5 Qualitative changes - Change of design

Recently, several changes in the design of products were found resulting from the implementation of the law.

Example 1 - Refrigerators

- Non-CFC refrigerator

In order to prevent to discharge the CFCs, some manufacturers stop using CFCs as refrigerants and in manufacturing process of insulators.

Example 2 - Reduction of use of hazardous substances

- Lead-free solder

Use of “Lead-free solder” is increasing in manufacturing process of electric appliances generally in Japan now. Most of the manufacturers of electric appliances have certification of ISO 14001 series and reported their environmental performance annually. It seems that the manufacturers try to use “Lead-free solder” in order to improve their environmental performances. There seems to be the effect of PRTR system.

- Other hazardous substances

Generally the manufactures try to reduce the number and amount of hazardous substances in their processes. There seems to be the effect of PRTR and Environmentally Sound Management. By the PRTR law, the manufacturers have obligation to report the amount of hazardous substances used at their factories. The consumers also prefer the environmentally sound products.

Example 3 - Smaller circle of recycling stream

Recovered materials from HEAs were used as lower grade materials. But now the manufacturers try to use the recovered materials into same kind of products/parts. This change makes the circle of waste to resources smaller and save the energy consumption.

- Glasses of CRTs into CRTs

Main part of CRT is glass tube. But this glass contains some hazardous substances like heavy metals. Therefore, it was difficult to recycle them into other products. But the technological

innovation brought the solution. The recovered glasses are converted into the glass tube of CRT by this method.

- Tank of washing machines

Most of washing machines use metal tank. The recovered metals from tank are recycled into the tank now.

There are also many similar cases like these cases.

Example 4 - Design for easier dismantling

In order to promote the recovery and recycling of HEAs, the design of appliances has been changed and is still improving.

- Connection and fix points

Especially the connection and fix methods were/are improved in order to dismantle the appliances. The plastic bolt and other connection tools are induced.

- Fewer kinds of plastics

Many kinds of plastics are used in HEAs, but this variety causes the problem to dismantle the devices and sorting of plastics. Therefore, the manufacturers try to reduce the number of materials in their products.

4.2.6 Future Actions for Electric Household Appliances Recycling Law

“The Electric Household Appliances Law” prescribes the consumers’ obligation to pay for transportation and recycling costs of the appliances at the time of discharge, based on the fact that the existing appliances amount to more than 300 million units nationwide and that the advance payment of the costs may involve some difficulty in terms of its management. Some people think, however, that the present system may lead to illegal dumping, asking for a change to the advance payment system, although the first year record shows very little concern. Others think manufacturers should bear part of the costs for the recycling needed for the illegally dumped appliances, which is currently borne solely by the municipalities.

In the remote islands, the transportation to the designated take-back depot will cost approximately 10,000 JPY, thus exceeding the recycling cost. This is a problem that cannot be avoided for a national system like this one with a uniform fee. Still other people ask for a solution to this problem.

Since the system is relatively new, the government is closely watching the progress of the system, listening carefully to those voices from consumers.

4.3 *Law for Promotion of Effective Utilisation of Resources (PC, Secondary Battery)*

Description of the law

“The Law for Promotion of Effective Utilization of Resources” was enacted in 1991, to utilize resources effectively, control the generation of waste, and protect environments. The law primarily aims at promoting recycling in business activities, encourages business companies to manufacture products in consideration of recycling at the stage of designing them, and prescribes the promotion for utilizing recycled resources in the process of manufacturing. It is regulated that the producers are imposed to display marks for easier sorting on container /packaging and rechargeable batteries. By “The Law for Promotion of Effective Utilization of Resources”, the producers tackles voluntarily “3R (Reduce, Reuse, and Recycle)”. Related to Extended Producer Responsibility, especially, it is regulated that collecting and recovering of personal computers and rechargeable batteries are performed voluntarily.

4.3.1 State of used Personal Computer units

Because of the innovation of IT (Information Technology) and distribution of PCs in business and households, many used PC units are discarded from enterprises and households. Most local municipalities regard used PC units as “wastes difficult to process properly”. For waste PC units from corporate users, PC makers and importers have recovered them since and established the appropriate scheme to do so. There are several voluntary recovery systems which were established by the cooperation of PC manufacturers and private recyclers.

After the 1st of April 2001, PC makers and importers are obligated to recover and recycle the PC units they made or imported, if users ask them to recover under “The Law for Promotion of Effective Utilisation of Resources” (2000). Users pay 2000 - 4000 JPY per unit to them as they did before.

Domestic shipments of PC units

The domestic shipment of PC units in Japan is as the following table.

Table 10: Domestic shipments of PC units in Japan (in 1,000 units)

	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000	FY2001
Total	5,704	7,192	6,851	7,538	9,941	12,102	10,686
Server/ Desktop	4,012	4,643	3,834	3,972	5,165	5,870	4,862
Portable	1,692	2,549	3,017	3,566	4,776	6,232	5,824

State of recovery of PC units

The following table shows statistics of recovery and recycle of PC units during the first year since obligation applied,

Table 11: Recovery and recycle (used as parts or resources) of PC units¹⁾ (FY2001)

	Recovered amount (kg)	Recovered number (appliances)	Recycled ²⁾ amount (kg)	Recycled ²⁾ rate (%)	
					(target in 2003)
PC, desktop	2,585,701	207,020	2,029,875	78.5	50%
PC, portable	270,886	68,877	163,072	60.2	20%
Display, CRT	3,645,583	222,743	2,640,520	72.4	55%
Display, LC	32,509	3,837	24,053	74.0	55%

Notes: 1) Only among PC units used by corporate users and recovered by 22 relevant PC makers and importers which are members of PC-3R Promotion Committee in Japan Electronic Industry Development Association.

2) Only materials used as parts or resources, Materials used as reductants or fuel are excluded.

For waste PC units from households, the recovery and recycle scheme is now being constructed and introduction of obligation to recover and recycle is suspended.

4.3.2 State of used secondary battery

There are several batteries used in daily life and industrial processes. Rechargeable batteries are collected at shops such as electric appliances retailing shops, and are recovered and recycled.

Since the 1st of April 2001, for the following 4 kinds of batteries, the manufacturer, retailer and importer of the batteries and appliances using the batteries have been obligated to recover and recycle them under “The Law for Promotion of Effective Utilisation of Resources” (2000).

These 4 kinds of specific batteries are;

- Nickel - Cadmium battery (Ni-Cd)
- Nickel - hydrogen battery (Ni-H)
- Lithium ion battery (Li-ion)
- Small sealed lead battery

The following table shows the recent statistics of recovery and recycle of the specific batteries.

Table12: Recovery and recycle of specific batteries

	Recovered amount			Processed amount	Recycled amount	Recycled rate	
	FY 1999	FY 2000	FY 2001				Target
Nickel - Cadmium	473 t	600 t	628 t	625.7 t	444.4 t	71%	60%
Nickel - hydrogen	72.2 t	52.7 t	44.5 t	41.9 t	28.7 t	68.5%	55%
Lithium ion	195 t	286 t	333 t	320.3 t	125.2 t	39%	30%
Small sealed lead	-	28 t	27 t	(3,678 t)*	(1,839 t)*	(50%)*	(50%)*

Note: *) Figures are for all lead batteries according to Battery Association of Japan.

Source: JBRC.

4.4 Law related to the recycling of End of Life Vehicles (EoL Vehicles)

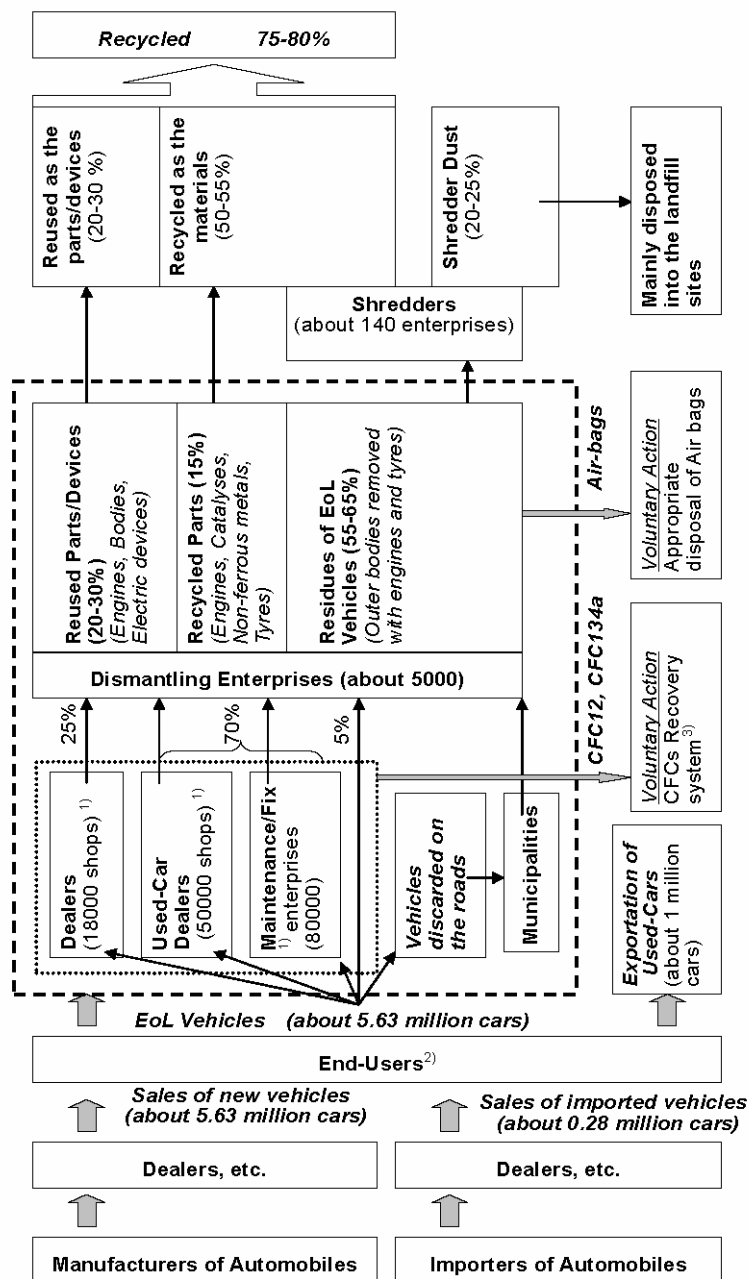
State of End of Life Vehicles

About 5 million end-of-life vehicles need to be disposed each year. Since they contain useful metals and parts with a high value as recovered materials, they are recycled and treated through a market for buying and selling conducted by dismantling operators and shredding operators.

On the other hand, there is a need to reduce shredder dust resulting from the treatment of end-of-life vehicles due to the limited capacity of the final disposal sites for industrial waste. In addition, the traditional recycling system has not functioned adequately due to the sharp rise in final disposal costs and the recent fall in the prices for steel scrap. There has also been rising concern over illegal dumping and inappropriate disposal.

Thus, in order to promote recycling and the proper disposal of end-of-life vehicles by regulating the operators concerned, who are mainly car manufacturers, the roles need to be shared appropriately in order to develop a new recycling system, which is an urgent issue requiring a solution. The state of flows of EoL vehicles and recycling is shown in Figure16. The ratio of imported vehicles to the total is approximately 20%.

Figure 16: State of Flows of End-of-Life Vehicles in Japan



- Notes
- 1: Dealers, Used-Car Dealers and Maintenance/Fix enterprises might be operated by the same owners.
 - 2: The number of vehicles in use is approximately 70 million and more at present.
 - 3: "Fluorocarbons Recovery and Destruction law" was enforced on October 1, 2002

4.4.1 *Plans for recycling*

The automobile manufacturers plan to recycle 75-80% of EoL Vehicles. Their obligations are as follows:

- To determine the recycling charge and announce it to the users.
- To take back CFCs, air bags, and shredder dust from EoL vehicles and recycle them except for CFCs which are to be destroyed.

4.4.2 *Relevant parties*

There are many relevant parties regarding with EoL Vehicles as follows:

- Manufactures of Automobiles
- Importer of Automobiles
- Dealers of Automobiles
- Dealers of Used-Cars
- Users (First users (Purchaser of new vehicle), End-Users)
- Maintenance/Fix enterprises
- Dismantling enterprises
- Recyclers of EoL vehicles
- Shredding enterprises

- **Manufacturers**

Six manufacturers account for more than 80% of the market of 4 wheeled vehicles and three manufacturer account for more than 98% of the market of motorbikes. These manufacturers have very big capitals and business scales. They are relatively stronger than any other relevant parties.

Table 13: Automakers' market share (Jan. 2002 - Oct. 2002)

Item	Amount of sales	Maker share
Four-wheeled	4.881 million cars	Toyota(29.0%), Honda(15.2%), Nissan(13.5%), Suzuki(10.8%), Daihatsu(8.7%), Mitsubishi(7.3%), th others(15.6%)
Two-wheeled	0.593 million bikes*	Honda(54.9%), Yamaha(29.3%), Suzuki(13.3%), th others(2.5%)

Source: Japan Automobile Manufacturers Association, Inc. (JAMA).

Note: * Produced number deducted by exported number.

- **Importers of Automobiles**

The importers of automobiles are not so powerful like the domestic manufacturers but some of them are owned or governed by the foreign manufacturers.

- **Dealers of Automobiles**

The dealers of automobiles are mainly owned or governed by the manufacturers.

- **Users**

All the vehicles in use have their identification number and are registered at the regional transportation offices. When the users discard their own vehicles, they should de-register their cars from the list.

- **Maintenance/Fix enterprises**

The Maintenance/Fix enterprises are categorised into the several patterns of ownership.

- Manufacturers
- Dealers
- Independent

The independent enterprises are mostly small/medium-scaled enterprises. The enterprises owned by dealers are likely to be small/medium sized.

- **Dismantling enterprises**

The dismantling enterprises are also small/medium sized. They get the revenue from selling the recovered parts and metals. They have good connection with the maintenance/fix enterprises.

- **Recyclers of EoL vehicles and shredding enterprises**

They are also small/medium-sized enterprises.

5. Conclusion and Future Prospects

5.1 Comparison of EPR systems

During the implementation of EPR system, as is introduced in the manual of OECD, defining who is the producer and what responsibility he should bear is very important.

For example, in Japan the “Containers and Packaging Recycling Law” defines the maker of the C&P and the maker who uses the C&P as the entities responsible for recycling but the responsibility for collection still lies with the municipality.

Regarding the establishment/operation of recycling centres, in the case of containers, waste treatment enterprises (pellets, plastics, sheets etc), chemical manufacturers (fibers, manufacture of monomers), steel manufacturers (reductant at high temperature incinerators) have a competitive relationship in terms of technological developments. The producers pay the recycle cost to the designated foundation (Japan containers and packaging foundation) which contracts out recycling to other companies. Hence a shared responsibility system is seen between the municipality and the producer.

“The Law for Recycling of Specific Household Appliances” holds the manufacturer or the importer of a commodity as the entity responsible for recycling where as the distributor/sales company is held responsible for collection. For recycling, in addition to the pre-existing waste treatment facilities, many electric appliance manufacturers have their own recycling facilities.

Further, “The Law Related to the Recycling of End-of-Life Vehicles”, like in the case of electric appliances, designates the manufacturers or the importers as the entity responsible for recycling but adds vehicle maintenance companies to the distributor/sales companies as the entities responsible for collection. The

role of existing shredding companies and disassembling companies is very important and the vehicle producers pay the treatment cost and also collect the airbags and shredder dusts. Hence, in the case of electric appliances and vehicles, an apportioned responsibility between producers, importers, dealers and recycling companies is seen.

Regarding the producer, the guidance manual states the manufacturer whose brand name is imprinted on the product or the importer of that product as the “Producer”. In the case of packages the entity whose product is enclosed is stated as the producers whilst in cases where the brand or the owner cannot be determined, the manufacturer has the possibility of being declared as the producer. Hence, generally speaking, the controlling mechanism is different according to the product. In context to EPR, the producer/manufacture is generally thought of to be the entity that bears the responsibility, but the responsibility of raw material industry and distributors is equally large. The consumers also need to cooperate by helping in sorting.

Regarding cost, primary cost (financial responsibility) in Japan for recycling is the responsibility of the producers of containers, household appliances, automobiles whereas the municipality bears the collection cost for containers, the distributor for household appliances and the distributor and the maintenance company for vehicles. As per the real cost, the cost for recycling containers is internalized whereas the cost for collection lies with the municipality (from tax etc). For household appliances, the consumer pays the collection cost to the vendor, the recycling cost to the manufacturer via vendor (TV 2,700 Yen, Washing Machine 2,400 Yen, Refrigerator 4,600 Yen, Air conditioner 3,500 Yen) when throwing the commodity. As per vehicles, the consumer bears the recycling cost during purchase (for new vehicles) or during vehicle test, which is obligatory once in 2 years.

5.2 *Effects of implementation of EPR system*

Implementation of EPR results in the increase of social cost for the formation of collection/transportation and recycling systems. On the other hand, increase in the life span of landfills, decrease in the amount of resource extraction, decrease in the amount of CO₂ and dioxin emission can be considered as the positive impacts.

Looking from the context of cost-benefit, increment of cost associated with the implementation of EPR would be:

- Increase in the internal cost due to the decrease in the consumption of C&P;

- Additional cost for sorting and collection;
- Payment for contracting out.

However, it also leads to the decrease in the final disposal cost at landfills (cost saving due to resource extraction and avoidance of incineration of waste is not considered here). Estimating the cost results in an amount of 1600 million for constructing new landfills (9500 million for existing landfills). However, in Japan, as the cost of landfills is expected to rise sharply and the cost for sorting/collection is expected to drop down, the chances that this amount will result in a negative value are quite strong.

Further, as new technologies for recycling are being developed, formation of a new environment related business and hence an impact to the economy as a whole is being expected.

5.3 *Towards formulation of recycling-based society*

Trying to change its conventional mass-production/mass-consumption pattern, to control heavy consumption of natural resources, and to formulate the recycling-based society, which allows reduced environmental loads, Japan enacted in FY2000 “The Basic Law for Establishing the Recycling-based Society”. The Law stipulates the basic framework for realizing such Recycling-based Society. The basic measures for wastes include i) control of waste generation, ii) reuse, iii) recycling, iv) heat recovery, and v) prioritization of optimal treatment and disposal, all of which target to establish “the Basic Plan for Promoting Recycling-based Society Formulation”. This plan details specific measures or numerical targets to materialize the Recycling-based Society. Made very clear in the Law is the concept of “Enlarged” Producer Responsibility, prescribing 1. Thorough working-out of designs and materials of products for their longer durability and easier recycling, 2. Establishing recovery routes for discarded products and efficient implementation of the whole system, and 3. Offering information of products.

5.4 *Creation of new businesses for recycling-based society*

One estimation is promotion of recycling-based society will encourage businesses in charge of reduce, reuse and recycle wastes and of optimal treatments, in addition to the conventional environment-related businesses which produce hardware such as equipment and products. Rental/lease businesses of HEAs, reuse businesses to circulate used PCs, newly emerging businesses to make cost-saving solder residue absorbing equipment or waste plastic sorting equipment which are used in the regeneration processes of the

HEAs, and maintenance and upgrading service businesses to use goods for a long span of time are just a few instances. As they grow, they would create jobs for 410,000 workers and 18 trillion JY of the market scale in FY2010, according to the estimation.

5.5 *Future approach*

The Government is scheduled to complete the Basic Recycling Plan based on “The Basic Law for Establishing the Recycling-based Society” by the end of March in FY2003 in order to promote EPR and other measures. It is also examining various waste and recycling issues, including improvements of the “Waste Management and Public Cleansing Law” and the “Law for the Promotion of Utilization of Recycled Resources” and introduction of EPR to FRP boats.

Chapter 5

Discussant Commentary on

EX POST EVALUATION OF EPR PROGRAMMES

by

Stephen Smith, Professor of Economics
University College London

The four papers presented in this session provide *ex post* evidence on the performance of EPR programmes

- Economic and Environmental performance of Alberta's used oil programme
- Effects of the introduction of EPR on the German economy
- Producer responsibility in waste policy in the Netherlands
- Evaluation of EPR programmes in Japan

Taken together the papers demonstrate that the study of practical experience can provide a substantial amount of evidence on the performance - and in particular quantification of the effects - of EPR schemes.

In my contribution I want to draw on some work that has been done by OECD on *ex post* evaluation methodologies and guidelines, to identify the key contributions that *ex post* evaluation can make to the better design and implementation of EPR policy, and the main methodological issues that need to be addressed in undertaking *ex post* evaluations.

What do we learn from ex post evaluation, and what do we already know?

Ex post evaluation can contribute information about certain key aspects of the performance of economic instruments, that cannot be assessed *ex ante* using theoretical or conceptual analysis, or *ex ante* simulation methods.

What are these key areas where *ex post* evaluation can contribute real “value added” to our ability to analyse and understand the effects of different instruments?

EPR policies encompass a range of possible policy instruments, including product taxes, tradeable permit schemes, assignment of liability through a take back mandate, etc. The critical issues in the design of policy include some that are broadly common across instruments (*e.g.* costs of administration), but also some that are specific to particular instruments. OECD work on *ex post* evaluation has identified key priorities for investigation in the case of the main types of policy instrument:

For product taxes, the critical issue is the scale of the behavioural response to the tax incentive, both in total and across different sources. How much environmental impact do we achieve, and which sources contribute it?

For tradeable permit regimes, the key issues are (1) the marginal abatement costs incurred by polluters in achieving the level of abatement, and (2) the efficient functioning of the permit market.

For EPR schemes that take the form of product taxes, or tradeable permit type regimes, these principles identify some of the key priorities for investigation in *ex post* evaluations of EPR.

We also need *ex post* evidence to shed light on the significance of the factors which might lead to a preference for EPR as compared with non-EPR instruments. As discussed yesterday these include the difficulty of regulating illegal disposal or “user charge avoidance activities”, inefficiency in recycling markets, and the greater administrative cost of differentiated charging for household’s garbage according to its precise disposal costs than equivalent charging at the producer level.

In addition, some EPR arrangements contain elements that are not encountered in other areas of policy, and which raise distinctive issues on which we urgently need *ex post* evidence. The most urgent priorities in my view are those concerned with the costs of actual or implied take back mandates, in terms of the significance of scale economies in the costs of collection, and the possible

disruption in competition that might arise if collective take-back arrangements become used as a competitive weapon.

Issues of methodology and organisation

Key issues of methodology and organisation that arise in *ex post* evaluation concern

The policy comparison that is being made. Do we compare alternative instruments achieving the same outcome, or EPR *versus* a “do-nothing” alternative?

How do we specify the baseline against which the effects of EPR policy are to be judged? What would have happened in the absence of the policy (the “counterfactual”). How can this be modeled?

How do we disentangle the effects of EPR policy from the effects of other instruments implemented as part of a policy package? Likewise, how do we disentangle the separate effects of specific components within an EPR package?

Part 3: Technical Innovation and EPR Policies

Chapter 1

EXTENDED PRODUCER RESPONSIBILITY AND INNOVATION

by

Candice Stevens, Head, Industry Division
Directorate for Science, Technology and Industry, OECD

1. Introduction

Extended producer responsibility (EPR) is defined by the OECD as an environmental policy approach in which a producer's responsibility for a product is extended to the post-consumer stage of a product's life cycle. *Innovation* is defined as the first use of a new product, process or system in a commercial context. Innovation occurs overwhelmingly in private firms in reaction to external signals. It is distinguished from *science*, which is the search for knowledge, and *invention*, which is a new technical idea.

This paper develops an analytical framework for examining the interaction between EPR and innovation. Innovation comes in many degrees and types, but the ultimate EPR innovation goal is the redesign of products towards sustainability. Better product design would mean less waste, more durable goods, and more reuse and recycling of products and their components.

2. Analytical framework

A framework for analysing the relationship between extended producer responsibility and innovation is presented schematically in Table 1. The framework consists of three components: *i*) the stimulus of environmental policy, which can take a variety of forms; *ii*) a range of possible innovative responses; and *iii*) firm-level and sectoral-level contextual variables which can

mediate the effects of environmental policies on innovation. This paper first discusses the innovative effects of different environmental policy instruments - of which extended producer responsibility is one type. It then extends this analysis to different types of EPR instruments and their potential effects on innovation as mediated through firm- and sectoral-level variables.

Table 1: Framework for analysing EPR and innovation

<i>Policy instruments</i>	<i>Innovative responses</i>		<i>Contextual variables</i>	
	<i>Degree</i>	<i>Type</i>	<i>Firm Motivation</i>	<i>Sector</i>
Regulations/ Standards	No innovation	Product change	Regulatory response	Packaging
Economic instruments	Incremental innovation	Process change	Cost savings	Automobiles
Information disclosure	Radical innovation	Resource use change	Reduced liabilities	White goods
Voluntary agreements	Continuing innovation	Managerial change	Enhanced image	Computers
Extended producer responsibility	Technology diffusion	Consumer behaviour	Patents and licensing	Mobile phones

In this framework, environmental policy instruments encompass a number of approaches, including regulations and standards, economic instruments, information disclosure, voluntary agreements and extended producer responsibility. Of course, these instruments overlap in their categorisation and their effects and are usually combined in policy implementation.

The innovative responses of firms differ in both in degree and type. In some cases, environmental policy may produce no innovative changes at all. Radical and incremental innovations represent different degrees of change, the latter denoting smaller improvements along a given trajectory, and the former, major departures from the technical *status quo*. The need for innovation to satisfy environmental policy may be continuing or it may be satisfied by a single technological modification. Technology diffusion succeeds innovation, as subsequent users adopt, often with adaptations, the technology pioneered elsewhere.

These degrees of innovation can take different forms. Most often, they are changes to either products or production processes to incorporate environment-related improvements. Innovation may or may not be embodied in a change in the type or level of resource inputs. More far-reaching innovations

relate to both the organisation and management of enterprises and to consumer behaviour, which can become more oriented to environmental considerations as an integral part of operational thinking.

The contextual variables show the set of boundary conditions which can limit the innovative responses to environmental policy. Enterprises have varying motivations for making environmental investments and introducing environment-related innovations. These include the desire to be in regulatory compliance, to realise cost savings and efficiency gains, to reduce future financial liabilities associated with possible damages or accidents, to enhance their public image and expand their consumer base, and/or to patent and sell a new technology. Lastly, the innovative response of a firm will depend to a large degree on the economic sector and particular product in question. The dynamics of these and other conditioning factors to the links between environmental policy instruments and innovation are analysed below.

3. Environmental policy instruments and degree of innovation

Table 2 summarises and compares findings concerning the probable innovative responses of firms to different types of environmental policy instruments: no innovation, radical innovation, incremental innovation, continuing innovation and/or technology diffusion (OECD, 1999). These policy instruments can have more than one type of effect.

Product standards are regulatory requirements that specify the environmental and/or safety characteristics of consumer and industrial products. Generally, such standards are imposed on products already in the marketplace. In the past, product standards have resulted in quick substitution of an existing technology, not true innovation. Lead and solvent-based paints, urea formaldehyde foam insulation and small engines are examples of products for which technology to solve environmental problems was moved “*off the shelf*.” The effects of product standards may thus be characterised as incremental innovation, although this may be widely diffused throughout the industry.

Pre-market approval generally involves government review and approval/denial of new products, including pharmaceuticals, pesticides and toxic chemicals. Studies show that pre-market approval systems tend to lengthen the period of research and development for products and increase the cost of R&D. There has been some concern that this type of regulation could actually retard the rate of product innovation. Generally, it results in incremental innovation to meet expected standards or specifications but not to exceed them.

Table 2. Environmental policy instruments and degree of innovation

	No innovation	Incremental innovation	Radical innovation	Continuing innovation	Technology diffusion
Product standards		X			X
Pre-market approval		X			
Product bans		X	X		
Performance standards		X		X	
Technology specifications	X				X
Facility permits	X				
Charges and taxes		X	X	X	
Emissions trading		X		X	
Subsidies		X	X		
Information disclosure		X			X
Voluntary agreements		X			X
Producer responsibility		X	X	X	X

Source: OECD, 1999.

Product bans are one of the most severe regulatory commands and have been applied almost exclusively to chemical products. PCBs, phosphate detergents, asbestos, DDT, leaded gasoline and CFCs are the main examples. Product bans always result in a change in technology. The nature of this change can range, however, from simple substitution of readily available products, processes or components (e.g. aqueous cleaning replacing CFCs) to incremental innovation (reformulated detergents or gasoline) to radical changes that restructure an industry (PCB substitutes produced by new firms which totally displaced the sole US producer).

Performance standards are widely used to implement process controls for air pollution, water pollution and hazardous waste management. Their advantage is that they combine a clear technological demand with flexibility in solving it. However, most performance standards are based on assumptions about what the best available technology can achieve. They thus require little or no technological changes from firms already at the state of the art. At best, performance standards lead to continuing incremental innovation rather than any radical changes.

Technology specifications are regulatory commands to use a particular technology. Such specifications foreclose the possibility of an immediate innovative response, since they are based on already available technology. Specifications do furnish a compelling force for technology diffusion. Since they are typically based on the best technology in use in leading firms, one effect is to force laggards up to the state of the art.

Facility permits allow regulators to review industrial technology, ensure compliance with applicable laws and involve various parties, particularly local citizens, in environmental decision-making. Permits do not lead to any appreciable innovative responses. Some observers believe such permits may have negative effects on innovation, causing the regulated industry to postpone the installation of new equipment to avoid scrutiny. However, from a public point of view, it is one way of gathering information about and influencing the technological decisions of firms.

Charges and taxes, and other economic instruments, can have significant effects on technological change, since in theory one of their major advantages rests in dynamic efficiencies. While regulation tends to provide a strong single stimulus to technological change, economic instruments may give a continuing impetus to innovation. At present, the level of charges and taxes is not sufficiently high in most cases, so that the tendency is towards incremental innovation, with radical improvements dependent on the marginal tax rate.

Emissions trading is focused on “efficient” pollution abatement, since it gives lesser-cost abaters (or situations) the ability to transfer their savings to higher-cost circumstances. Being tested for air pollution, water effluents, and CFC phase-outs, such trades tend to be more a balancing device within overall emissions targets than a stimulus for technological change. Trades take place largely among industry insiders which also limits the competitive stimulus for change. Continuing incremental innovation, rather than radical change, is the most likely result.

Subsidies are generally considered to be environmentally-damaging by discouraging the internalisation of costs into prices and encouraging the over-consumption of resources. However, most OECD governments give supports to firms - directly through grants and indirectly through tax incentives - for both environmental investments and for research and development. Some governments have combined these to give grants or fiscal incentives to R&D for the environment. Such research, which is taking place more often within the context of public/private partnerships among firms and universities/research institutions, can lead to incremental and/or radical innovations, although these may be one-off rather than continuing.

Information disclosure covers a range of initiatives pertaining to public disclosures of environmental performance and also monitoring requirements. To the extent that information systems are holistic and range across various environmental media, they can stimulate true innovation rather than end-of-pipe, medium-specific fixes. However, this is not often the case. Beyond the impact on polluting firms, information policies help to create markets and diffuse monitoring and control technology as well as new process approaches.

Voluntary agreements assign the initiative for specifying change to the party with the knowledge to design it and the means to implement it - *i.e.* the firm. Other major virtues include flexibility and realistic time-frames, all of which should in principle promote technological responses. However, there is as yet no evidence of major technological changes or radical innovations arising from voluntary agreements. The absence of reporting and monitoring requirements in most voluntary agreements is one obstacle to assessing their impact on environmental innovation.

Extended producer responsibility can lead to far-reaching design changes of benefit to the environment. EPR generally changes the time-frame and range of factors that appear in the design space of an engineer. It can be an important force for environmental innovation, particularly among companies which would, in the traditional regulatory model, have been the major targets of *ex post* product standards, as well as among younger firms willing to experiment with new approaches. Certain EPR instruments can lead to continuing innovation and broad adoption of technologies across a sector. However, the innovation effects depend on the stringency of the EPR instrument.

4. Environmental policy instruments and type of innovation

Table 3 indicates the different types of innovation which may be engendered by various environmental policy instruments. Here, they are classified into product changes, process changes, modifications to resource use, changes in firm-level organisational and managerial approaches, and alterations of consumer behaviour. In cells of the matrix, + or - signs indicate the tendency (positive or negative) and magnitude (single or multiple signs) of the effect on innovation (blank cells are neutral).

Table 3. Environmental policy instruments and type of innovation

	Product change	Process change	Resource use change	Organisational/ Managerial change	Consumer behaviour
Product standards	+			+	+
Pre-market approval	-			+	
Product bans	++				++
Performance standards		+	+		
Technology specifications		+			
Facility permits		-	+		
Charges and taxes	+	++	++		++
Emissions trading		++	++	+	
Subsidies	++	++		-	-
Producer responsibility	++		++	++	++
Information disclosure	+	+	+	+	
Voluntary agreements		+	+	+	

Source: OECD, 1999.

The table can offer conclusions by reading horizontally or vertically. For example, reading horizontally, it shows that *product standards* may have mild positive effects on product change, management attitudes as well as consumer behaviour. *Product bans* would have much more radical effects on innovation involving products as well as on consumer choices. Economic instruments - charges and taxes and emissions trading - have the potential for significant positive impacts on production processes and resource use. Subsidies can lead to product and process innovations, but may actually have passive or negative effects on managerial and consumer attitudes. Information disclosure and voluntary agreements may invoke some valuable innovative responses. Achievements in eco-efficiency in terms of redesign of products, reduced resource use, and development of managerial and consumer environmental awareness may best be stimulated through extended producer responsibility. EPR may thus have the most potential for innovative change across a range of economic actors.

5. EPR instruments and innovation

Extended producer responsibility encompasses a range of approaches, which are analysed here in terms of their innovative effects (Table 4). While other policies target a single point in the production-consumption-waste chain,

EPR seeks to integrate signals throughout the chain. As a general concept, EPR allocates the physical and/or financial responsibility for the environmental externalities of products along this chain to the producer, with attendant costs and benefits.

Two main types of instruments can be used to implement EPR policies: *i) regulatory instruments* (take-back requirements) and *ii) economic instruments* (deposit/refund schemes, advance disposal fees, materials taxes, pollution charges, subsidies, combined schemes). Other instruments can be complementary to these: product standards (minimum recycled content), information instruments (eco-labelling), and voluntary approaches, which often include aspects of the other instrument categories. Each of these EPR approaches has different effects on innovation, which will also vary according to other firm- and sectoral-level factors.

The goal of EPR in terms of innovation is to encourage producers to alter the design of products so that they will lead to reduced or less polluting waste streams. With regard to product redesign, various EPR approaches could lead to no innovation, incremental innovation or radical innovation. Both incremental and radical innovation may decrease energy and materials consumption as producers have incentives to make less wasteful and more recyclable products.

It is difficult to distinguish between what constitutes incremental or radical innovation in terms of product design. EPR-related innovation could encompass product simplification, standardisation of components, modifying components for reuse, standardisation of material types, easily detachable parts, reduction in number of pieces requiring dismantling, fewer material types, etc. Separately, all of these could lead to less waste and lower costs of waste management and disposal, but would probably be termed incremental innovation.

More radical innovation would be in the holistic approach of “design for the environment”. Green product design includes a variety of techniques and strategies which aim to increase a product’s recycled content, eliminate problematic ingredients, or create a system to take-back a product or its packaging for reuse, refurbishing or recycling at the end of its useful life. This includes designing products in their entirety that can be easily upgraded, rather than replaced when they become outmoded, or that can be easily disassembled for reuse or recycling.

EPR-driven radical innovation can have far-reaching effects on enterprises which invest in product-oriented environmental management systems and re-conceptualise the design process so that environmental factors are an “integral” part. Firm-level managerial and organisational changes could lead to

the development of “*inverse engineering*” which thinks backwards from the environmental consequences of wastes to the initial design problem. In the long-term, EPR could prompt changes in the behaviour of consumers, who would base their purchases to some degree on environmental criteria relating to a product's waste effects.

5.1 *Regulatory EPR instruments*

Take-back requirements are the primary EPR regulatory instrument. These require the producer and/or retailer to take back the product or its packaging after use. They are often associated with targets for collection and recycling and have been applied to a range of products, but most often packaging. When regulated by law which assigns take-back responsibility to producers, they are one of the purest forms of EPR. Such requirements can encourage firms to redesign products for easier recycling, recovery and re-use of components as well as reduction of hazardous materials. In the long-term, they can be one of the strongest incentives to green product design.

Table 4. EPR instruments and type/degree of innovation

	No product innovation	Incremental product innovation	Radical product redesign	Modified material use	Managerial organisational change	Consumer behaviour change
Regulatory instruments						
Take-back requirements		X		X	X	X
Economic instruments						
Deposit/refund schemes	X			X		X
Advance disposal fees	X					
Materials taxes		X		X		
Product charges		X		X		X
Subsidies		X	X			
Tax/subsidy schemes	X					
Leasing		X			X	
Other instruments						
Labelling		X				X
Product standards		X		X		
Voluntary schemes		X		X	X	

5.2 *Economic EPR instruments*

Deposit/refund schemes require a payment to be made when a product is purchased which is fully or partially refunded when the product is returned to a dealer or specialised treatment facility. These schemes have primarily been used for beverage containers. Since in current practice, most responsibility is assigned to the consumer and dealer rather than to the producer, they have had limited impact on innovation in product design. Their function is primarily to realise reduction in materials use through encouraging reuse and recycling.

Advance disposal fees are fees levied on certain products upon sale to finance collection, treatment and recycling. They are often used for longer-life products such as tires, refrigerators and cars. Since consumers and dealers assume most responsibility, as in deposit/refund schemes, they have had limited

impacts on product innovation. An alternative is to require producers to pay the fees, but they may then have the incentive not to redesign products but to reduce the fees they pay. Advance disposal fees may push manufacturers away from new materials towards heavy metals that are more easily recycled.

Materials taxes are intended to reduce the use of virgin materials (or materials that are difficult to recycle, contain toxic properties, etc.) in favour of secondary (recycled) or less toxic materials. Special taxes may be levied on particular materials or those deemed to cause pollution or create a hazard. When set at the optimal level (where marginal costs of the tax equal the marginal treatment costs) and when treatment/recycling responsibility is delegated to the producer, materials taxes can stimulate product redesign. At a minimum and even when set at lower levels, they can contribute to beneficial modifications in materials use.

Product charges are payments applied to products that create pollution when consumed or discarded, such as the sulphur and carbon content of fuels, fertilisers, pesticides or batteries. Product charges can influence the types of materials used although they may not stimulate radical innovations. In raising product prices, product charges have more effects on consumer behaviour. For example, some countries have introduced product charges to shift consumers away from harmful substances such as PVCs.

Subsidies - in the form of direct payments to producers to redesign products to minimise adverse environmental effects - can lead to innovation. Due to allegations of government involvement in “picking winners”, most environmental R&D subsidies are now allocated to public/private partnerships, such as for the design of “clean cars”. Studies show that subsidies may induce one-off investments resulting in either incremental or radical innovation, but not continuing changes in the innovative behaviour of firms or consumers.

Tax/subsidy schemes combine a tax paid by producers combined with a related subsidy to fund waste treatment. When levied by weight on particular materials, the tax would have the same effects as a materials tax. If the subsidy is paid to local authorities rather than to producers, there would be few incentives for product redesign. Innovative effects would only be realised when producers were required to pay the tax and were also given the subsidy as well as responsibility for post-consumption treatment.

Leasing is when the government requires a firm to lease its equipment to users rather than sell it, thereby assigning whole-life responsibility to the producer. For example, some OECD governments are proposing that public procurement of office equipment, etc. should be oriented to leasing rather than

purchasing to obviate government responsibility for end-of-life treatment. Some leasing programmes have been implemented voluntarily by firms, for example for computers. However, leasing is not practical for many products. Still, it could lead to incremental innovation in the greater reuse and recycling of parts so as to reduce treatment costs to firms.

5.3 *Other instruments*

Labelling or seals of approval transmit information about the environmental characteristics of products, their recyclability or recycled content to consumers. For example, product durability labels can increase pressure on firms to improve their environmental record regarding the durability of products while enhancing the environmental awareness of consumers. The transmission of signals to producers for product redesign would depend on the extent to which consumers base their purchasing behaviour on the information transmitted. However, the creation of markets for green products is often difficult given their generally higher prices. More difficult, though, is finding ways of reducing inputs and waste in the absence of green demand.

Product standards can be considered an EPR instrument, particularly when they pertain to minimum recycled content and specify a minimum amount of secondary materials per product. These can stimulate product innovations as well as increased recycling and reuse of products and have been used most frequently to date with regard to paper products, glass containers and plastic beverage containers. In being specifically directed to EPR goals and concerned with both design and waste management, these standards can lead to innovation as well as modified materials usage.

Voluntary schemes. Most of the instruments discussed above have been implemented on a voluntary basis by firms, sometimes in co-operation with governments and under varying degrees of commitments. These include computer recycling programmes, automobile recovery programmes, packaging take-back schemes, etc. If the degree of compulsion involved is close to that of a mandatory instrument, the stimulus to innovation in terms of product redesign will be similar to that of a regulatory standard. However, most often, enterprises implement these schemes in order to ward off new laws, regulations or taxes relating to waste management. Still, voluntary agreements and initiatives can induce incremental innovation in giving firms flexibility in devising new approaches and reducing administrative costs. They can lead to new managerial attitudes and approaches. Producers may also be more willing to share information about their innovative responses to specific environmental problems, thereby spreading technologies farther and faster than would otherwise have been the case.

6. Firm Motivations

The innovative actions of firms are not simple responses to the pressure of government regulations and other policy instruments. Firms undertake environmental investments for a variety of motives relating to finances, markets, image and other factors. Enterprises may act because they do not want to be perceived as polluters, they are concerned about future liability claims, or they seek to realise financial gains through market expansion or technology sales. The enterprise response to EPR policy instruments will be moderated through firm-specific factors relating to their motivations. This will also temper the degree of the innovative response, whether incremental or radical. In most cases, only radical change will generate future profits. EPR instruments need to build on other drivers to lead to radical innovation in terms of product design.

Regulatory response - Compliance with government regulations and policies remains the most forceful driver of corporate environmental performance as it requires firms to take mandated actions, or meet certain standards, in the absence of which fines or other measures are likely to be imposed. The stringency of the regulation is an important determinant of the degree of innovation. Firms are also motivated by the desire to get a jump on government regulations and thus save time and expense or gain a market edge. For example, some multinational enterprises headquartered in the United States are currently complying with EPR mandates in Europe. They see company-wide product responsibility initiatives as an opportunity to adapt early to European mandates and potential state-level regulations in the United States.

Cost savings - Many technologies producing environmental benefits are adopted by firms for the normal business reasons of reducing costs and enhancing product quality. Firms that give priority to resource productivity and product innovation can often achieve significant performance gains at lower cost. EPR is one approach that can yield benefits to enterprises by improving the efficiency with which they use energy, water and other natural resources. Greater use of recycled materials can yield significant cost-savings. An EPR-focused approach to the life-cycle management of a product can be cost-effective in the long-term once initial investments are made.

Reduced liabilities - Enterprises may be motivated to redesign products to reduce longer-term financial liabilities associated with hazardous wastes, toxic materials and other repercussions from poor waste management. Assuming total product responsibility could reduce potential environmental hazards associated with storage, shipping, handling and disposal of products. Financial institutions and insurance companies are now looking at potential environmental liabilities when lending to and insuring companies. Unforeseen liabilities and

environmental problems associated with production and distribution can be minimised through EPR approaches.

Enhanced image - Corporate image is an important aspect of a company's marketing strategies and can be a significant driving factor for improving environmental performance. For some firms, developing and selling greener products and adopting a greener corporate image is a pro-active sales strategy. The introduction of innovative product designs can enable the firm to brand itself in a way which allows it to capture market share from environmentally-conscious consumers. Companies that can creatively and strategically meet this goal without compromising product performance and price will have a marketing advantage with discriminating consumers.

Patents and licensing - Some firms realise that there are significant opportunities to gain the competitive advantage that accrues to early movers in the environment area. In addition to expanding markets, firms can develop entirely new product designs and technologies which it can then patent and sell to other market actors. EPR can make it attractive for companies to research and specify environmentally-sound materials, to design products to have multiple life spans, and to eliminate unnecessary parts of the product or packaging in the design phase. Small entrepreneurial firms can build on market niches in innovative, environmental product designs based on EPR.

7. Direction of innovation

Product considerations are important when assessing how EPR policy instruments can influence the direction of innovation in terms of product design and waste prevention. Some products and waste streams may be better candidates for EPR intervention than others. Important factors include the primary objective (*e.g.* waste prevention, waste management, design for the environment), the structure of the industry and size of producers, and the costs of EPR relative to potential profits. In general, EPR may be most effective in the case of products where the primary objective is total product redesign, producers are many and diversified, and potential profits may outweigh costs.

7.1 Sector/product examples

Packaging - EPR has been widely applied to packaging in the attempt to reduce waste and improve its management. Because redesign of packaging is likely to generate costs to industry rather than profits, voluntary schemes and other approaches have not been effective in promoting radical innovations. These instead have led to incremental innovations in the form of package lightweighting, elimination of unessential packaging, and increased use of

concentrates and refill packs. There has been some shift from difficult-to-recycle composites and plastics to more recyclable materials such as paper. As seen in the case of plastic packaging in Norway, EPR in the form of recycling fees has resulted in few new solutions that go beyond incremental improvements in dematerialisation (Roine and Brattebo, 2001). Packaging take-back requirements have been somewhat more successful in prompting innovation. There have also been related process innovations. For example, German companies have developed new sorting and recycling technologies based on infrared and laser beams, which they are now licensing to other firms.

Automobiles - Because vehicles are already among the most highly recycled products, the EPR innovation goal here is total product redesign. About 75% of vehicles by weight consists of metals which are usually recycled. The EPR target is the remaining 25% consisting of mixed materials such as plastic, rubber, glass, textiles, paint, etc. which are difficult to recycle, may be contaminated with hazardous substances, and are usually landfilled. Incremental changes in auto design have been realised through increased recycled content and labelling of components. Take-back requirements or assigning responsibility to producers for end-of-life vehicles could lead to more innovation. Some producers are aiming at complete automobile redesign for total recycling of parts and materials (*e.g.* the *US Vehicle Recycling Partnership* including Chrysler, Ford and General Motors). These firms are anticipating possible EPR requirements relating to end-of-life vehicles as now exist in some European countries. However, when the target industry consists of a few large firms as in vehicles, the likelihood of diverse, radical solutions will be less than in a highly entrepreneurial business environment. Radical redesign of automobiles may originate only in subsidised research partnerships with governments. In addition, as automobile producers become more service-oriented, EPR regulations could lead to managerial and organisational innovations in this sector through modified relationships between producers, assemblers and dismantling/recycling operators (Zoboli, 1998).

White goods - White goods - large household appliances such as refrigerators, ovens and washing machines - have aspects in common with automobiles. About 75% of their metal content is recycled. They generally enter the scrap metal feedstock along with other products such as vehicles for processing in local shredding facilities. Like automobiles, the white goods industry is a high-volume, mature sector somewhat resistant to major change. Total product redesign to address the 25% of non-recyclable materials could be stimulated by take-back requirements which require manufacturers to accept products for disposal at the end of their commercial lifespan, but this would be very costly to producers. Assigning households some role and cost at the time of disposal can also influence and encourage changes in consumer behaviour

both in terms of encouraging purchases of more durable products and promoting proper care and maintenance. In Japan, the *Household Appliance Recycling Law*, which combines manufacturer obligations to recycle their products with disposal fees paid by consumers, is expected to lead to significant changes in product design and recycling practices (Tanaka, 1998).

Computers - In the case of computers, innovation has led to shorter lifecycles and greater waste management problems. While the miniaturisation of computer equipment may reduce the volume of waste, it makes collection, repair and recycling more difficult. Although this sector is dominated by large established firms, there are also many smaller entrepreneurial ventures in the information technology industry. Cost-effective computer recycling will require product design changes that reduce disassembly time and increase the reuse and recyclability of components as well as eliminate hazardous materials. This is the direction of the draft EU *Directive on Waste from Electrical and Electronic Equipment* (WEEE) which prohibits the use of mercury, cadmium and other chemicals in all electrical goods by the year 2004 and puts full financial responsibility on producers to establish collection systems. Although it is left to individual EU countries to implement this directive, it could lead to cleaner computer product designs by companies seeking a green market niche. In addition, “eco-PCs” with easier dismantling and recycling may be cheaper to produce, providing an added incentive to innovation.

Mobile phones - Mobile phones are causing waste problems due to their short life-span (18 months to two years) and increasing numbers. Several policy instruments could induce incremental improvements in cell phone-related waste problems. Materials bans could reduce the use of toxic substances, particularly lead and brominated flame retardants. Financial incentives, such as deposit/refund systems, could encourage consumers to return mobile phones for recycling and reuse. Voluntary take-back schemes could be implemented, particularly for phone batteries. Eco-labelling and seals attesting to product durability - for what is a relatively low-priced product - could appeal to environmentally-aware consumers. Other instruments - such as product standards or charges - could lead to standardised design elements so that users are not forced to purchase a new phone when changing service providers or travelling abroad. Total redesign for disassembly, reuse and recycling of mobile phones may be induced by take-back requirements which put the burden on the producer. In this sector, there are smaller firms and potential new entrants who may develop innovative design responses and reap profits through enhanced company image and patenting new approaches.

8. Conclusions

Experience shows that many environmental policy instruments can stimulate incremental innovation in industry. Among the instruments which have the potential to engender more radical innovation are product bans, subsidies and extended producer responsibility, which are themselves more extreme policy approaches. These instruments primarily invoke changes in product design rather than in processes.

Several instruments can be used to implement EPR policies, whose ultimate innovation goal is complete product redesign to prolong the life of products and reduce waste. Many EPR instruments may induce incremental innovation in the form of simplifying products by reducing materials and components and increasing the recycling of parts. More radical innovation to completely redesign products to prolong their life, allow easy upgrading and reuse and/or promote complete recycling of components is more difficult to achieve. Take-back requirements, which assign full responsibility to producers across the product lifecycle, are the EPR instrument most likely to induce radical innovation.

Stringent EPR take-back requirements can produce technologically beneficial results over the long-term, provided the transient disruptions and costs can be sustained. Other EPR instruments - including taxes and charges, subsidies and leasing - can lead to beneficial but mostly incremental innovations in terms of products. They can also promote modified and reduced materials usage and changes to both firm-level managerial and organisational approaches (*e.g.* in the case of leasing and voluntary schemes) and consumer behaviour (*e.g.* in the case of deposit/refund schemes, product charges and eco-labelling).

Firms undertake environmental investments for a variety of motives, including government regulations and financial and image considerations. Depending on the structure of the industry and the product in question, certain firms may be motivated to redesign products to realise cost savings, market niches or patent earnings. Governments should tailor their EPR policies to take into account the potential range of responses in different industry sectors and the possibilities to profit from product innovation. It appears that EPR (particularly take-back requirements) may be most effective in diversified sectors where firms could realise longer-term benefits from related innovation. For this reason, case studies of the application of EPR to particular products and waste streams could be useful.

The innovative element of EPR - and thus the longer-term benefits - can be augmented by complementary industry-related policies. When introducing

instruments which allocate take-back and treatment costs to producers, governments may need to alleviate the short-term adjustment costs through financial or technical assistance. Governments can undertake R&D to provide generic technologies for product redesign as well as enter into partnerships with industry to advance EPR-related innovation (OECD, 2002a). Through green government procurement, more emphasis could be placed on leasing goods or purchasing products with beneficial design elements. Governments can also promote the patenting and licensing of EPR product innovations, increase the number of environmentally-conscious consumers, and expand markets for vendors of EPR-based products.

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***Part 4: Political Economy for Implementing
EPR Policies***

Chapter 1

POLITICAL ECONOMY FOR IMPLEMENTING EPR-BASED POLICY INSTRUMENTS

by

Naoko Tojo and Lars Hansson

International Institute for Industrial Environmental Economics
at Lund University, Sweden¹

SUMMARY

In light of the growing use of extended producer responsibility (EPR) as a principle that underpins environmental policy instruments among OECD member states since the early 1990's, this paper attempts to draw some lessons from the implementation of EPR programmes to date. The paper evaluates the results of different types of EPR programmes, analyses the institutional and structural factors that influence the results and the measures to overcome barriers, and suggests what types of products are most suitable for certain types of EPR programmes.

The focus of the evaluation is on four product groups, namely packaging, small consumer batteries, electrical and electronic equipment (EEE) and cars, for which EPR programmes have been used widely among the OECD member states. Approximately 20 programmes, which have been implemented for a

^{1.} A draft of this paper was prepared for/presented at the OECD Workshop on Economics of Extended Producer Responsibility, held in Tokyo, 10-11 December 2002, and was finalised in 28 March 2003, incorporating the inputs at the workshop.

relatively long time and have taken different approaches (e.g. style of enforcement, responsibilities given to the producers), have been evaluated.

The evaluated results include: collection, reuse and recycling rates; the stimulation of innovation (e.g. design for reuse/recycle/end-of-life management, reduction of toxic substances at source, change in a product system); the costs of implementation; soft effects (e.g. capacity building, generation and diffusion of information, improved communication between the upstream and the downstream); approaches to overcome barriers such as existing and orphaned products and free riders. The difference in the calculation method of collection/reuse/recycling rates, in the range of end-of-life management that is covered by the paid fee, as well as the question on the reliability of the data, posed limitation when comparing the results.

When discarded, products selected for evaluation pose threats to the environment and human health due to their high volume (e.g. packaging, cars), and/or hazardous substances in their parts and materials (e.g. batteries, cars, EEE), making it difficult and costly for conventional waste management facilities to handle them properly. EPR programmes have been used both for durable, complex products (e.g. cars, EEE) and for non-durable simple products (e.g. packaging), and compared to the latter, the former add difficulties in the management of EPR programmes. EPR programmes are most effective in reducing waste generation and increasing recycling where there is a potential for design changes of the product that can reduce the costs of recycling.

In determining the scope of an EPR programme, the consumers' ability to distinguish the difference between the products covered by an EPR programme and those uncovered (e.g. different types of batteries) should be considered. An EPR programme that covers all similar products may help avoid confusion and free riders. When a product covered by an EPR programme contains products covered by other EPR programmes (e.g. tyres in cars), governments either co-ordinate the coverage of these products, or delay implementation of a programme to avoid an overlap.

Voluntary programmes seem to work best when the product contains a high amount of valuable resources at post consumer stage (e.g. cars), however they suffer from free rider problems. Involvement of governments in an EPR programme, on the other hand, reduces free rider problems, achieves higher collection/reuse/recycling results, and stimulates design for end-of-life management without consumers demanding it (e.g. cars, EEE). Among the programmes evaluated, there is a definite shift from voluntary initiatives of producers to the programmes where governments are involved (either mandatory legislation or negotiated agreements).

Mandatory numerical targets have been effective in achieving high collection/reuse/recycling rates. While collection targets help increase separate collection from the rest of the waste stream and reduce littering, reuse and recycling targets drive design changes and technical improvement, leading to the reduction of environmental impacts of discarded products not only at their end-of-life, but also at source. Due to the uncertainty as to when a product comes to its end-of-life, it is non-trivial to set collection targets for durable products (e.g. EEE, cars).

Substance/landfill bans and the mandatory achievement of recycling rates for specified materials have been powerful components of some of EPR programmes that trigger product re-design and development of alternative substances. Threat of a ban often encourages increased collection and recycling (e.g. batteries).

The establishment of a successful collection system is the prerequisite for a successful EPR programme. Achievement of high collection rates requires 1) adequate financial incentives for consumers, 2) convenience for consumers (e.g. size, weight and ease of handling of the discarded products, distance to the waste bins) and/or 3) information to consumers. Particular problems with a conventional deposit-refund system can be overcome by combining the deposit refund system with an advance disposal fee system. Some retailers participating in the collection of old products experienced increase in customer numbers.

In introducing an EPR programme, issues such as the number of producers and distributors that exist in the market, the financial and physical capacity of the individual producers to establish and manage the end-of-life management system of their products, the number and capacity of existing end-of-life managers in the market, must be considered. Use of an existing physical infrastructure, skills and knowledge for collection and recycling (e.g. local governments, retailers, recycling facilities) facilitates fast and efficient implementation of an EPR programme. The ownership and management of existing infrastructure can be adjusted for EPR programmes.

For non-durable, relatively simple products (e.g. packaging, some batteries), producers often organise a collective collection and recycling infrastructure. The properties of these products allow the advance fees on new products paid into a collective financial system to reflect actual collection and recycling costs of the products sold.

Properties of durable, complex products (e.g. EEE, cars), on the other hand, make a collective financial system ineffective at stimulating design change. Individual financial responsibility presents an important opportunity to

stimulate design changes that ultimately minimise the cost of recycling, but it fails to address orphaned products and requires an appropriate collection system where brands and properties of collected products can be easily distinguished. A last-owner-pays system, when coupled with individual physical responsibility, can be an effective measure to promote design change, but create disincentives for collection.

In order to improve the evaluation, consistent measuring and reporting of performance level and costs of EPR programmes is necessary, requiring additional research and/or co-ordination among the different EPR programmes. Further research is also required on the influence of different types of EPR programmes on eco-design and innovation.

List of abbreviations

EEE: electrical and electronic equipment

ICT: information and communication technology

PRO: producer responsibility organisation

RoHS Directive: Directive of the European Parliament and of the Council on the restriction of the use of certain hazardous substances in electrical and electronic equipment

WEEE Directive: Directive of the European Parliament and of the Council on waste electrical and electronic equipment (WEEE)

1. Introduction

Extended producer responsibility (EPR) is an environmental policy approach in which a producer's responsibility, physical and/or financial, for a product is extended to the post-consumer stage of a product's life cycle (OECD, 2001). Current trends indicate an expansion in the application of EPR-based policy instruments to new products and waste streams in OECD Member countries.

There are a number of factors that are important to consider when designing institutional and financial arrangement of EPR-based policy instruments. These include, *inter alia*, government institutional factors, institutional factors between firms, characteristics of products covered under EPR programmes, and uncertainty associated with the implementation. These factors, together with the actual financial and structural implementation mechanism, may influence issues such as free-riding, need for information dissemination, transaction and administrative costs, competition and trade. However, there is not sufficient information and research indicating the relation of these factors with various EPR-based policy instruments and with the achievement of policy goals.

The purpose of the paper is to review and analyse the relation between various institutional and market factors surrounding EPR-based policy instruments and their implementation.

The paper focuses primarily on selected policy instruments that have been widely used by OECD countries to implement EPR programmes, namely take-back requirements, advance disposal fees and deposit-refund systems.² The roles of requirements accompanying the three instruments (*e.g.* informative responsibility, targets for collection, reuse and recycling, substance and landfill restrictions, minimum recycled material content requirements), as well as other EPR-based/supporting policy instruments that are used in combination with these three instruments (*e.g.*, material taxes), will also be examined wherever appropriate. EPR programmes for products widely addressed by the OECD Member countries (*e.g.* packaging, small consumer batteries, automobiles, electrical and electronic equipment - EEE), being in place for a relatively long

². These three instruments are often used in combination within one EPR programme, and many of the phenomena found in implementation may be common for all the three instruments. Thus, unless specified, the discussion in this paper the discussion in this paper concerns the implementation of EPR programme in general.

period, introduced by different level of governments (national, state, local), and using some or one of the aforementioned policy instruments, are selected to illustrate the concrete implementation. The paper does not attempt to make a comprehensive description of specific EPR programmes. Instead, elements of different EPR programmes are introduced to illustrate issues relevant for discussion.

Literature on the subject produced by the OECD constitutes the primary source of the study. It is complemented, to the extent possible, by review of academic articles, publications and professional magazines, as well as personal communication with actors in OECD countries.

The five sections on this paper review and analyse institutional and market factors surrounding the EPR-based policy instruments. These inter-relating factors include: government institutional factors (Section 2); institutional factors between firms (Section 3); characteristics of the products (Section 4); financial and physical implementation mechanisms (Section 5); transaction and administrative costs (Section 6) and competition and trade (Section 7). Based on the findings from Section 2 and 7, conclusion is made (Section 8).

2. Government institutional factors

This section discusses some of the factors related to the allocation of roles and responsibilities among the governmental actors that affect the formulation and implementation of EPR programmes. The section first discusses the challenges and strengths connected to diversified regional requirements, followed by seemingly contradictory aspirations of some local governments in implementing EPR programmes. Observed constraints linked to the division of responsibility among government bodies, as well as effects associated with nationwide targets are also reviewed.

2.1 *Diversified regional programmes*

Although the specifics vary from country to country and from product to product, regional (state, provincial, prefectures, canton) as well as local governments often play a crucial role in formulating and implementing EPR programmes. Regional governments in some countries with federal political and administrative structures establish their own EPR programmes (*e.g.* Canada, USA). In others, regional governments may be responsible for issues such as certification of recycling plants (*e.g.* EEE in Switzerland) and establishment and management of collection system (*e.g.* packaging in Japan). In some EPR programmes, local governments are responsible for setting up systems for collection and sorting of the discarded products covered by the respective EPR

programmes (e.g. packaging in France and Japan, batteries in Sweden, part of EEE in the Netherlands, Sweden and Norway).

2.2 *Differences in collection system*

With regard to source separation and collection, differences in economic incentives, such as refunds or disposal fees, for consumers in neighbouring regions or countries may lead to unwanted transfer for disposal. For instance, the deposit-refund system for aluminium cans in Sweden suffered from the empty cans brought from outside Sweden. Similar problems may occur within a country where one region has a deposit-refund system, and the neighbouring region does not have one (e.g. United States and Canada). If a take-back requirement were introduced with an end-user pay system in one region but not in the adjacent region, some discarded products covered by the take-back requirement in the former would most likely be transported to the latter, either by private consumers or waste dealers. The problem of “abuse” of the deposit-refund systems has been solved by the introduction of different types of marking system (e.g. bar code system in Sweden, marking on top of the can in the individual states in the United States), or reducing the size of the refund. Östhammar, a small Swedish municipality, which introduced a deposit-refund system for batteries, experienced very little abuse despite the absence of a deposit-refund system in adjacent regions, partly because of a relatively small size of the refund (0.25 SEK: 0.03 Euro)^{3,4} (Lindhqvist *et al.*, 1990). It can be noted that the size of the refund can be relatively small as an incentive for consumers to bring back the used products (Lindhqvist, 2000).

Difference in convenience for consumers between the neighbouring regions may also induce illegal disposal and/or transboundary movement of waste. In Japan, the EPR programme for packaging assigns responsibility for collection and sorting of packaging waste to local governments, which also allows each local government to set up its own collection system. With the full introduction of the EPR programme for packaging in 2000, one city requires consumers to separate their waste (packaging as well as non-packaging waste) into as much as 16 different categories (Tanaka, 2001b). Upset and confused, consumers started to bring their non-separated waste to the neighbouring

3. Throughout the document, the following exchange rate was used: 1 SEK = 0.1093 €, 1 CHF = 0.7647 €, 1 NOK = 0.136 €. (Forex, 2002).

4. The community achieved roughly 100% collection rate for alkaline manganese batteries, while the national average is approximately 25% (Lindhqvist *et al.*, 1990).

communities (Tanaka, 2001b). Allegedly, some citizens even moved to neighbouring communities to avoid this duty.

2.3 *Differences in other requirements*

Establishing a tailor-made system that meets different requirements set forth by the respective regional governments can be costly for industries operating nationwide. Differentiated design of products that serve the same function (*e.g.* different marking system) is an example of such requirements. Electronic industry in the United States has expressed concerns that in order to meet the different requirements set by the respective regional governments, it might be necessary to establish small scale recycling plants in several locations, leading to an inefficient situation where economies of scale cannot be utilised (Davis, 2002).

Industry's responses suggest strong preference towards uniform systems. In the United States, producers of nickel-cadmium rechargeable batteries, when faced with development of legislation at the state level,⁵ established a nationwide voluntary take-back programme themselves (Fishbein, 1997). Producers of EEE in Canada as well as the United States voiced their preference to have a harmonised system across the nation when some states/provinces started to develop their own EPR legislation (NEPSI, 2001; Betts, 2002).

Differences in standards related to the quality of recycling, such as achievement of certain reuse/recycling targets from specific materials, emission standards, workers' health standards, are often reflected in the differences in the cost of recycling. This may lead to an increase of recycling activities with lower standard, thus lead to more severe environment and health impacts from the recycling activities. It may, in turn, put recycling plants with higher standard in an uncompetitive position. Similar can be said about the introduction of landfill restrictions by a single region. When the State of California banned landfilling of cathode ray tubes, it was feared that it would result in transboundary shipment of discarded cathode ray tubes collected in California to the adjacent states (Smith, 2002).

Challenges surrounding differences in requirements within a nation are parallel to the diversified requirements set by different nations. Battery producers, when faced with stringent restriction in the use of mercury set up in EU, allegedly sold their products with higher mercury content in nations with

5. 13 states introducing legislation on battery labelling and removeability, out of which 8 also had take-back requirements (Fishbein, 1997).

less stringent requirements (Lindhqvist, 2002). Export of waste EEE to developing countries under the name of/as one possibility of recycling has raised strong concern due to unacceptable consequences of lower recycling standards in these countries (Puckett *et al.*, 2002).

2.4 *Contradicting aspirations of local governments*

Prior to the introduction of EPR programmes, aside from the discarded products recycled by private actors due to their economic value (*e.g.* cars, glass bottles, aluminium cans, large batteries), it was local governments that were primarily responsible for the management of most of the discarded products generated from households. Development of EPR programmes for the latter often causes dilemma for local governments.

On one hand, they would wish to avoid costs necessary to maintain and upgrade their waste management system to deal with different types of waste that require special care (*e.g.* EEE, batteries) and to introduce more extensive source separation. Indeed, though not necessarily stated explicitly, reducing the financial burden for local governments related to waste management is one of the objectives of many EPR programmes.

On the other hand, local governments may not necessarily be ready to give away responsibility associated with waste management, both with respect to self-interest in employment (public choice theory) and with respect to controlling. In fact, in countries such as Sweden and Finland, introduction of EPR programmes were regarded as a breakthrough that allowed privatisation of waste management, which had been monopolised by local governments (Tarasti, 1998; Jobin, 1997). Resistance of local governments to give away their authority of managing household waste was also perceived when a battery importer in the Netherlands try to obtain necessary permits to take back used batteries by utilising his own distribution network (Struijk, 1992).

This rather contradictory stance of local governments on EPR programmes seems to be reflected in the formulation and actual implementation of the programmes. In Ontario, Canada, after lengthy discussion among various stakeholders, it was agreed that industry would cover up to 50% of the expenses for collection and recycling of packaging materials (financial responsibility), while local governments bear the rest of the financial as well as physical responsibility.⁶ Although the responsibility on the side of producer was rather

⁶. Bearing the *financial responsibility* “means that the producer will cover all or part of the expenses, for example, of the collection, recycling or final disposal of the products he is manufacturing”, while *physical responsibility* refers to

weakened due mainly to the dominant negotiation power of the industry (Gaynutdinova, 2000), most of the stakeholders participating in the discussion process, including the local governments, were perceived to be satisfied with the outcome (van Rossem, 2002). In Japan, responsibility for the collection and source separation under the EPR programme for packaging remained in the hands of local governments, partly because of the necessity of the local governments to secure employment of their own staff (Morishita, 1997).

Some EPR legislation (*e.g.* packaging in Germany and Sweden, EEE in Sweden) requires producers to consult with local governments when setting up a collection/recycling system. On one hand, it would help secure the easy access to the collection depots for consumers. On the other hand, it may increase the cost of setting up the infrastructure for collection and/or recycling, as found in the initial implementation of the German EPR legislation for packaging. Due partly to a rather short timeframe given to the producers to set up the system, the Producer Responsibility Organisation (PRO) that coordinate the system on behalf of the individual producers had to rely on existing infrastructure for collection and recycling, who were in many cases local governments. The binding period of the contract with some of the local governments, which was up to 20 years, have been considered as invalid.

The requirement of consultation with local governments may also make it difficult for individual producers to set up its own collection infrastructure. Some municipalities in Sweden refused to consult with an EEE manufacturer in Sweden who wished to establish an alternative collection system, on the ground that a PRO that represents the majority of EEE producers already established collection depots (Lindhqvist, 2002).

2.5 *Allocation of responsibility among government bodies*

Some countries with federal political and administrative structures provide governments at the regional level (state, province, canton) with wide range of authority to establish and implement their own waste-related legislation (*e.g.* Canada, the United States).⁷ Jurisdiction over waste management is often

the situation where “the manufacture is involved in the physical management of the products and/or their effects.” (Lindhqvist, 2000).

7. For example, in Canada, aside from waste management in federal land and facilities regulated by federal legislation and transboundary movement of waste, responsibility related to waste management is in the hands of provincial governments (Estin *et al.*, 1993; OECD, 1998d). In the United States, state governments can establish environmental regulations that are broader in scope or more stringent than federal programmes, while they must

reflected on the respective roles assigned to the different levels of governments in the formulation and implementation of EPR programmes. Limitations of the national governments to establish uniformed requirements may pose challenges both for the industry covered by an EPR programme and for society at large.

However, even when the jurisdiction of federal/national governments can be limited, they could facilitate the formulation and implementation of EPR programmes in various ways.

In Canada, though federal government cannot directly enforce a take-back requirement, it has been promoting establishment of EPR programmes at the provincial level by providing information (Bury, 2001). Concrete measures include development of a guideline, organising a series of workshops, and establishment of a website. Establishment of a nationwide voluntary take-back and recycling programme of rechargeable batteries in the United States was facilitated greatly by the revision of federal legislation (Fishbein, 1997). The revised legislation established standardised national labelling and removeability regulation, which released the industry from putting different labels in accordance with the requirements from the respective states (Fishbein, 1997). It also made it unnecessary to fill out hazardous waste manifest and use hazardous waste haulers when transporting discarded nickel-cadmium batteries (Fishbein, 1997). The United States Environment Protection Agency has supported and participated in the discussion of multi-stakeholder groups on the establishment of take-back programme for electronics optimal in the United States (NEPSI, 2002).

It should be noted that though countries with federal political and administrative structures have the common characteristics of having governments and legislation at the state/provincial/canton level, the extent to which the regional governments have their jurisdiction differs from issue to issue, and from country to country. Countries such as Germany and Austria are federal republics but have central governments and have wider jurisdiction than the examples given before.⁸

receive approval for the implementation and enforcement of federally established regulatory programmes (OECD, 1998d).

⁸. In Germany, a state (land) is only permitted to issue waste management legislation when “the federal competence to issue legislation is not or is not fully used”, while enactment of federal legislation generally requires consent of the chamber consisting of representatives from the states (Bundesrat) (OECD, 1998d).

Further, overlapping/unclear responsibility among government bodies, as well as conflicts relating to the area of authority and interest of ministries, have posed challenges to the formulation and implementation of EPR programmes with coherent and clear objectives. For example, as many as five ministries share the responsibility for the EPR legislation for packaging in Japan. The compromise of the respective ministries is manifested in the relatively small allocation of producer responsibility in the legislation (*i.e.* financial responsibility for recycling when the recycled materials have negative monetary value) (Morishita, 1997).⁹

2.6 *Nationwide targets and rural areas*

In most of the non-federal states, as well as the member states of European Union who have the obligation to implement EU Directives that incorporate the concept of EPR (*e.g.* cars, EEE), collection/recycling targets are set nationwide. In this case, efforts of establishing efficient collection/recycling systems may be concentrated in the urban areas where the majority of discarded products are generated, thus most efficient in achieving the nation-wide target. This may make sense from commercial point of view. However, this may reduce the resources allocated for the improvement of rural areas facing equal, if not more, waste problems. It would also reduce the possibility of creating/maintaining local employment, which would often contradict to goals to enhance local employment in rural areas.

On the island of Lesbos in Greece, virtually everything is dumped in the landfill without any source separation. National targets have lead the Producer Responsibility Organisation (PRO) of packaging materials to concentrate its efforts in big cities, while little or no activities were observed on the island. The only waste dealer on the island receives no support, neither from the government, nor from the PRO.

Setting up national collection and/or recycling targets may also lead to the establishment of PROs that operate nationwide, which may limit the possibility of establishing a local collection and recycling system. Åre, a ski resort in northern Sweden, was planning to establish a local collection and recycling system. With the introduction of the Swedish EPR programme for packaging, a PRO was established, where most of the packaging producers participated, including the companies that would have sponsored the initiative in Åre. This lead to the elimination of a viable local initiative, partly because the industry

⁹. At the OECD workshop where this paper was presented, representatives of the Netherlands and the United States shared the same constraints (Veerman, 2002; Hickie, 2002).

who started to pay the fees to the PRO did not wish to sponsor the local programme any longer. The central system introduced by the PRO did not allow the sought-for flexibility to meet various local requirements, such as instalment of collection bins aesthetically preferable for a ski resort, and visit of haulers with higher frequency. Moreover, the local recyclers, who used to agree to collect the waste from Åre, refused to do so, seemingly for fear of upsetting the central system (Fadeeva, 2002).

3. Institutional factors among firms

Following the review of governmental setting and its influence on the implementation of EPR programmes, this section discusses how private actors surrounding the product chain covered by EPR programmes may affect/be affected by the implementation of EPR-based policy instruments. The section first reviews the existing private actors other than producers in the market, and their influence on the formulation and implementation of EPR programmes. It subsequently examines how characteristics of the producers themselves affect the implementation of EPR programmes, focusing on the issue of their choice between cooperation and competition.

3.1 *Private actors other than producers*

Besides the producers themselves, private actors involved in the different parts of the product chain may affect the formulation of EPR-based policy instruments, who may also influence/be affected by the implementation of EPR programmes. From life cycle perspective, the actors affected most may be those who have been/are/will be involved in activities related to recycling, collection and transportation, and manufacturing of materials and components.

3.2 *Actors involved in recycling*

Recycling business for some discarded products, such as cars, glass bottles, large computers and equipment with metals, have existed on a commercial basis due to the value of the products, materials or components contained in the discarded products. On one hand, the existing infrastructure and expertise of these recyclers may facilitate the implementation of EPR programmes. On the other hand, just as seen in the case of local governments, these actors may fear the introduction of an EPR programme could jeopardise their business. Challenges facing their survival may be even more immediate, considering that the size of many of the recycling businesses is small, and that the conventional practice of most of the pre-existing recyclers may not meet the standard set in an EPR programme (e.g. environmental standards, workers' health and safety standards, fiscal control).

Government as well as private actors (manufacturers) have been dealing with these issues in various ways when formulating and implementing EPR programmes. Car manufacturers in Sweden have collaborated with selected technically well-equipped dismantlers in an effort to enhance the dismantlability/recyclability of their cars (Tojo, 2001). Similarly, some EEE manufacturers in Japan, in the process of establishing sophisticated recycling facilities to meet the EPR legislation for large home appliances, collaborated with recyclers that already had state-of-the-art technologies (Sony, 1999; Matsushita, 1998).

EPR programmes for products containing hazardous substances (*e.g.* EEE, cars) often demand that the discarded products are recycled and treated in recycling plants certified by the government. In order to make sure that their products are recycled in a proper way, producers, or the organisation that collectively fulfil the responsibilities of the producers (Producer Responsibility Organisation: PRO), contract only with recyclers with high standards (*e.g.* EEE in Switzerland, cars in the Netherlands and Sweden). In some cases PRO may set their own standard for recycling which is even higher than the governmental standards (*e.g.* EEE in Switzerland) (Bornaman, 2002).

Use of recyclers with advanced technology, together with the requirement of achieving collection and recycling targets, have helped establish a steady and increased supply of recycled materials with a stable quality. EPR programmes for plastic packaging in Norway, as well as for cars and EEE in Sweden, helped secure the availability of a certain type of recycled plastics, enabling a Norwegian furniture producer to use these recycled plastics as a raw material for a chair (Lee, 2002).

Introduction and enforcement of stringent requirements would inevitably lead to the disappearance of recyclers that do not have resources/capacities to meet the requirements for certification, which is positive from environmental point of view. However, it may not be socially and politically acceptable under certain circumstances, which necessitates the measures to help survive smaller recyclers that may not have the resources and capacity to practice in an environmentally acceptable way. The scope of take-back requirements given to the producers at the initial phase of the EPR programme for cars in Japan is said to be limited to auto shredder residues, car air conditioners with freon gases and air bags, so that the existing dismantlers and recyclers could keep their business (Togawa, 2002). One of the Japanese car manufacturers has been developing relatively inexpensive recycling technologies that are easily adoptable by small-scale dismantlers and scrappers (Himeno, 2001). The company has been disseminating information about these technologies to the dismantlers and

scrappers through newsletters. It also has a demonstration plant accessible for anyone (Himeno, 2001; Tojo, 2001).

3.3 *Actors involved in collection*

Aside from the local governments, retailers may be the main actors that have been involved in collection of discarded products.

In some cases, retailers have been involved in the collection of discarded products that have relatively limited distribution channel. An importer of a special type of batteries in the Netherlands has established his own collection network, utilising the fact that only specific retailers (retailers of telecommunication equipment) sell the type of batteries he is dealing with (Langrova, 2002). EPR programmes for large home appliances in Japan assign responsibility for collection to retailers, considering the possibility and business practice of utilising reverse logistics (*i.e.* taking back a similar old product when delivering a new product).

Responsibility for collection assigned to retailers is often limited to the extent such as the take-back of a discarded product when selling a similar new product (old-for-new), of discarded products from households, of discarded products that have similar functions as those the retailer is currently selling, and/or of products that the retailer him/herself sold. The combination of such limitation varies among the programmes.

Retailers may be engaged in collection not only because they sell similar products, but also because they are conveniently located for consumers. In the deposit refund system for aluminium cans and PET bottles in Sweden, local super markets serve as collection depots. Car manufacturers in Sweden are considering the expansion of collection network by involving car dealers (Rydén, 1995).

Taking advantage of the consumers' preference to convenience and existing distribution network, some convenience stores in Japan started a new business as a dealer of second hand products (Tanaka, 2001b). The stores take back large home appliances that are less than certain years old, and pay a small sum to consumers (Tanaka, 2001b). This is very attractive to consumers who are, under the EPR programme for EEE with end-user pays system, obliged to pay for collection and recycling of discarded products otherwise.

Retailers have resisted participating in the collection in various instances. Involving retailers in a planned deposit-refund system trial for batteries experienced resistance in Denmark, presumably as it was not clear if the retailer

would be compensated for the extra work associated with the collection in a future system and in deposit-refund systems for other products (Lindhqvist *et al.*, 1990). In the process of developing the EPR programmes for packaging, Japanese retailers strongly refused to participate due to the limitation of space and cumbersome process of dealing with end-of-life products (Tanaka, 1999). Retailers of electronic products in, for instance, Canada, have shown resistance in collecting discarded products, as they fear that involvement in the waste collection would diminish their image (Lindhqvist, 2002). When introduction of visible, advance disposal fee was discussed, retailers of consumer EEE in the Netherlands feared that they would not be able to actually get the fee from the consumers due to the low margin and price competition (Stevels, 1999). Examples of the measures to overcome such resistance include compensation fees (*e.g.* deposit refund system for aluminium cans and PET bottles in Sweden) and convenience (*e.g.* batteries in Switzerland, the United States).

3.4 *Material and component producers*

Virtually all the EPR-based policy instruments may contribute to the increase of the supply and use of recycled materials, which would compete with virgin materials. In some cases, manufacturers of virgin materials became involved in the recycling of the same materials prior to the implementation of the instruments (*e.g.* glass, aluminium).

When use of specific materials is restricted under an EPR programme, the manufacturer of a product would need to find material and component manufacturers that can supply him/her with materials and components that enable him/her to meet the requirement. Similar situation occurs when the recycling target set under an EPR programme cannot be met with the materials and components currently used. In both cases, the current suppliers to the product manufacturer should modify the supplied material/component, or they would lose customers. Whether the material/component manufacturer modifies a product or not would depend on the importance of the product manufacturer as a customer (Lindhqvist, 2001).

Various material restriction requirements (*e.g.* PVC, halogenated compounds) facing product manufacturers urged some material manufacturers in Japan to modify their products. They thought that environmental differentiation may be the way for Japanese material manufacturers to survive against their fellow competitors abroad (Nakanishi, 2001b). Just as the existing recyclers with high advance technology participate in/help establishing an infrastructure for an EPR programme, skilled material producers participate in the development of recyclable materials (*e.g.* cars in Sweden and Japan) (Tojo, 2001).

Introduction of EPR programmes for complex products (*e.g.* cars) may help promote an efficient circulation of used components. Prior to the enactment of EPR programmes for cars, a car manufacturer in Japan started to establish a network with existing recyclers to communicate the availability of specific car parts.

4. Producers

National EPR legislation/negotiated agreements typically set merely the framework for the allocation of responsibility and requirements, while leaving the means of implementation to the producers. Experiences of implementing EPR-based policy instruments to date have been that in most cases, producers cooperate rather than compete with each other in fulfilling their tasks, as seen in practices such as creation of Producer Responsibility Organisation (PRO) and collaboration among the producers, including the industry-wide voluntary initiatives and common research and development projects. However, as illustrated in the lengthy discussion around the proposed EU Directive on Waste Electrical and Electronic Equipment, elements of competition have emerged, in particular among the producers of complex products.

4.1 Cooperation among the firms

Implementation of the EPR programmes for packaging typically involved establishment of a PRO, an entity that fulfils the requirements collectively on behalf the producers, as represented by, among others, Duales System Deutschland AG (DSD) in Germany. Similar has been seen for the implementation of EPR programmes for products such as batteries (*e.g.* the Netherlands, the United States), cars (*e.g.* the Netherlands), EEE (*e.g.* Switzerland, Norway, the Netherlands, Sweden), and used-oils (*e.g.* Canada). National EPR legislation sometimes explicitly mentions the possibility of joining a collective system or contracting with the government through negotiated agreements in place of fulfilling their responsibilities individually (*e.g.* packaging in Germany, France, the Netherlands, EEE in the Netherlands).

In general, it can be argued that the larger the number of producers, the higher the tendency for the producers to create a PRO. Among the EPR programmes for packaging, the number of companies (packers, fillers, importers and distributors) participated in the PRO amounted to 19,150 in Germany, more than 9,600 in one of the systems (Eco-Emballages) in France, and about 10,000 (packers and importers) in Sweden (DSD, 2000). Setting up an individual logistical arrangement would be difficult and costly for domestic small and medium sized enterprises, relatively small importers and importers from developing counties (OECD, 2001).

Although the structure and roles of PROs vary, reflecting the requirements set forth by legislation/negotiated agreements, their primary task is to set up and manage an infrastructure that enables their member producers to meet take-back requirements, often accompanied by collection/recycling targets. PROs often try to utilise the existing infrastructure, and engage, negotiate and contract with a variety of entities who have been engaged in collection, transportation, and recycling. They may also engage in the development of infrastructure themselves (*e.g.* collection, transportation and recycling of plastics in the case of DSD in Germany).

The activities of PROs are typically funded by the specific fees collected from the producers. The fee structure as well as the management of the financial flow (collecting money from its member and re-distributing it to entities physically carrying out the end-of-life management) has an important implication to the implementation and result of EPR programmes. The structure, roles and financial mechanism of the PROs will be discussed further.

Cooperation among the firms on the issues surrounding end-of-life management is not limited to meeting the requirements set forth in mandatory EPR programmes. As discussed in Section 0, a common wish of industry to avoid inconsistent regional requirements drove the establishment of a nationwide voluntary take-back initiative of batteries in the United States. Car industries in Europe developed a common manual for dismantlers and scrappers (ENDS, 1999).

Industry associations often play an instrumental role in facilitating the cooperation. They may set up an internal committee for specific issues related to environment and end-of-life management of their products (*e.g.* cars and EEE in Sweden, Japan). The car association in Sweden (BIL) conducted a joint research programme for the design for end-of-life management (Tojo, 2001). It also provides its member with the list of recyclers with high-level performance (Kvist, 2001). Prior to the enforcement of the legislation that gives producers physical responsibility for recycling, EEE manufacturers in Japan established a common demonstration pilot plant to examine the feasibility of various recycling options (AEHA, 1998; Tojo, 1999).

Such collaboration enables producers to gain new knowledge and information, which may be prohibitably expensive for individual firms to find out themselves. Industry associations also help reducing the transaction costs of individual members by way of representation and information provision. Sometimes different branches of the industry association become members of a PRO, thus reducing the burden of the individual members to negotiate with the

PRO themselves (*e.g.* EEE in Sweden). They also update their members with upcoming legislation and its implication to their members.

4.2 *Competition among the firms*

Despite the wide spread phenomena of cooperation among the firms in fulfilling the mandates set forth in EPR programmes, elements of competition have emerged, most prominently among the manufacturers of EEE and cars.

One of the major disputes surrounding the proposed EU Directive on Waste EEE (EU WEEE Directive) has been if the producers fulfil their financial responsibility on their own, or collectively. The opinion of the industry as well as the government has been divided, with some of the prominent manufacturers of EEE having been strongly supporting the individual responsibility (ENDS, 2002a; AeA Europe *et al.*, 2002). The main argument for individual responsibility is to reward the efforts of the manufacturers that produce products with higher recyclability (including the lesser use of hazardous/environmentally harmful substances) and lower costs for recycling, by differentiating the fees producers have to pay.¹⁰

A research in 2001 clearly showed that manufacturers of cars and EEE in Sweden and Japan are both striving for design for end-of-life management, in order to reduce the future costs for recycling. Individual companies, sometimes in collaboration with material manufacturers, have been working on the development of recyclable plastics. Some of the firms have established strong communication channels with selected recyclers to get feedback about the recyclability of their products. Competitions have been observed among the EEE producers in the area of material restriction as well, in particular the development of lead free solders. Respective EEE producers in Japan, in compliance with the EPR legislation enforced in 2001 that assigns individual physical responsibility to the producers, manage at least one recycling plant to deliver knowledge from the downstream to the upstream and to grasp actual recycling costs (Tojo, 2001).

Competition between the firms may affect/be affected by some of the legislative development. EPR legislation for cars in Sweden is built on individual responsibility, and requires producers to internalise the future recycling costs in the price of a new product and to keep aside the future recycling costs in a transparent system (a balance sheet of annual report or

^{10.} The European Parliament and the European Council of Ministers finally agreed on the text of the two Directives on waste EEE (WEEE Directive and RoHS Directive) in October 2002.

insurance).¹¹ The system allows the increase in the recyclability of a car to be reflected on the price of a new product, thus giving incentives for producers to strive for design for end-of-life management. During the development of the legislation, car manufacturers jointly presented their position paper to express their preference of the introduction of a system that allows the implementation of an individual system (Rydén, 1995). The forthcoming EPR legislation for cars in Japan also has an element of individual responsibility. Producers must announce the recycling fee for the respective cars they produce, which is paid by consumers at the time of purchase. Just as the Swedish system, the fee should be used for the recycling of the new car itself, though the fee will be put in a publicly managed fund.

Both EEE and car manufacturers seem to feel high pressure from consumers on environmental issues in general, especially when consumers regard them as environmentally conscious companies. In an annual survey by a major Japanese business newspaper, both EEE and car industries are among the top industries “that incorporate environmental consideration in their business activity” (Nakanishi, 2001a). However, consumers’ demand related to end-of-life management seems to be scarce (Tojo, 2001).

In the area of packaging and batteries, aside from the individual initiatives (e.g. a battery importer in the Netherlands, see Section 0) companies prefer the solution of joining a PRO. It should be noted, however, that a PRO that manage the physical flow of the products collectively could still, at least theoretically, introduce differentiated financial arrangement, thus making producers financially responsible in an individual manner.

4.3 *Characteristics of products*

Closely related to the choice of the governments and firms with regard to the implementation of EPR-based policy instruments are the characteristics of the products, including, *inter alia*, the number of existing products, durability, and the cost of end-of-life management.

5. Number of existing products and durability

Currently there are approximately 700 million automobiles in the world (Bilbranschen, 2001), which are used, in average, for about 12 years. The increase of portable electronic products in recent years, with the estimated

^{11.} The legislation was enforced in 1997, replacing an advance disposal fee system that was run since 1975.

number of worldwide sale in 2001 to be 600 million units, suggests rise in the use of rechargeable batteries (Langrová, 2002).

A challenge facing the implementation of take-back requirements for durable products such as cars, EEE and rechargeable batteries is the handling of products on the market prior to the introduction of an EPR programme (existing products), and products whose producers cease its operation (orphaned products).

It has been argued that requiring producers take-back of existing durable products would give, if any, very little incentives for design change. Observed exception could be when producers have opportunities to actually communicate with recyclers. Producers of large home appliances in Japan, who, upon the introduction of EPR legislation, have been involved in the physical recycling of discarded products, mentioned that recycling of existing products provided them with learning opportunities for design for end-of-life management (Tojo, 2001). Communication with the recyclers may not necessitate the involvement of producers in the physical recycling. As discussed earlier, some car manufacturers in Sweden have been actively communicating with recyclers. What is common between the two systems (cars in Sweden, EEE in Japan) is that producers are fulfilling their responsibility in an individual manner.

Some producers argued that making producers responsible for the take-back of existing products and achievement of certain recycling targets may violate the principle of the prohibition of retroactive law (Ford 2002; ENDS 2000a). However, the application of the retroactive law differ significantly from country to country.

Legislation deals with this issue in several ways. For example, the Swedish Ordinance on Producer Responsibility for Cars has two systems (advance disposal fee system for existing cars, individual financial responsibility for new cars) running in parallel. EU Directive on End-of-life Vehicles limits the responsibility of producers to finance the take-back and achievement of certain recycling targets of new cars during the first 5 years, while subsequently extending the responsibility to all the cars on the market. The Dutch EPR legislation for EEE similarly introduced a differentiated starting time. For the first 6 years, producers take back discarded products from retailers on old-for-new basis, while take back their own products from aggregation sites¹² and repair companies (brand-based responsibility). After that, all the take-back

^{12.} An aggregation site refers to an intermediate storage site prior to transportation to recycling facilities.

responsibility will be brand-based. Proposed EU WEEE Directive gives individual, financial responsibility to producers for take-back and achievement of certain recycling targets of new products¹³, while making all the existing producers collectively responsible for existing products.

Setting collection targets for durable products in percentage have been difficult, due to, for instance, the difficulty of determining the denominator (total amount of discarded products in a certain year), changes in the type and weight of products in the market. Moreover, products such as batteries may stay in the drawers of consumers for a long time (hoarding effects). Proposed EU WEEE Directive gives EU Member States a collection targets in absolute figure (4 kg per person per year). The fact that all the existing EPR programmes for EEE in Europe already achieved a result higher than the proposed targets (*e.g.* 5.1 kg in Switzerland in 1999, 7.2 kg in Norway in 2001, 10 kg in Sweden in 2001-2002) may suggest the difficulty of estimating the appropriate targets (Türk, 2001; Elektronikkretur AS *et al.*; 2002, Swedish EPA, 2002).

Estimating the costs of end-of-life management of durable products in advance poses challenges in establishing an appropriate financial mechanism, which will be discussed further in Section 0.

6. Cost of end-of-life management

If a product is made of non-hazardous materials that already have an infrastructure for recycling on a business basis prior to the introduction of EPR programmes (*e.g.* glass bottles, aluminium cans), the main sources of additional costs would be on the establishment and/or reinforcement of a collection network, as well as transaction costs with existing actors. Increase in collection may require additional recycling facilities, but as long as there is enough demand on the market for increased recycled materials, the expenses for building new plants would be covered within the market mechanism. Here, it may be useful to introduce EPR-based policy instruments that stimulate collection (*e.g.* take-back requirements with collection targets as found in most of the countries for packaging, deposit-refund system), and the demand on recycled materials (*e.g.* minimum recycled material content target for paper in the United States) (Lifset, 1992). Additional expenses occur if introduction of a new system to distinguish products covered by a programme and those not covered become necessary (*e.g.* introduction of a bar-code system in the deposit-refund system for aluminium cans in Sweden).

¹³. Products put on the market later than 30 months after the enforcement of the Directive.

For a product that had an infrastructure for end-of-life management on a business basis prior to the introduction of EPR programmes, but contains hazardous substances and/or materials whose treatment has not been economically feasible (*e.g.* cars), costs regarding the upgrade/selection/monitoring of recycling facilities that would meet additional requirements (*e.g.* proper treatment of hazardous substances) should also be considered. In this case, in addition to the policy instruments to stimulate collection and demand on the recycled materials, instruments such as substance restrictions (*e.g.* EU Directive on End-of-life vehicles, proposed EU Directive on the Restriction of the use of certain hazardous substances in EEE: RoHS Directive) may promote design change upstream. Meeting the requirements set in the forthcoming implementation of the EU Directive is one of the main reasons for the Japanese car industry to reduce hazardous substances (Tojo, 2001). Countries where recycling plants for EEE already existed prior to the introduction of take-back requirements (*e.g.* Switzerland, Sweden), also introduced standards to secure environmental/health standard of recycling activities.

Introduction of EPR programmes for products that has no infrastructure for collection and/or recycling on a business basis (*e.g.* consumer batteries, most of EEE, PET bottles, plastic packaging) requires initial investment costs for establishment of necessary infrastructure for collection and recycling, as well as consultation with existing actors (*e.g.* local governments involved in collection). In this case, various EPR-based instruments mentioned so far could be useful. However, the choice and priority could be different depending on the characteristics of the products.

Collection of some of these products (*e.g.* consumer batteries, small EEE) has experienced significant challenges (Tojo *et al.*, 2001; Türk, 2001). Establishment of a system based on individual financial responsibility requires an identification system at the recycling plants, unless a producer sets up an individual collection system. In such cases, instruments promoting design change upstream, such as requirements restricting the use of certain substances or material tax, instead of take-back requirement as such, may give higher incentives for design change. Several examples, such as elimination of mercury in some batteries and development of lead free solders among electronic industry, have shown the effectiveness of material restriction requirements in driving innovation. Introduction of a material tax on batteries using cadmium in Sweden, which is 300 SEK (33 Euro) per kilogram of batteries (*e.g.* 15 SEK for a battery weighing 50 g) could explain the reduction of the sale of batteries from 328 ton in 1997 to 190 ton in 1998 (Langrova, 2002).

6.1 *Physical and financial implementation mechanism*

This section discusses some of the key functions that need to be fulfilled in order for an EPR programme to work, and how these functions are actually implemented. These functions include collection and sorting, recycling, information provision to/contract making with actors involved in collection, sorting and recycling (*e.g.* consumers, retailers, recyclers, producers), reporting to the authorities, environmental quality control of recycling activities, and financial management. The section examines who fills these functions in what manner under different existing programmes. Issues about the distribution of costs will also be mentioned. It then attempts to shed some light to functions that can be fulfilled by a PRO that may be different from its traditionally perceived roles.

7. *Collection and sorting*

In the mandatory take-back programmes, primary actors responsible for collection and sorting include retailers (*e.g.* packaging in Germany) and local governments (*e.g.* packaging in France, the Netherlands and Japan, batteries in the Netherlands). For durable products that used to be collected primarily by local governments (*e.g.* EEE), retailers and local governments often share the responsibility for collection (*e.g.* Japan, Sweden, the Netherlands, Norway). In some programmes, both producers and retailers are responsible for collection (*e.g.* EEE, old-for-new basis, in Sweden, batteries in Switzerland, packaging in Sweden).

Once discarded products are collected, they are often gathered at aggregation sites. Some legislation assigns responsibility for establishing these aggregation sites to producers (*e.g.* EEE in Japan and Sweden) and local governments (*e.g.* EEE in the Netherlands). Producers of EEE in Japan are required to establish these aggregation sites that are easily accessible for consumers and retailers. Similarly, producers of EEE in Sweden, upon request, must consult with local governments as to the location of aggregation sites.

In reality, individual producers and retailers often gather together and establish one or more PROs, which would make necessary arrangement to fulfil the responsibility on their behalf. The PROs can be established together with the actors responsible for recycling (producers). The PROs would then establish a network by contracting with new and existing actors, such as waste management company and local governments (*e.g.* packaging in Germany, EEE in Sweden). The PRO for packaging in Germany established a collection network partly independent from the municipal collection system, while EEE in Sweden utilised the collection infrastructure that already existed prior to the

introduction of the system. In the case of EEE retailers in Sweden, while their responsibility for collection is fulfilled mostly by the PRO, they are still responsible for informing their customers of the local collection depots.

When producers are responsible for fulfilling certain recycling targets, they (or their PRO) may contract with retailers and have them facilitate collection to fulfil their requirements (*e.g.* deposit refund systems for aluminium cans and PET bottles in Sweden). In order to meet a rather high collection target (90%), the PRO for battery producers in the Netherlands initiated a collection programme at schools (Langrova, 2002). Similarly, the PRO for rechargeable battery manufacturers in the United States, which runs the nationwide voluntary take-back initiatives, have been developing their collection network through four channels: retailers, communities, businesses and public agencies, and manufacturers themselves (Fishbein, 1997). Retailers participating in the scheme are provided with collection containers and possibility of postal service free of charge once the containers are full (Fishbein, 1997). The PRO for batteries in Switzerland, whose original role is to manage financial flow of the system, provide retailers with collection containers as well, despite the fact that retailers are by law responsible for accepting the batteries from consumers free of charge (Jordi, 2002). Retailers have been also used as collection depots in an individual collection system (*e.g.* batteries in the Netherlands).

The review above illustrates that physical infrastructures arranged by the PROs, at times required by law, seem to try to make it convenient for consumers through means such as setting the collection depots either at the place where consumers are used to go (*e.g.* use of municipal waste collection system) or at the place they go anyway (*e.g.* retailers, school). The establishment of collection network by a PRO that operates nationwide may, in turn, make it difficult for individual producers to establish their own collection depots. An EEE manufacturer in Sweden, wishing to establish an alternative collection system, requested consultations with municipalities. However, the consultations were refused, on the ground that a PRO that represents the majority of EEE producers already established collection depots (Lindhqvist, 2002).

Besides convenience, financial incentives for consumers help achieve high collection rates. With this regard, deposit refund systems have been found to be useful in achieving high collection rates (Lindhqvist, 2000). Deposit-refund system for beverage containers in British Columbia, Canada as well as in the State of California have achieved relatively high results, despite the fact that consumers have to bring the empty containers to collection centre which may not be located in the vicinity of their houses (Robinson, 1996; Lindhqvist, 2002).

A study of beverage container recycling systems in Germany, Sweden and Switzerland, all of which has achieved high results (above 85% for aluminium cans in 1997), showed that fees for consumers were highest in a “bring” system (Switzerland), middle in a kerbside collection system (Germany), and lowest in a deposit-refund system (Sweden) (Vanthournout, 1998). The result suggests that implementation of a deposit-refund system may not be necessarily the most expensive, as often perceived.

8. Recycling

Virtually all the take-back programmes make producers responsible for recycling. In most of the implementation to date, it is the PROs who make contracts with recyclers to fulfil the responsibility assigned to producers. However, as previously discussed, producers in some programmes (*e.g.* cars in Sweden, EEE in Japan) fulfil their responsibility in an individual manner.

Car manufacturers in Sweden have both the physical and financial responsibility of recycling of the cars that are put in the market after the introduction of the EPR programmes for cars. They contract directly with dismantlers and negotiate the size of the fees for recycling (Kim, 2002).

In response to the introduction of the EPR programme for EEE in Japan, two networks for transportation and recycling were developed. Prominent manufacturers of EEE in Japan, without establishing a PRO, take part in one of the two networks, and cooperate with each other in the establishment of aggregation sites, take-back networks as well as recovery and treatment facilities. However, each manufacturer manages at least one treatment plant, and tries to compile and communicate information from the downstream to the upstream, accumulate knowledge on recovery technology, and grasp the actual cost for recovery and environmentally sound treatment of their discarded products (Tojo, 2001).

Introduction of take-back programmes is often accompanied by requirement of environmentally sound treatment of the discarded products, components and materials. The requirement takes the form of specification of treatment methods of specific components and materials and/or certification of recycling plants (*e.g.* EEE in Switzerland, Japan, Sweden, proposed EU WEEE Directive, cars in Sweden).

Some PROs (*e.g.* cars in the Netherlands, EEE in Switzerland) established their own stringent standards for the recycling activities to secure an environmentally sound treatment of the discarded products of their members (Kim, 2002, Bornand, 2002). One of the PROs for EEE in Switzerland also

inspects the recyclers periodically and tries to make contracts with the best recyclers from the respective cantons (Bornand, 2002). Although car manufacturers in Sweden fulfil their responsibility individually, they establish a PRO that, among other things, provides its members with a list of recyclers with high environmental performance (Kim, 2002).

With the aim of enhancing the smooth implementation of the EPR programmes, some PROs (*e.g.* for plastic packaging in Norway, or cars in Sweden) have also been active in finding/cultivating the market for recycled materials (Lee, 2002, Kim, 2002).

9. Information provision

Responsibility of providing information to the public may be assigned by law to producers and retailers (*e.g.* EEE in Norway and Sweden, batteries in Switzerland) and to the government (*e.g.* packaging and EEE in Japan, partly EEE in Norway).

When information provision does not correspond to the interest of the actor that is responsible for its provision, enforcement of such informative responsibility may not be easy. In Norway, after one year and a half of the implementation of the EPR programme for EEE, the authority found that five of the biggest retail chains failed to fulfil the informative responsibility (ENDS, 2000b). Continued failure would mean the payment of fines up to 1,500 NOK (204 Euro) per day per shop (ENDS, 2000b).

However, some of the PROs have been quite active in providing information. Most of the existing PROs list information provision to the public as one of its roles. Their activities include providing the public with brochures (*e.g.* EEE and batteries in Switzerland, packaging in Spain) and campaign through TV broadcast (*e.g.* batteries in Switzerland and the United States). They also provide information about the results of the programmes, upcoming events, relevant legislation, list of retailers/local governments that consumers could contact when they wish to return the discarded products. The PRO for batteries in Switzerland has been providing information to the retailers about their responsibility for collection (DSD, 2000; El Kretsen, 2002; Bornand, 2002; Jordi, 2002; Fishbein, 1997).

10. Reporting and monitoring

Most mandatory take-back programmes require private actors involved in the collection and recycling (producers and retailers) to report to the authorities about their achievement. In the system where PROs make necessary

arrangements that enable producers to fulfil their responsibilities, it is the PROs who gather such data and present to the authorities. Sometimes producers are also required to inform the authority of their plan of fulfilling their responsibility (*e.g.* EEE in the Netherlands).

Even when a recycling system exists for a substantially long time, reasonably accurate data on the situation surrounding the end-of-life management may not be grasped by the authority. In Sweden, an advance disposal fee system for cars was introduced in as early as 1975, with the aim of reducing the cars abandoned in nature (Lindhqvist, 2001). The system gives an incentive to the last owner to return the car to a scrapper by providing the last owner with a premium in exchange of the deregistration certificate provided by the scrapper. The size of the premium is determined by the government. In 2001, due to the alleged increase of the number of abandoned cars in nature, the government substantially increased the level of the premium given to the last owner when he/she returns the end-of-life vehicle.¹⁴ Meanwhile, a campaign was initiated to collect such cars, which announced that as much as 1 million cars had been abandoned in nature. Through the course of a research where information was gathered from a number of different entities (*e.g.* NGO in charge of the campaign, government, PRO), it turned out that the number most likely close to the actual situation was 40,000, only 4% of the number originally stated (Lindhqvist, 2002). The lack of adequately accurate data is striking, especially considering the fact that reducing the littering is one of the main objectives of the system. Convincing data concerning abandoned cars could also not be found from a number of other European countries, including Germany, the Netherlands, France and the United Kingdom (Kim, 2002). Similar lack of data was also found with regard to the battery collection in Sweden, despite the fact that different legislation concerning the collection and treatment of batteries exist since 1984 (Langrová, 2002).

Increased communication of individual producers with recyclers, as well as enlistment of recyclers with high performance by the PRO, may help grasp the actual situation surrounding end-of-life management of cars.

11. Financial Management

As previously mentioned, when a PRO manages the physical infrastructure on behalf of individual producers, it is typically the fees paid by the members that finance the activities of the PRO. Aside from the recycling fees further

^{14.} From 500 SEK (55 €) to 700 SEK (77 €) for cars up to 7 years old, 1,200 SEK (131 €) for cars between 7 and 16 years old, and 1,700 SEK (186 €) for cars more than 16 years old (Kim, 2002).

discussed below, the members of the organisation may pay fees such as entrance fees as well as annual membership fee (*e.g.* packaging and EEE in Sweden). The recycling fees are often charged as advance disposal fees based on the amount of products that are put on the market.

When a PRO coordinates with actors involved in end-of-life management, such as local governments, retailers, recyclers and dismantlers, opportunities for producers to interact directly with these actors are naturally reduced. Indeed, one of the reasons why the individual producers have a third party to deal with the actual arrangement is that they do not want to involve in the time consuming process of dealing with different actors (Lundgren, 2001). In such cases, the feedback an individual producer gets with regard to the end-of-life management of their products, such as the degree of difficulty of handling the product, value contained in the products (reuseability, recyclability, dismantlability, and value of the recovered parts/recycled materials) may be limited to the size of the recycling fees.

When the fees are differentiated in accordance with the cost of end-of-life management, it gives incentives to the producers to change the design of the products to reduce the cost associated with the end-of-life management. Differentiation of the fees among the packaging materials have induced significant changes, such as reduction in the use of composite and plastic packaging, increase in the use of reusable packaging and major reductions in volume and weight by alternation of container shapes and sizes (OECD, 1998b).

Differentiation of the fees for complex products, such as EEE and cars, that reflects the actual costs of end-of-life management of individual products, faces challenges, due to the relatively large number of materials and components used in the products, practical difficulty of distinguishing one product to another, and the like. The durability of these products make the calculation of the future recycling costs very difficult, as it would require consideration on uncertainty arising from issues such as the timing of the products to be discarded, the development of recycling technologies, changes in the price of recycled materials, and changes in legislation regarding recycling requirements. Among the packaging materials, differentiation of the recycling fees among different types of plastics has not been implemented, either.

The fee structure most commonly used in the take-back programmes for these complex products is advance disposal fees that set flat rate for similar type of products, managed as a “pension system” (*e.g.* EEE aside from information and communication technology (ICT) equipment in the Netherlands and Sweden, EEE in Switzerland, cars in the Netherlands). In Switzerland, an advance disposal fee per kilogram of battery sold is determined via legislation.

These fee structures have been criticised for their inability of promoting design change, but they would effectively cover the costs for end-of-life management (Bornand, 2002).

A challenge facing the advance disposal fee system for durable products managed as a pension system is the management of the fund. The size of the reserve in the Dutch EPR programmes for cars increased more than 4 times in 6 years,¹⁵ although the proportion of the amount put to the reserve out of the total income is reduced from more than 70% in 1995 to less than 10% in 2001 (Kim, 2002). Although the size of the advance disposal fee has been reduced twice: from 113 Euro in 1995 to 68 Euro in 1998, then to 45 Euro in 2001, which is considerably lower than the costs of treating one car today; it is still criticised to be too high (Kim, 2002). A PRO for EEE (large and small consumer EEE) in the Netherlands was criticised by the industry that the large amount of reserve lead to comparatively high advance disposal fees.¹⁶

The two examples above illustrate the difficulties of setting the reasonable size of the advance disposal fee managed as a “pension system”. The sufficient level of reserve may be different, depending on the issues such as the durability of the products covered by the system, the number of new products sold and discarded products collected, and characteristics of the producers participating in the system (*e.g.* large *versus* small, domestic *versus* import).

In the case of EPR programmes for cars in the Netherlands mentioned above, increase of new cars that are sold (more than 200,000 between 1995 and 1999), as well as the high number of exports of second hand cars (about 30% of the cars deregistered in the Netherlands), are perceived to be the two main reasons for a rapid increase of the reserve despite the decrease of the fee (Kim, 2002).

Regarding the EPR programme for EEE in the Netherlands, two mis-estimation contributed to the development of reserve: 1) the number of actually collected was lower than estimated; and 2) the actual cost of recycling was lower than estimated (Veerman, 2002). With this regard, the management of fund for products whose sale is decreasing (*e.g.* nickel-cadmium batteries) may require attention. Together with the threat of ban and high material tax, the sale

^{15.} From less than 40 million € in 1995 to more than 170 million € in 2001 (Kim, 2002).

^{16.} The size of the reserve in 2000 was more than 65% of the expenditure in the first year, as opposed to nothing in the case of PRO for ICT equipment. (ENDS, 2001a; Mayers, 2002).

of nickel-cadmium batteries in Sweden dropped from 328 ton in 1997 to 190 ton in 1998. Lack of reasonably accurate data on the collection level would make it difficult to adjust the level of advance disposal fees in accordance with the amount of batteries collected.

Alternatives to the advance disposal fee system run as a pension system include payment of future recycling costs at the time of purchase and end-user-pay system. The Swedish EPR programmes for car, which allocate individual physical and financial responsibility for recycling of the new cars to the producers, allow producers to internalise the future recycling costs in the price of the new products, while keeping aside the cost of future in a separate account within the company. Though there is a risk of orphaned products, the system has the advantage of providing producers with incentives for design change (Tojo, 2001).

Use of recycling insurance has been suggested in Sweden as an alternative financial mechanism for durable, complex products that ideally reflect the costs of future recycling of individual products in the price of the premium, while guarantee the risk of orphaned products. A number of manufacturers, including a car importer in Sweden and some wood cutting equipment producers, started to buy the insurance.

In the Japanese EPR programmes for EEE, producers are fulfilling their responsibility in an individual manner, while the end-user pays for the collection and recycling of discarded products. Individual producers must announce the recycling costs in advance. Though the initial fees announced by prominent producers turned out to be the same, it may still induce competition among the producers, as the size of the fees was considerably lower than the estimated actual recycling costs. However, end-user pays system has a risk of attracting illegal dumping/unsorted dumping.

In Switzerland, where industry initiated a voluntary EPR programme for EEE already in 1994, different financial systems (*i.e.* advance disposal fee systems and end-users pay system) co-existed when the law was first enforced in 1998, which created confusions among the consumers. Revision of the law been proposed so that all the discarded EEE can be brought back free of charge (Bornand, 2002).

Another form of financial mechanism often used in an EPR programme is a deposit-refund system. One of the main objectives of a deposit-refund system is to secure a high collection rate of discarded products. A traditional deposit-refund system, which forces the producers to make the deposit exactly the same as the refund, often runs into financial difficulty, as the system is financed

solely on the unclaimed deposit, interest generated from the deposit and revenue from recycling. In this system, ironically, the higher the collection rate becomes, the more difficult the financial management becomes.

The Swedish deposit-refund system for aluminium cans and PET bottles is a combination of deposit-refund system and advance disposal fee system. In this system, the size of the refund is set so that it is large enough to secure collection rates, while the deposit (combination of the traditional deposit plus advance disposal fee) is adjusted to cover the cost for managing the system while paying the refund. This hybrid system is used for the advance disposal fees for cars as well.¹⁷

12. Distribution of costs

“Costs may be distributed according to market power irrespective of where the legal obligation is placed” (UK Department of Trade and Industry, 1999). The number of entities fulfilling the same function in an EPR programme and their relative importance in handling the product covered under the programme have influenced distribution of costs, as well as degree of competition.

The Swedish advance disposal fee system for cars provide the last owner with incentives to bring the car to a scrapper by giving them a premium. The size of the premium has been adjusted so that the amount of recycling fee that the last owner pays to a scrapper is lower than the premium paid to the consumers. It has been observed that the change in the size of the scrapping premium is closely related to the amount of fees that a scrapper demands, who has a stronger negotiation power than the consumer.

Similarly, it has been observed that retailers have been receiving relatively high compensation in the Swedish deposit refund system for aluminium cans. Among the actors responsible for collection and recycling, retailers, who have more products to handle than material producers or fillers, have the highest negotiation power.

13. Roles suited for PROs

The review of functions that constitute financial and physical implementation mechanism of take-back programmes seem to suggest that the roles of PROs are much more diverse than what have been assumed in literature

¹⁷. Another form of a deposit-refund system has been used in Korea, where producers are the receiver of the refund. The system is currently under revision (MOE, Korea, 2001).

(i.e. fulfilment of responsibility mandated by legislation or what the members of the organisation commits to do on behalf of the producers). Different types of roles include securing the quality of recyclers' work, provision of information about the content and results of the programmes to the actors in the chain (consumers, producers, retailers, local governments), provision of information about other actors (e.g. recyclers) to the producers, reporting and monitoring of the end-of-life management activities, cultivating the market for recycled materials, and management of a guarantee fund.

These roles may not necessarily directly fulfil the roles of the individual producers. Rather, they may support the primary roles of the producers as well as other actors involved in the implementation of the programme and make it sustainable in the long run. Some of these roles may not necessitate the establishment of a new entity, but may be fulfilled within the existing industry association. For example, the aforementioned PRO for cars in Sweden is a part of Swedish car manufacturer and wholesaler association. Similarly, The Association for Electric Home Appliances in Japan manages the transfer of recycling fees from the consumers to the producers (RKC, 2002).

13.1 *Transaction and administrative costs*

Transaction costs are those costs that arise through an exchange of assets between actors. This section discusses the transaction costs for actors involved in the implementation of EPR programmes (e.g. producers, retailers, local governments, recyclers, consumers, PROs) related to the respective implementation mechanisms. The section does not intend to quantify the transaction costs for individual programmes. Instead, it attempts to highlight factors that may affect the transaction costs for the respective actors, and the advantages and disadvantages for other actors.

14. Transaction costs surrounding collection and sorting

Contract making and communication with actors such as local governments, which are necessary for the fulfilment of responsibility allocated to producers, are often carried out by PROs on behalf of the producers. On one hand, negotiation through PROs reduces the transaction costs for individual producers, as well as for the local governments who would otherwise need to communicate with different entities wishing to establish different paths for collection. This is especially the case when the number of producers covered under a take-back programme, and/or the number of actors involved in collection and sorting, is high. However, as experienced in the Swedish ski resort, implementation of an EPR programme by a nationwide PRO may reduce the possibility of adjustment to the local conditions. It may also hinder the

establishment of alternative solutions by individual producers and thus influence competition.

Introduction of EPR programmes per se may increase the transaction costs for consumers. Consumers need to sort discarded products covered by the respective programmes from the rest of the waste stream and bring them to the collection depots. They also need to learn about the system.

Transaction costs for consumers can be reduced by increasing the convenience. Measures taken include establishing collection depots that are easily accessed by the consumers, providing collection bags/containers for discarded products (*e.g.* batteries in Switzerland, various municipal collection system, kerbside collection system by DSD in Germany), and providing clear information about their tasks (*e.g.* source separation) and possibilities (*e.g.* acceptance of discarded products free of charge). Having one system for the same type of product would also help reduce the transaction costs for consumers related to information. Financial incentives can be used to counter-balance the transaction costs (*i.e.* deposit refund system).

Involvement of retailers in the collection network may increase convenience for consumers, but would increase the retailers' transaction costs in terms of time and space. Measures taken for compensation include making it convenient for retailers (*e.g.* batteries in Switzerland and the United States), paying some fee (*e.g.* deposit refund system in Sweden), and publishing of the participating retailers, which may give them market advantage (*e.g.* batteries in the United States).

15. Transaction costs surrounding recycling

Just as collection, contract making and communication with actors such as recyclers and dismantlers, which are necessary for the fulfilment of responsibility allocated to producers, are often carried out by PROs on behalf of the producers. It reduces the transaction costs for individual producers, as well as for the recyclers. However, having another entity in the middle would limit the opportunities for individual producers and recyclers to communicate. The value for the producers to communicate with recyclers may depend on, for example, financial mechanism, type of products (complex or simple), size of the producers, and if they are domestic manufacturers or importers.

16. Transaction costs surrounding financial management

The transaction costs for producers and actors involved in the management of infrastructure would reduce when individual producers do not have to

involve in the financial management of the system (*e.g.* calculation and determination of advance disposal fees, negotiation and payment to recyclers in different regions). However, it may reduce the possibility for the individual producers to get feedback for the design for end-of-life management.

17. Transaction costs surrounding reporting

Reporting to the authority on the result of the implementation would generate transaction costs for producers. It would also add transaction costs for the authority who needs to make sure that producers submit the results, and to aggregate the information gathered from individual producers. When the producers delegate the management of the physical implementation of their responsibility to a PRO, the PRO typically undertakes reporting as well, which would reduce the transaction costs both for individual producers and the authorities.

18. Others

As reviewed earlier, industry fears that difference of requirements between neighbouring regions would increase the transaction costs. When some provinces in Canada started to establish take-back requirement for used oils that were different with each other, a representative of the industry association explicitly mentioned their concern over the increase in transaction costs for its member companies (Van Rossem, 2002). Similarly, the manufacturers of EEE in the United States and Canada raised their concern over the development of regional EPR programmes (Betts, 2002, Davis, 2002). Enforcement of the federal legislation related to the labelling and removeability requirement for rechargeable batteries in the United States is perceived to “have cost saving implication for industry which formerly had to deal with a patchwork of inconsistent legislation in different states” (Fishbein, 1997).

It should be noted, however, that the allocation of jurisdiction at regional governments would allow, among others, flexibility, implementation of measures specific to the local needs, and prompt implementation of measures in the absence of action at the national level. Moreover, development of the regional EPR programmes, as seen in the United States for the rechargeable batteries, may trigger expansion of the programme to the national level.

When industry associations participate in a PRO on behalf of the individual producers, it would reduce the transaction costs both for the producers and the PRO.

19. Competition and trade

This section examines the implication of the implementation of EPR programmes to competition and trade, focussing on the effects on the actors (*e.g.* producers and PROs, local governments, recyclers, importers). The section does not attempt to make a comprehensive review of the implication of EPR programmes to these two issues. Instead, issues that have actually been raised through the implementation of the EPR programmes are presented to illustrate the concrete implication. Discussions surrounding the EPR programmes and its potential effects on trade to date suggest that actual implementation of EPR programmes have not been in conflict with trade regime (OECD, 1998a; OECD, 2001, Salzman, 2002). Thus, the implication of EPR programmes to international trade regime as such is excluded from the scope of this paper.

19.1 Competition

The existence of a dominant PRO in a country, though it may not actively prevent competitors from coming into market, may effectively hinder the establishment of alternative collection/recycling systems. A local government who already went through a consultation process with a PRO, of which the majority of the EEE producers in Sweden became a member, refused to have a consultation with an individual EEE manufacturer. Implementation of the Swedish EPR programme for packaging by a nationwide PRO prevented a system that allows adjustment to the local necessity. The PRO for packaging in Germany has been criticised for its abuse of its dominant market position (ENDS, 2001b).

When there exists only one PRO for an EPR programme, its potential monopolistic behaviour may be of concern. Not having an alternative system to compare or participate, producers may have to accept fees set by the PRO even if they exceed the actual implementation costs. The PRO for large and small consumer EEE in the Netherlands has been challenged by the industry for setting up relatively high recycling fees (ENDS, 2001a). The PRO for packaging in Germany has been accused of being the only dominant collective system operating nationwide and for its high charges (ENDS, 1998).

When there are only one or a limited number of the recycling facilities, costs for end-of-life management may become high. In Switzerland, where there is only one recycling company for batteries, the current fee for recycling batteries is 4.8 CHF (3.24 Euro) per kilogram of batteries, which is perceived to be very high compared to other recyclers in Europe (Langrová, 2002). Recycling of batteries outside of Switzerland would be difficult as waste management is subject to the proximity principle.

In relation to the implementation of EPR programmes for EEE, the Fair Trade Council in Japan published guidance with regard to the application of Anti-Trust Law on the collective measures taken in relation to recycling activities. The Council clarified, among others, that collaboration in the establishment of take-back system as such would have little possibility to violate the Anti-Trust Law, as long as the proportion of the price of recycling costs as compared to the price of the product is small, and if the companies participating in the collaborative system does not unreasonably refuse the participation of other small and medium-sized companies. It also stated that if the participating companies decide on the common recycling fees, it would constitute violation of Anti-Trust Law (Kousei Torishiki Inkai, 2001).

Regarding the market for end-of-life management, creation of collective systems may effectively limit the competition among the actors participating in the end-of-life management by making it difficult for the existing actors (*e.g.* waste collectors, haulers, recyclers) to carry out their activities or for other actors to enter the market (Kousei Torihiki Inkai, 2001). One of the two PROs for EEE in Switzerland has exclusive contracts with only one transportation company, and does not allow its members to use others, thus hinders another transportation company to come into the market (Rizzotti, 2002). The PRO also selects one EEE recycler from each Canton, who meets the stringent environmental and quality criteria set by the PRO, and all the products collected through the system managed by the PRO only go to the selected recyclers (Rizzotti, 2002). This may reduce the expenses for the PRO/producers/consumers and may help secure high recycling standard. However, this may also lead to the disappearance of recyclers not selected by the PRO, and may give the PRO an excessive bargaining power.

It has been pointed out that when a PRO has to establish a collection/recycling system in relatively short time period, it may effectively lead to the preferential treatment of existing actors, *e.g.* local governments, and private collectors. This would put the PRO in a weaker position in the negotiation process (OECD, 2001). A PRO established in response to the German EPR legislation for packaging ordinance had to contract with existing actors partly due to the necessity of establishing the collection and recycling network in a short time period. The validity of some of the contracts with the duration of up to 20 years has been challenged.

Some programmes use unemployed labour force with subsidies, or use, for instance, prison labour (EEE in the United States). This may, on one hand, have positive effects such as mitigating unemployment and helping the prisoners gain some professional skills. However, it may make it difficult for market-based

recycling to establish itself, as commercial recyclers would not be able to survive in the price competition.

When an EPR programme suffers from a large proportion of free-riders, the participating companies would be put in a disadvantageous positions, as they would end up paying for the free-riding companies. The problem of free riders often leads to the introduction of mandatory programme (Tojo *et al.*, 2001).

Introduction of mandatory deposit refund system for certain types of packaging materials in Germany have been facing protests from domestic producers, retailers, as well as importers. When the deposit-refund system is imposed only for certain type of products, which is often the case, it would risk giving competitive disadvantages to the producers using that packaging materials.

The EU Committee of the American Chamber of Commerce raised concern on the implication of the proposed WEEE Directive to competition. It stated that the financial responsibility “could create a disincentive for non-EU based manufacturers of electronic and electrical equipment to enter the EU market” (American Chamber of Commerce, 2000). The fact that the domestic manufacturers would bear the same burden makes the validity of the argument questionable.

19.2 Trade

Potential effects for importers include information costs, relatively high compliance and reporting costs, and low volume/non-standard packaging or products (OECD, 1998a; OECD, 2001).

Additional information costs for importers can be reduced through measures such as notification of the upcoming legislation, provision of information and opportunities to participate in the consultation process. An industry association representing the importers could serve as a window for such a process, and could also facilitate information collection. For products whose materials and components are produced worldwide (*e.g.* EEE), information costs for material and component suppliers could rise.

Relatively high compliance and reporting costs for importers have been avoided by the establishment of collective compliance schemes (*i.e.* PROs). Although unfairly high fees on importers could be imposed, the authors have not come across such cases.

As experienced in the early days of the EPR programme for packaging in Germany, non-standard packaging material in the importing country (*e.g.* jute bags used for exporting coffee from Colombia and metal straps used on wool bales from Australia) may suffer from not being recognised as recyclable products (OECD, 2001). In the case mentioned above, the situation was resolved with the PRO approving these materials as recyclables (OECD, 2001).

The introduction of mandatory deposit-refund system for certain types of packaging materials in Germany has been facing protests by importers from France and England on the ground that it would violate free movement of goods within the European Union (ENDS, 2002b). It may give *de facto* disadvantage to foreign producers who may have difficulties in participating in the system. The change of packaging material solely for one region/one country could be costly. The trade implication of the Danish mandate of the use of refillable containers for beers and soft drinks has been discussed at length, which is now replaced by the mandatory deposit system for both refillable and non-refillable containers.

The legality of the proposed RoHS Directive was challenged due to the alleged introduction of substance ban prior to the finalisation of risk assessment. It was argued that it would create technical barrier to the trade of WEEE, violating the international trade regime (American Chamber of Commerce, 2000).

Export of products, components and materials that contain hazardous substances (*e.g.* EEE) to the developing countries have raised concern (Puckett *et al.*, 2002). Difficulty of distinguishing between second-hand products and products that are exported for recycling, lack of recycling standards imposed on producers/recyclers in the exporting country, lower/non-existing recycling standards and inexpensive labour in the importing countries, non-membership to the Basel Convention on the Transboundary Movement of Hazardous Waste, are among the factors that contribute to the increase.

Increase of trade over the Internet may effectively let private persons and importers escape from take-back requirements. However, the PROs for EEE in Sweden and Switzerland to date have not experienced serious challenges (Ghandi, 2002, Bornand, 2002).

20. Conclusion

As seen, the implementation of EPR-based policy instruments affect/are affected by various interrelated institutional and market factors. A factor that may bring benefit to one actor, or to one aspect of an instrument, may increase

burden on the other. A balance between these benefits and costs requires careful attention.

This concluding section attempts to highlight the relation of the studied factors that are affecting the implementation of selected EPR-based policy instruments, namely, take-back requirements, deposit refund systems, and advance disposal fees. The section does not attempt to specify the relation of these factors in a form of function. Instead, it intends to summarise some of the important institutional and market factors as well as their relation that have been illustrated in the paper through observation of actual implementation.

20.1 *Relation of factors affecting take-back requirement*

The main steps involved in the fulfilment of a take-back requirement include *collection* of discarded products covered by the EPR programme and *recycling* of the products, including the proper treatment of residues. Actors and issues surrounding these two steps may be different. Thus these two steps will be discussed separately.

20.2 *Collection*

The majority of take-back programmes carry out collection in a collective manner, and utilise existing infrastructure for collection, namely local governments and, in some cases retailers (dealers), by law or through contracts with Producer Responsibility Organisations (PROs). Aside from their existing infrastructure, a somewhat contradicting aspiration of local governments, who wish to secure their own employment while trying to avoid costs, may explain the continuation of their involvement in collection. Exceptions include take-back programmes for cars in some countries, where neither local governments nor dealers are involved in collection in the existing systems.

Establishment of a collective body that manage infrastructure for collection has the possibility to reduce transaction costs for all parties involved (*i.e.* consumers, producers, local governments, retailers). This is especially the case when the number of the producers covered under a take-back programme is high (*e.g.* packaging). A collective system is especially attractive for small and medium-sized enterprises and small importers, who risk facing relatively higher difficulties in setting up their own collection system. However, it may reduce the possibility of adjusting the infrastructure so that it meets local conditions (*e.g.* packaging in Sweden). It may also create barriers to individual producers who wish to establish their own collection network (*e.g.* EEE in Sweden) and thus be a barrier for innovation of a product system. Moreover, it may hinder

new actors to enter the market for collection and transportation (e.g. EEE in Switzerland).

When retailers are involved in collection, their inconvenience from increased transaction costs is often compensated. If the retailers are responsible for take-back requirements together with producers, the relative strong negotiation position of retailers may allow them to secure high compensation in the price of the product or by direct compensation through the EPR systems (e.g. aluminium cans in Sweden).

The selection of the actors involved in the collection, as well as the measures for collection, determines the convenience of consumers, and requires product specific consideration.

20.3 *Recycling*

Giving producers financial and/or physical responsibility for recycling of the discarded products is the core of take-back programmes. Although the majority of take-back programmes physically carry out recycling requirements in a collective manner, whether their financial responsibility should reflect the actual costs of the end-of-life management of products that they themselves produced or not (individual *versus* collective responsibility) has been debated, especially for complex, durable products (e.g. EEE, cars). The main rationale for the individual financial responsibility has been to give incentives to the producers to change the design/material use of their products upstream so as to reduce problems at source.

PROs for simple, non-durable products (e.g. packaging) typically allocate financial responsibility to the individual producers based on the type of materials used in the products and the amount of the products they put on the market. Various programmes experienced the decrease in the total amount of packaging put on the market, as well as increased use of materials that yield higher reusability/refillability/recycleability.

In the case of complex, durable products (e.g. cars, EEE, rechargeable batteries), differentiation of fees that reflect the actual costs of end-of-life management of individual products face various challenges due to, for example, the complexity in structure, components and materials, difficulty of distinguishing between different products and of estimating the future recycling costs. In order to cover the recycling costs of existing products and to avoid additional costs to overcome these challenges, advance disposal fees managed as a “pension” system has been used in most cases.

As found in the case of collection, existing infrastructure and expertise for recycling has been also utilised. Not all the existing recyclers may have the capacity to meet with the recycling standards set by legislation or the PROs, and may force some recyclers to disappear. The tendency of non-well performed recyclers to disappear would be higher if the recycling infrastructure is managed by a PRO who has more control than the recyclers.

The fact that only the recyclers with high environmental performance survive is good from environmental point of view, and also is a natural consequence of market economy. However, the transition towards a new system may bring up issues such as increase of unemployment and social instability. Consideration to these issues may affect the formulation of legislation that help the existing recyclers to improve their performance and bring forward the overall recycling activities in a positive direction (*e.g.* cars in Japan).

A simultaneous introduction of equal and adequate recycling standards nationwide/among the neighbouring regions would facilitate the growth of sound recycling industry. Use of subsidised labour force (*e.g.* subsidised unemployed workforce, use of prison labour) may make it difficult for the commercial recyclers to compete, thus may hinder the growth of sound recycling industry. When collected products are exported to developing countries or exported for recycling, caution should be taken so as to avoid dumping of waste. The exporters should see if the products would be used as second-hand products, and recycling standard of the importing countries should be examined.

Management of recycling infrastructure by a collective body would reduce transaction costs for producers as well as recyclers. However, when recycling of the products relate directly to the design of their own products (*e.g.* EEE, cars), it becomes useful for producers to gain knowledge on recycling, as they could reduce the recycling costs by changing their design. When producers wish to contact recyclers directly (*e.g.* cars in Sweden) or involve in recycling themselves (*e.g.* EEE in Japan), a collective body may help reduce the transaction costs by providing a list of recyclers with high performance (*e.g.* cars in Sweden), or help manage the financial mechanism (*e.g.* EEE in Japan).

When material and component producers of complex products spread worldwide (*e.g.* EEE), unlike the producer of the final products, these material and component producers are not likely be represented in the consultation process of the development of legislation that affect the final products. They may face an increase in information costs to keep up with the development of various legislation abroad.

20.4 *Relation of factors affecting advance disposal fees*

While an advance disposal fee system is a financial mechanism most widely used for take-back programmes, the actual implementation varies mainly in two areas: how to determine the level of fees, and how to manage the collected fees. The difference in these two areas may have a strong implication to various factors reviewed in the paper.

One of the important aspects regarding the determination of the fees is if the fees reflect the difference in the actual expenses and social costs of end-of-life management of individual products. Stability of the flow of discarded products and less fluctuated price of the recycled material, as well as the shorter life of the products, facilitates establishment of differentiated fees for simple products (*e.g.* packaging) that reflect the characteristics of different material used, as experienced in various take-back programmes for packaging. However, characteristics of durable, complex products put higher challenges.

The flat fee structure for the same type of products (*e.g.* all the TV belonging to a certain range of size) and for the same type of materials (*e.g.* all types of plastics) regardless of the degree of the ease of end-of-life management would discourage producers to strive for making upstream changes. In Japan, the industry-wide flat fee structure is regarded to be in conflict with the competition law. On the other hand, the management of differentiated fee structure would most likely require higher transaction costs than the flat fee structure. However, as discussed below, if the flat fee is combined with pension system, as typically found in most of the flat fee system, the difference in the transaction costs could be offset by the amount of necessary reserve in the fund.

The management of the collected fees could be categorised into two: a pension system, as found in most of the advance disposal fee systems, and the system where the fee collected at the purchase of a new product will be used for the recycling of the same product in the future. Some pension systems established a relatively large reserve, especially at the initial stage, partly due to the lack of data on the amount of discarded products collected. The necessity of having a high reserve, connected to the relatively high disposal fees set on the new products, was questions by the participating producers (*e.g.* EEE and cars in the Netherlands).

The sufficient level of reserve may be different, depending on the issues such as the durability of the products covered by the system, the number of new products sold and old products collected, and characteristics of the producers participating in the system (*e.g.* large *versus* small, domestic *versus* import). When the sale of new products is increasing/constant while the number

discarded products collected is decreasing, the fee would be reduced (*e.g.* cars in the Netherlands). Meanwhile, if the sale of the new products is decreasing while the number of discarded products collected is increased/constant, the fee would most likely be increased. Lack of adequately accurate data for collection may make it difficult to determine the right size of advance disposal fees (*e.g.* batteries in Sweden).

When differentiated advance disposal fees are put on the price of the new products and the collected fee is managed by individual companies (*e.g.* cars in Sweden), funding for orphaned products would be of concern. Use of recycling insurance with differentiated premium, which has been initiated in a smaller scale in Sweden, may serve as a guarantee for funding for end-of-life management of orphaned products. As discussed in Section 0, use of recycling insurance also decreases transaction costs for individual producers to negotiate with recyclers and to secure the management of their cars in high quality.

Another factor that affects the size of the fee is the power relation between the PRO and other actors. When the PRO has a relatively high negotiation power over the existing recyclers (*e.g.* the PRO selects among a number of existing recyclers), the cost of recycling could be cut down (*e.g.* EEE in Switzerland). On the other hand, when the recyclers have a relatively high negotiation power among the actors involved in end-of-life management, they may claim and manage to obtain higher recycling fees (*e.g.* cars in Sweden).

The advance disposal fee could be either visible, explicitly on top of the price of the new products, or internalised in the price of the products. Visible fee has the advantage of making consumers aware that they are paying the recycling costs. However, it may face refusal from the retailers who are afraid that the fee is not collected due to the severe price competition of the products and negotiation power of consumers (*e.g.* EEE in the Netherlands and Japan).

If the size of the fee becomes significantly high in proportion to the price of the product itself, it may raise concern from the fair competition point of view.

20.5 *Relation of factors affecting deposit-refund systems*

A main challenge facing the deposit refund system is that it would induce transboundary movement (*i.e.* illegal import) of discarded products (*e.g.* experiences in United States, Canada and Sweden). Indeed, just as the end-user pay system would induce illegal dumping to avoid the costs, deposit-refund system would attract illegal import to get some money.

One way of decreasing the cheating is the introduction of a bar-code system or other suitable marking system. Moreover, illegal import could be diminished by making the size of the refund relatively small (*e.g.* battery in Sweden). Experiences showed that the size of the refund can be modest to give incentives for consumers to bring back products to the collection depots.

Deposit-refund systems in most cases are carried out collaboratively, partly to secure convenience/keep the transaction costs down. Industry-wide implementation would also reduce transaction costs for individual companies. Retailers can be selected as collection depots for consumers' convenience. However, as noted above, the relatively strong negotiation position of retailers may allow them to secure high compensation (*e.g.* aluminium cans in Sweden). Systems where less number of collection depots are set up at relatively less convenient locations (community collection centres) have also achieved high results (*e.g.* British Columbia, Canada, California, the United States).

A traditional deposit-refund system, which forces the producers to make the deposit exactly the same as the refund, often runs into financial difficulty, as the system is financed solely on the unclaimed deposit, interest generated from the deposit and revenue from recycling. Alternatively, a combination of deposit-refund system and advance disposal fee system can be used. In this case, the size of the refund is determined independent of the size of the deposit. The size of the refund should be just as large enough to enhance collection rates, while the deposit (combination of the traditional deposit plus an advance disposal fee) should be big enough to manage the system.

As one of the main objectives of introducing a deposit-refund system is to reduce littering, adequate monitoring system should be in place to follow the result.

Although a deposit-refund system often is perceived to be a very expensive system, this may not be true if compared with the programmes that achieve equally high results. Aside from the initial installation costs, implementation costs as well as transaction costs may not necessarily be higher than a "bring" system.

Introduction of a mandatory deposit-refund system often raises concern on the competition and trade. It may give *de facto* disadvantage to foreign producers who may have difficulties in participating in the system. When the deposit-refund system is imposed only for certain type of products, which is often the case, it may give competitive disadvantages to the producers using that packaging materials. Changing the packaging material solely for one region/one country could be costly.

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Chapter 2

Discussant Commentary on

POLITICAL ECONOMY OF IMPLEMENTING EPR-BASED POLICY INSTRUMENTS

by

Jean-Philippe Barde, Head, National Policies Division
Environment Directorate, OECD

The authors provide a useful review of key issues, factors and constraints related to the implementation of EPR schemes. This overview is comprehensive and based on practical examples drawn from a variety of countries.

Summarising the substance of the paper would not be helpful and would not pay credit to the richness of the analysis. I will rather make a few remarks in relation to selected key issues presently studied in OECD: governance, financial mechanisms and recycling.

1. Governance

Good governance is a key condition of sustainable development and the paper rightly reviews two aspects: public institutions and private sector organisations.

As for public institutions, the need for coherence and continuity is essential, but seems particularly difficult to meet with the great variety of EPR systems, objectives and actors: local vs. regional and national goals and schemes; potential conflicts with other local socio-economic objectives.

Public sector governance will be improved if objectives are clear. This is well known, but particularly relevant with EPR having multiple objectives. Here we can refer to Margaret Walls' paper stressing the need to specify the environmental objective that EPR policies are designed to achieve. Public institutions at different (regional, local, national) levels will adhere if objectives are clear and coherent. The paper presents useful analysis of this key issue.

A recent OECD study on "*Improving Policy Coherence and Integration for Sustainable Development: a Checklist*" [OECD 2002] develops a list of criteria to ensure policy coherence at the level of institutions, *i.e.*:

- A common understanding of sustainable development. Translate: of EPR objectives.
- *Clear commitment and leadership.* Translate: EPR-related institutions.
- *Specific institutional mechanisms to steer integration.* Translate: need for an EPR "institutional catalyst" and feed-back mechanisms between different institutions.
- *Effective stakeholders involvement.* Translate: effective channels between responsible institutions and EPR players.
- *Efficient knowledge management.* Translate: effective diffusion of EPR related technologies.

The paper rightly underlines the potential conflicts between EPR and *regional employment objectives*. This issue is of particular relevance since many OECD countries implement so-called "bottom-up" policies to combine regional environmental protection and employment creation. We are presently reviewing these policies (several hundreds of cases in OECD countries). A large proportion of these "bottom-up" approaches relate to waste management and recycling. *The integration of regional EPR policies with regional employment creation schemes could be further investigated.*

For the private sector, the paper provides important and useful insights on the role of private organisations, in particular Producer Responsibility Organisations (PROs). These organisations are essential to the "governance" of EPR, in particular to achieve economies of scale, reduce transaction costs and disseminate information. In this respect, PROs can contribute effectively to technical innovation (see Candice Steven's paper).

However, two possible obstacles can be mentioned:

1. The risk of *anti competitive behaviours* of PROs (e.g. exclusion of small firms, market entrance barriers).
2. The numerous *pitfalls and weaknesses of voluntary approaches*, in particular, business as usual, regulatory capture, poor monitoring, free riding and transaction costs [see OECD 2003]. These shortcomings of voluntary approaches can make the implementation of EPR particularly delicate.

On the issue of *transaction costs*, the paper provides a very useful analysis showing the multiple sources of transaction cost and proposes ways to reduce these costs. These multiple cost sources, plea for the implementation of *simplified EPR systems*.

2. Financial mechanisms

This is an intriguing and challenging issue for the economist and raises a fundamental question: should we aim at incentive or financing systems? In other words, should EPR related taxes, charges and fees be designed to minimise at source the production of environmentally harmful products, or to finance safe disposal, recycling or reuse, or both?

Here I see a nice complementarity with Margaret Walls' paper. Whilst Tojo and Hansson provide a useful review of the existing financing mechanisms and requirements and their complexities, M. Walls rightly shows that *each objective should have a separate instrument* and that the ultimate goal should be to minimise the total cost of managing waste products, i.e. external and private costs. Hence policy instruments should be designed to achieve this goal.

3. Recycling markets

The paper underlines that virtually all take-back programmes make producers responsible for recycling and the key role of PROs. Section 1 provides useful insights on the issues related to recycling markets and organisations, indicating that there are no universal ready-made organisation, depending upon the types of goods (simple or complex durables), the effectiveness of recycling plants etc.

Whether recycling markets are properly functioning (or at all existing), is a key issue that we are currently studying at OECD. Let me mention some of the issues:

When there is a small number of producers, e.g. an oligopoly like in the case of the automobile industry, and when recycled materials have a real economic value, producers do not use PROs, but have direct contracts with recyclers.

In this case, producers have a large control of the life cycle and can impose their prices. The consequence on EPR are twofold: On the one hand, it is not in the producers' interest to encourage a high quality, expensive recycling; this works against the EPR objectives. On the other hand, in order to optimise the life cycle, producers will have an incentive to modify their products (design for the environment).

When there is a large number of producers, whose products are costly to recycle with small markets (e.g. plastics and used tyres), public intervention (regulations) is needed to push the creation of PROs (e.g. Eco-emballages in France).

Therefore the issue of recycling markets is central for a good functioning of EPR, in particular when successful EPR schemes result in large quantities of recyclable products. The OECD is presently analysing how these markets works, or don't work and how they could be made more efficient in particular for 4 waste streams: plastics, used tyres, lubricating oils and construction and demolition waste.

PROs can be subject to free riding when participation is not mandatory. One way to minimise free riding is to set up a *level playing field* through common minimum standards for waste disposal, recovery and recycling. This is why OECD is presently working to develop so called "Environmental Sound Management of Waste" (ESM), *i.e.* common good practices for the management of waste destined for recycling. An OECD Council Act is being elaborated.

Concluding remarks

This paper, once more, indicates the complexities and subtleties associated with EPR: multiple objectives, multiple agents, multiple products, multiple dimensions. The challenge we are facing is to keep EPR within manageable proportions. If it becomes too complex, cumbersome and conflicting with other objectives, it will lose its effectiveness and legitimacy. The best, and probably, only way to foster EPR is to be extremely vigilant as to its economic rationale. This was the very purpose of this workshop to shed some light on this and pave the way for economically sound and well managed EPR policies.

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Part 5: EPR and the Cost-sharing Issue

Chapter 1

SEGMENTED SOCIETY: EXTENDED PRODUCER RESPONSIBILITY AND THE COST-SHARING ISSUE

by

Kazuhiro Ueta, Professor, Graduate School of Economics and
Graduate School of Global Environmental Studies, Kyoto University, Japan
ueta@econ.kyoto-u.ac.jp

1. Introduction

In waste administration of today, the responsibility of producers to carry out recycling and appropriate waste disposal is expanding, at least in developed countries. By the Product Liability Law, rules have been already established as an institution to define the circumstances and the kind of responsibilities that producers should take for damages occurred during the consumption process of their products. In the discipline of waste management policy, it has been proposed as an idea to hold producers responsible for implementing recycling and appropriate disposal of the discard products, even when consumers found no defects in the products during the consumption process. Many countries have introduced this idea as practical institutions, as so-called Extended Producer Responsibility (hereinafter referred to as EPR).

In this article, the background for introducing EPR is overviewed in relation with “Segmented Society”(after-mentioned), and issues of sharing responsibilities emerging from the introduction of EPR, as well as the issue of cost sharing which arises as a new subject, are examined.

2. Formation of Segmented Society

The characteristics and the aims of EPR are to 1) shift the municipalities' responsibilities for waste disposal (a part or all of physical responsibilities and financial responsibilities) to the producers in the upper stream of the product chain, and to 2) give incentives to the producers to take environmental conservation into consideration when designing their products. From the standpoint of viewing the physical responsibility as an inherent characteristic of EPR, among the three methods of EPR defined by OECD (2001), "product take-back requirement" and "performance standards" will be taken into consideration in this article, excluding "economic instruments".

Now, let us examine why it is necessary to expand the responsibility of the producers to the products discarded after consumption. It is definitely because of the significant increase in the amount of waste generation and its deleterious effects. In order to clarify the effectiveness and issues related to EPR, it is important to properly understand an economic mechanism where such tendency has developed.

Mass waste-producing and throwaway society is a reality existing as a result of the market's evaluation and adjustment under current social regimes. In a society like this, we are facing problems such as shortage of disposal site and environmental damage caused by waste disposal.

However, simply recognizing that the problem is the reality existing as a result of the market mechanism is not enough to find a proper solution. What is more important is to pay attention to the mechanism where the function of the market mechanism works to create the waste problems. In other words, it is necessary to focus on the "process" of adjustment made by the market mechanism.

Given that there is a flow of goods such as production, distribution, consumption, disposal and waste treatment, currently production is carried out by producers, distribution by distributors, consumption and disposal by consumers, and waste management of municipal waste is conducted by public sector.

In the process of production, distribution, consumption, disposal and waste management, what is the principle that each unit follows in their decision-making process as an economic agent? The producers' priority in production is not to make waste processing easier. Needless to say, it is rational to think that they make decisions in such a way to maximize the profit and minimize the costs of their production. It should be reasonable to say that they

choose returnable bottles or one-way containers based on the same criterion of judgment. The distributors should make the same kind of judgment as the producers.

With regard to the consumption and the waste disposal by the consumers, while there are some movements or notions to review the recent throwaway-life style, the general standard has been to seek for convenience and low price so that their degree of satisfaction are maximized. In other words, consumers have also been acting without giving consideration to waste disposal.

Now, let us consider the performance standards of the public sector, which exists in the final point of the flow of goods. While many municipalities recently started to conduct sorted collection and recycling of valuable resources, it had been their basic principle to appropriately manage the wastes, viewing its quality and quantity as given. In other words, they had been focusing on implementing the appropriate management of generated waste, without causing interference with the actions made by the producers, the distributors and the consumers. It has been already made clear that this system of the public sector has reached the limit.

In each process of production, distribution, consumption and disposal, each economic agent make decisions of their actions based on their own principles such as profit maximization, cost minimization or utility maximization. As long as the public sector does not make any interference with these decision-making processes, the adjustment by the market mechanism works to create a system where production, distribution, consumption and disposal are done without giving consideration to the waste management, thus establishing a socioeconomic system with mass waste production.

That is to say, though the flow of goods is consecutive, the economic agents concerned in the process is segmentalized and making individual decisions based on their own preference, without pondering whether it is socially desirable. This is the reality of the economic society of today. Consequently, the socioeconomic system as a whole is vastly deviated from the social optimum, generating significant social costs or social loss, particularly in the waste management process. Let us call a society with such socioeconomic system a “Segmented Society” (Ueta, 1992).

3. EPR and Reallocating Responsibilities of Appropriate Waste Disposal and Recycling

The socioeconomic system is segmentalizing the product chain and keeping the system of production, distribution, consumption and disposal that

goes without considering about the waste management. Now, the task is to establish a system where each economic agent makes decisions in consideration of appropriate waste disposal and recycling, so that the impact on the environment could be reduced and the recycling of resources is enhanced. In order to do so, it is necessary to integrate the segmented socioeconomic system. In this context, the question we have to ask is what would be the meanings and effects of EPR.

Under the segmented socioeconomic system, the producers, the distributors and the consumers remain unaware of the issues such as environmental pollution, destruction of nature and regional conflict brought by mass waste generation, therefore, they have no incentive to change the mass waste-producing and throw-away industrial structure and life-style. With regard to general goods and services, as long as the market mechanism as an automatic adjustment structure functions properly, consumers can gain necessary information to change their performance by recognizing the increase or decrease of demand and supply caused by price fluctuations as signals. The price signals persuade, or rather, economically force the producers and the consumers to change their performances. By contrast, in the segmented socioeconomic society, agents concerning the process of production, distribution and consumption behave individually based on their own principle, thus making the public sector solely responsible for the treatment of mass waste generation. There is no system to communicate the issue of waste problem and the relevant costs to all of the concerning agents, thus making no signals or incentives for each agent to change their performances.

These signals and incentives are not self-generating and need to be created institutionally. The most fundamental and plain way is to reallocate the responsibility of conducting waste management taken solely by the local municipalities, so that the above-mentioned signals and incentives would work appropriately. The damages and costs resulting from mass waste generation and its deleterious effects have been entirely borne by the public sector and local residents near the concerning facilities in the final point of the product chain. In order to reallocate such damages and costs to the upper stream of the product chain, various methods can be assumed including making a product charges or charging for hazardous substances found in the products. As described in the definition of EPR by OECD (2001), the most apparent characteristic of EPR is that, while the responsibility for processing the discarded products after its life cycle has been conventionally taken by local municipalities, EPR reallocates the responsibility by holding the producers responsible for the appropriate treatment and recycling of the products.

The question we have to ask here is what would be changed by reallocating the responsibility from the local municipalities to the producers. There are many common characteristics in the contents of the responsibility for the appropriate waste management conventionally borne by the local municipalities, and the responsibility for the appropriate waste management and recycling that EPR imposes on the producers. However, in the strict sense, they are different in many cases, therefore, it is necessary to carry out specific examination on case-by-case basis, as it is not suitable to discuss this issue by and large. Let us now suppose that the content of the responsibility is equally the appropriate waste management. In this case, what would be the meaning of shifting the responsibility from the municipalities to the producers? Since the waste disposal conducted at the cost of public sector will be covered by the private sector, it means a significant difference in relation with the primary payer of the costs for waste management. The term “primary defrayer” indicates that the costs arising from the responsibility given to the producers may shift to other party. Consequently, it is important issue that who will be the ultimate payer as a result of the shift. This issue will be described in detail later.

Now, let us consider what impact would it have on efficiency by changing the allocation of responsibilities for waste treatment. Under a circumstance where Coase’s theorem (Coase, 1960) apply, it has been said that changing the initial allocation of responsibilities would have no impact on the efficiency, since negotiations would be carried out between the concerning¹ agents. However, from the viewpoint of efficiency, shifting the responsibility of waste management from the municipalities to the producers has a meaning that goes beyond the circumstance assumed in Coase’s theorem. What is important is to note that the meaning is not only to change the allocation of responsibilities concerning waste management, but also to integrate the segmented socioeconomic system that has been a factor to produce mass waste disposal. By shifting the responsibility, the producers would incorporate the losses the costs resulting from mass waste generation to their own economic calculation for the production. As a result, they would have incentives to minimize such damages and costs and to improve their product design or selection of materials so that they would be more environmentally sound products. Which is to say, the change in sharing of responsibilities institutionally creates incentives to fundamentally remove the causes of mass waste generation, and in that context, it contributes to realize dynamic efficiency.

1. More thorough investigation is necessary with regard to relationship between efficiency and laws or rules concerning responsibilities. See Mishan (1981) for the sharpest criticism for Coase’s discussion.

The second characteristic of the sharing of responsibilities in relation with EPR is that the reallocation of the responsibilities includes two kinds of responsibilities, namely a physical responsibility that is to actually implement the appropriate waste disposal and recycling, and a financial responsibility to bear the relevant costs. When we compare EPR with other economic measures for implementing waste management, such as emission charges and product charges, EPR can be characterized by the fact that it imposes specific engagements regarding the appropriate waste disposal and recycling as the physical responsibility. In general, an economic measure would give incentives to the agent that is regulated by the measure, but the agent would be able to decide their responses on their own. On the contrary, as EPR specifically regulates what should be done with regard to the appropriate waste disposal and recycling as the physical responsibility, the agent subject to EPR do not have any choice whether to fulfil the physical responsibility or not. They would only be allowed to consider how efficiently (*e.g.* cost efficiency) they could achieve the imposed physical responsibility. In this sense, it is possible to regard EPR as a kind of direct regulation. For example, when a numerical target is set as a recycling rate,² it would be a direct regulation and it could be regarded as a mandatory recycling system. In this case, the recycling rate is set as a target without giving consideration to the efficiency, at least in the context of static efficiency. Therefore, it is not efficient from a general economic point of view. The intension of setting such numerical target is rather to have it act as a trigger in creating technological innovation to achieve the target, so that the costs to comply with the target shall be balanced out. By emphasizing the physical responsibility, it becomes easier to demonstrate a clear principle for determining the direction of the technological innovation, therefore, it is all the more important to present a precise target. It should also be noted that if we try to achieve the same effect by imposing tax, the tax rate could become quite high and cause too much burden.³

4. EPR and the Issue of Cost Sharing

Primarily, EPR is a concept to reallocate the physical responsibility concerning waste disposal, however, it also reallocates the financial responsibility, as it involves the issue of sharing the costs that arises anew. When the responsibility shifts from the local municipalities to the producers, it means that the primary of the costs for the appropriate waste disposal and

². German Packaging Ordinance is a typical example.

³. In regard to this point, it is necessary to conduct strict comparative examination with so-called policy mix, such as combining tax imposition and subsidization.

recycling changes from the public sector to the private economic agents. In general, few people would object to the promotion of recycling in principle. However, when it comes to realizing the idea, it tends to be difficult because of the new issue of cost sharing, in either case of introducing EPR or other public policies. The agent that becomes responsible for the financial responsibility must bear additional costs, therefore, when the change brought by the reallocation is quite drastic, it could be difficult to reach an agreement on the introduction of the policy. This matter of cost sharing often becomes a controversial point among the concerning agents, and there are several theoretical and political issues involved. In this article, the discussions are focused on the issues in relation to EPR and PPP (Polluter Pays Principle).

The first question we have to ask here is whether it is possible to say that EPR is an applied form of PPP. PPP is regarded as a fundamental principle in the issue of cost sharing concerning environmental policy measures, however, we need to clarify whether it follows from this that EPR is created as a result of applying PPP to the waste problems. Turner (2000) describes “green dot” system in Germany as a system established as “an attempt to make polluter pay”, thus regarding EPR as an applied form of PPP.

When it comes to actually applying PPP, there are considerable controversial issues such as what kind of cost should be included in the scope of PPP, or what should be done when the polluters are not in bankruptcy. However, the most important point in relation with EPR is the question of who is the polluter. When we regard EPR as an applied form of PPP, who would be the polluter? In relation with EPR, the polluter is not the direct emitter of wastes. It is rather the agent who is able to integrate the agents acting individually under the segmented socioeconomic system by controlling the product chain, thus reducing the social costs and losses generated by the current product chain. The polluter in EPR is the agent who is able to reduce the social costs generated by the product chain; in other words, it is the agent who is capable of playing a decisive role in controlling the product chain.

The same argument is developed by OECD; by taking as an example the pollution problem of automobile exhaust, OECD (1992) also argues that the polluter should be described as an economic agent who has a decisive role in pollution problems and capacity to perform most efficiently in the pollution chain, rather than an agent who directly emits the pollution, taking into consideration economic efficiency and facility in administrative management.⁴

⁴. The author was given instruction on this point by Mr. Yosuke Asaki, in the doctoral program of Graduate School of Economics, Kyoto University.

It follows from the above discussion that the polluter in EPR is not the direct emitter of wastes, but it is the agent who created the structure of mass waste generation, by not utilizing their capacity to control the product chain. When we consider the reason why they did not use their controlling power, it must be because the system of sharing the responsibility was not established in such a way to enhance them to do so. It means that we are facing an issue of choice with regard to the methods of sharing the responsibilities for the appropriate waste disposal and recycling. From this viewpoint, it is possible to say that EPR is an institutional policy measure that places responsibilities to the agent who has the controlling power, so that they would actually exercise the ability. At the same time, the rules regarding sharing of responsibilities will be an institutional foundation for creating a recycling-oriented society, where the abatement of waste generation, promotion of reuse and recycling are incorporated within the society.

Now, some references to several remaining issues should be made.

The first issue is to investigate the concepts of controllability of the product chain and the agent's controlling power more thoroughly. Various indexes can be supposed, such as technological capacity for recycling, exclusive procession of knowledge and information and options in product design. In general, it is the final producers that have such abilities, however, examinations on possible exceptions should be carried out with regard to the contents and the conditions of the exceptions.

Secondly, it requires some consideration whether it is appropriate to regard the agent who has the controlling power as the same agent who is capable of conducting optimum control of the product chain, including waste treatment, at the minimum cost. If so, it seems possible to utilize the concept of "cheapest cost avoider" (Calabresi, 1970), a concept proposed in relation with a compensation system for traffic accidents, to have a similar formulation for the agent who has the controlling power. If not so, more specific definition would be required to clarify the cases where they would not be regarded as the same.

Thirdly, it is necessary to define both the positive aspects and problems of separately discussing the issue of allocation of responsibility (the physical responsibility in EPR) and the issue of cost sharing (Hosoda, 1999). By separating these two issues variety of the options for the institutional design of EPR significantly increases; therefore it is evident that more flexibility would be secured in the establishment of the institution. However, when separating the issues of allocation of the responsibilities and cost sharing, it should be carefully examined whether the result would be the same with the case when they are not separated, with regard to the structures of incentives and allocation

of the responsibilities. This point is in relation with the issue of shifting the costs and its incidence. More specifically, it means that even when both the physical and financial responsibilities are imposed on the producers at the same time, these responsibilities may still be shifted to the consumers, suppliers of raw materials and laborers through the market mechanism. It may be possible to minimize the needs to make the shift itself by technological innovation, however, with regard to which of the above cases would emerge to what extent, it should be examined on a case-by-case basis, as it depends on the market structure of the concerning product, as well as on the conditions of the industrial organizations. In addition, the consequential result would not be the same with the case where only the physical responsibility was reallocated and the relevant costs are imposed on the other agent. Accordingly, even if the physical responsibility is imposed on an agent who has the controlling power and we separate the issue of cost sharing from the issue allocation of responsibilities, it still remains as an important issue of the institutional design to define an agent as the primary of the costs.

5. Conclusion

EPR is not a definitive concept yet, however, it is a very attractive concept as it institutionally creates dynamic movements of the producers in order to contribute to the establishment of a recycling-oriented society. While it is still in a developing stage as a policy measure, it has already been introduced in many countries and there is increasing number of actions taken as experimental approach. It is necessary to implement an ex post evaluation of such experimental approach and existing institutions, in order to evolve the institutions and the policy measures relevant to EPR, as well as to keep making efforts to clarify the position of EPR within the system of public policy which aims to contribute to the establishment of a recycling-oriented society.

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OECD PUBLICATIONS, 2, rue André-Pascal, 75775 PARIS CEDEX 16
PRINTED IN FRANCE
(97 2004 02 1P) ISBN 92-64-10526-3 – No. 53323 2004