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APPLYING ECONOMIC INSTRUMENTS TO PACKAGING WASTE: PRACTICAL ISSUES FOR PRODUCT CHARGES AND DEPOSIT-REFUND SYSTEMS

ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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ENVIRONMENT MONOGRAPHS

This series is designed to make available to a wide readership selected technical reports prepared by the OECD Environment Policy Committee and the Environment Directorate.

Pursuant to the Recommendation of the OECD Council on "The use of economic instruments in environmental policy, [C(90)177 Final], the OECD has been requested to study the practical possibilities and issues related to the application of economic instruments in specific environmental fields. In this context, the management of packaging waste was chosen as a first area of investigation. This pilot study was carried out under the supervision of the OECD Group on Economic and Environment Policy Integration. The Secretariat gratefully acknowledges the help of Mr Hans B. Vos (DHV Environment and Infrastructures, The Netherlands).

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ORGANISATION FOR ECONOMIC CO-OPERATION AND DEVELOPMENT

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EXECUTIVE SUMMARY

Following a set of general guidelines for the application of economic instruments in environmental policy developed by the OECD in 1991, this report focuses on the potential role economic instruments could play in efficient management of packaging waste. Within a cost-benefit framework, the life cycle of packaging -- ranging from raw materials for manufacturing packaging, to end disposal of packaging waste -- is considered in order to analyse the relevance and applicability of different economic instruments.

Although a wider range of economic instruments could be considered, this report focuses on two types of instruments, product charges/taxes and deposit refund systems, both considered particularly relevant to the issue of packaging waste. The report includes, *inter alia*, criteria for evaluating each instrument's performance, practical considerations, such as the structure of the instrument or the target groups; and key issues which should be addressed when designing, implementing and enforcing these instruments.

PART 1

ENVIRONMENTAL ISSUES AND ECONOMIC INSTRUMENTS

INTRODUCTION

The OECD has in an early stage recognised the growing role for economic incentives in the implementation of environmental policy. In 1989 the OECD report Economic Instruments for Environmental Protection was published (19). This study revealed that the use of economic instruments had increased significantly over the last fifteen years: in the 14 countries reviewed there were over 150 instances of application of economic instruments including systems of financial aid. Since then, the use of economic instruments has continued to increase in OECD Countries. Following this report OECD developed a set of guidelines for the use of economic instruments in environmental policy (4). The Recommendation of the Council on the Use of Economic Instruments in Environmental Policy [C(90)177/final], adopted at the last meeting of the Environment Committee at Ministerial level, instructs the Environment Policy Committee to "develop its work on economic instruments in order to assist Member States on the choice of the most effective policy instruments and to provide information regarding their effectiveness in achieving specific environmental objectives".

Within the framework of the new programme on economic instruments, it was decided to further examine various aspects of operating economic instruments as tools of environmental policy and to develop guidelines for the application of such instruments. This work was carried out under the supervision of the Group on Economic and Environment Policy Integration, in co-ordination with the work done by the Waste Management Policy Group.

In order to arrive at guidelines as practical and specific as possible, this study has been deliberately limited to one concrete subject. Packaging waste has been chosen as a focal point in the analysis, because of the significant share it has in solid waste, of its widespread application and significance as an economic activity, and because of the close attention packaging waste currently receives within the framework of general waste management policy. It is fully recognized, however, that (1) packaging waste management is, or should be, an integral element within the more general framework of waste management, and that instruments applied must be geared towards that purpose, and (2) that other options than those investigated in this report are available as tools of general and packaging waste management.

Furthermore, the report does not attempt to push the use of economic instruments unconditionally, but it recommends about practical aspects of such instruments, when they can be effectively and efficiently applied, compared to alternative approaches, and sets forth guidelines for their practical introduction. In this report, only major characteristics of waste management objectives and of the implication of instruments will be taken into account. Dealing with all the numerous primary and secondary implications of adopting a given policy approach would go beyond the scope of the study.

This report consists of two parts. Part 1 deals with packaging waste as a problematic environmental issue, with (packaging) waste policy approaches, and with theoretical notions as well as practical experiences in the field of economic instruments for waste management. Case studies in this field

(Denmark and the USA) are briefly presented. These findings and experiences imply lessons which should serve as a basis for the drafting of a checklist of practical issues for the use of such incentives.

Part 2 consists of two chapters. Chapter 1 presents *general guidelines* for implementation and use of economic instruments. It contains a policy framework, policy options, a definition and typology of economic instruments, criteria for choice and some ideas about the level of implementation. Here, the full life cycle of packaging is considered, ranging from raw materials for manufacturing packaging to end disposal of (packaging) waste. Therefore, economic instruments available in principle include virgin materials levies as well as waste collection or disposal charges.

Chapter 2 follows with a set of *specific guidelines* for two types of economic instruments: product charges and deposit refund systems. These types of instruments have been selected for further elaboration, not as if they should be superior to other types, but since they are directly related to the issue of packaging which has been chosen as a focal point in this analysis. Although marketable permits also fulfil this requirement, they are ignored in this chapter, due to lack of practical experience.

Chapter 2 has been constructed so that it can be used independently from the other parts of the report. Therefore, in some parts repetitions occur. Chapter 2 presents a definition of the instruments dealt with, their purpose and the criteria for their use. It goes into some detail regarding practical considerations of implementation and use and finally presents a number of key issues.

1. Packaging: a major environmental issue

1.1 Definition and role of packaging

The term "packaging" includes all materials of any nature (containers, wrappings, pallets) for the containment, handling and the delivery of any product, from raw materials to processed goods, from the producer to the user or consumer. Packaging can be subdivided in three categories (19):

a) Primary packaging is packaging used for protection of the packed product, or to make the product transportable and for security and marketing purposes.

b) Secondary packaging that is used for transports to the distribution network (boxes, crates containing products).

c) Tertiary packaging that is used for bulk transportation (pallets bearing boxes, crates)

Packaging is an important economic phenomenon. The share of the costs of packaging in the sales price of consumer products ranges from 2 per cent for liquors to over 20 per cent for drugstore and hobby products. In the distribution sector, 25 per cent of the costs are related to packaging. Packaging can contain advertisement information and prescriptions or warnings. Finally, by simplifying handling and transportation and by preserving product life, packaging permits the processing of foods and beverages and the manufacturing of products in larger facilities at a small number of locations serving a larger geographic area.

Packaging plays an important role in the economy and has many valuable functions which should not be overlooked when seeking instruments to reduce packaging waste. Packaging has facilitated the rise of supermarkets by replacing personal service, since it permits easier handling through standardization. It protects products against external influences (rough handling, weather, theft, contamination), and it also protects people against products when containing hazardous substances. Furthermore, it extends product life (food) and reduces spoilage.

A change in the type of packaging might result in a change of the existing production and distribution infrastructure resulting in considerable economic effects, e.g., the introduction of refillable PET-bottles might be quite easy if extensive use is already made of refillable containers (Germany, the Netherlands, Scandinavia), but it might prove to be expensive if the beverage market is dominated by disposal containers (USA).

To further define and structure the scope a distinction of appropriate categories of packaging must be made. A first point of discussion in the framework of this project is the selection of sources of packaging waste. Roughly, three sources can be distinguished: 1) households, 2) offices, services and shops, 3) industry. Sources 1) and 2) approximately produce three quarters of the total packaging waste generation (17). They cannot always be separated clearly, since both contribute to the municipal waste stream. Some (gradual) differences between industrial and consumer packaging are:

Consumer packaging	**Industrial packaging**
Large variety of materials	Limited variety
Sometimes composites	Mostly one material
Mainly food packaging	More dangerous substances
Mostly throw-away	Traditionally more return systems
Large dispersion after use	More concentrated
Municipal collection/disposal	Commercial reprocessing/disposal

Due to their characteristics industrial packaging management makes a greater use of return systems and recycling than municipal waste management. Industrial packaging is treated as an economic item. Economic instruments are likely to have a much smaller role in industrial packaging management. Accordingly, this report has been restricted to consumer packaging only.

1.2 Key facts on packaging

Packaging mainly consists of six types of materials: paper/paperboard, glass, metal, plastic, wood and other. The data for the amounts of packaging materials in the waste stream are of variable quality. More than once governments and industries disagree about the figures presented. Countries use their own definitions for measuring packaging waste, making international comparisons difficult.

The shares of each of these materials in the packaging waste stream varies among countries. Paper and paperboard are the largest component: 40 to 60%. of the total weight. The percentages of packaging recycled vary considerably among countries and types of material. Table 1 gives some rough indications.

Table 1. **Rough Indications of the Share of Various Materials In the Packaging Waste Stream and of the Percentages Recycled (OECD)***

Material	Share in packaging waste	Percentage recycled
Paper/paperboard	40 to 60 %	20 - 50 % **
Glass	10 to 20 %	10 - 60 %
Plastics	10 to 25 %	< 5 %
Metal	< 10 %	10 - 80 % ***
Wood	< 5 %	--
Other	< 1 %	--

* Recycling does not include reuse; figures are base on weight
** Figure for paperboard
*** Aluminium cans

Source: based on (3)

Paper/paperboard

Paper and paperboard represent the largest component of the packaging waste stream in virtually all OECD countries. In the United States, for example, they constitute 58% of packaging waste by weight and 49% by volume. In other countries for which data are available, the percentages are somewhat smaller: in Canada paper constitutes 49% of packaging use, by weight; in the United Kingdom 50%, in the Netherlands 46%.

The most important component in paper/paperboard waste are corrugated containers (e.g. 70% for the USA). High recycling rates exist for this component (up to 51% in the USA). Recycling of other components is as yet considerably lower. Policy measures taken in a number of EC countries will expectedly boost the volume of waste paper recycled. It is important that investments in plants for processing waste paper keep up with these developments.

Glass

Glass is the second most prevalent packaging material in the OECD countries by weight, although it ranks lower by volume. Unlike paper the amount of glass in the waste stream is generally not expected to grow in the future. For economic reasons one-way bottles and other glass packaging meet strong competition from other types, such as plastic and composite packaging. Furthermore, under the influence of environmental policies in most countries, there is a tendency to replace one-way glass packaging by returnable packaging, under a deposit-refund system. For glass, recycling methods are relatively well-developed. Bring systems dominate.

Plastics

Unlike consumption of paper and glass, where US levels are as much as double the European levels, European consumption of plastic packaging is slightly greater than that of the USA. As a result plastic packaging generally represents a substantially higher percentage of total weight of packaging waste in Europe: 24.7% for the Netherlands, for example, as compared to 12.7 % in the USA. Although it is difficult to develop precise measures of plastic volume, plastic packaging probably occupies a greater volume of the waste stream than its weight indicates in most countries. In the USA, where EPA developed a methodology for assessing both measures, plastic packaging of total packaging by volume is estimated to occupy 27.4% of total packaging by volume, more than double the percentage it accounts for by weight.

Plastic packaging is dominated by five materials. One of these, polyvinyl chloride (PVC), is under a phase-out procedure in some countries, on the basis of the assumption that it causes severe environmental problems when disposed of (notably in incineration plants). Polyethylene terephtalate (PET) is used for beverage packaging, both one-way bottles and returnable bottles. Polyethylene (PE), polypropylene (PP) and polystyrene (PS) are used in may forms. This makes it difficult to efficiently recycle plastics, because these must be separated by hand from the waste stream, or technologies and markets for mixed plastic recycling must be developed. It is often argued that incinerating plastics in a waste-to-energy plant is a more favourable option.The variety of resins used to produce plastic packaging increases the difficulty of processing them for recycling as resin separation must frequently be done by hand

Metals

Metal packaging consists mostly of steel and aluminium. Steel packaging, like glass, is a decreasing application for food and beverages, replaced by lighter materials such as plastics and aluminium. In the US, for example, steel packaging has declined from 4.6 mln tons in 1960 (16.8% of total packaging) to 2.8 mln tons (4.9% of the total) in 1988. A further decline to 2.0 tons (2.4% of the total) is projected for the year 2000. Aluminium cans are increasingly being recycled. Deposit-refund systems play a crucial role here, as is shown in countries like Iceland, Sweden and in some States in the USA, where such systems facilitates return percentages of over 70%.

Wood

Wood packaging occupies a small and declining share in the packaging waste stream in most OECD countries. In the USA for example, generation of wood packaging is essentially unchanged since 1960, at 2.1 mln tons per year. In 1988 this constitutes slightly less than 4% of total packaging, down from 7.5% in 1970.

Other

Other materials play a minor role. The position of composite packaging is complicated. The best-known type is the three-layer aseptic container for liquids. This packaging is economically favourable. The light weight of this packaging and the ability to forego refrigeration have resulted in major changes in the milk market. In West-Europe, for example, 60% of milk products by volume are now delivered in multi-layer cartons, against 30% in 1976. Composite packaging is difficult to recycle due to the multi-layer structure. There is a growing pressure on producers of such packs to develop recycling facilities.

1.3 Main environmental issues

The OECD countries produced 420 million tons of municipal waste annually in the late 1980s. The composition and the definition of this waste varies from one country to another, but in most countries packaging occupies a significant place. In those countries that have estimated the amounts, packaging generally comprises one-quarter to one-half of the municipal waste. There are also significant amounts of packaging in industrial and commercial waste streams.

Data concerning packaging waste are summarized in Table 2 (viz. 3). The total amount generated in OECD countries is in the order of 140 mln tons annually.

While there are many advantages, at the same time there are problems. These problems are not unique to packaging: the use of heavy metals, for example, in colouring, as plastic stabilizers, and in closures, is one of the many ways in which such metals enter the waste stream. The growth in the volume of packaging material, while dramatic, is matched by the growth of many other non-packaging wastes. But packaging has drawn particular attention due its short life and its, in quite a few cases, superfluous nature in the eyes of some.

Upon examination there is little doubt that the amount of packaging material in the waste stream has grown dramatically. To give just two examples, since 1948 paper, glass, metal and plastic have increased their combined share of the municipal waste in Paris from 13.5% to 61.8%. In the US, since 1960, packaging and containers have increased by nearly 30 mln tons (108%). Other countries have had similar experiences. Packaging now accounts for a significant percentage of the municipal waste stream in OECD countries.

As a major component of municipal waste, packaging uses scarce space in landfills which have to compete with other spatial destinations. In densely populated countries, the availability of space for new landfills is diminishing, and, in general, costs of landfill disposal are raising, partly as a consequence of stringent environmental requirements regarding landfill construction.

A very visible environmental problem of packaging is litter. This is manifest both on land and in water bodies.

Although packaging is only a portion of overall metal, glass, plastic, and paper production, the production of packaging is a source of air and water pollution. Air pollution concerns an increase in carbon dioxide concentrations and of ozone layer damaging gases like CFC’s, and a number of voluminous contaminations (carbon monoxide, sulphur oxides, nitrogen oxides, hydrocarbons and particulate). Major sources of air pollution, mainly found in the production and distribution stages, are the generation of energy, oil refineries, ore melters and the metal industry, chemical industry, glass industry, the pulp and paper industry and transportation. The packaging industry itself emits CFC’s when producing foamed

polystyrene. CFC's are subject to a phase-out under the Montreal Protocol. Incineration of waste contributes to air pollution.

Water pollution includes sediments, nutrients, oxygen-demanding substances, toxic substances (heavy metals and micro pollutants) and the emission of thermal energy from cooling. Each of the industries producing package materials or packaging, as mentioned above, cause water pollution. The paper and pulp industry is a dominant source, but also the metal industry is a large source of water pollution. After disposal packaging can cause water pollution as a consequence of contaminated leachate in landfills.

Table 2. **Packaging Waste Generated in OECD Countries, (Late 1980s)**

Region/Country	Total Packaging (million tons)	Amount per Capita (Kilograms)
European Community	50.5	154
Belgium [1]	1.7	270
Denmark		
France	10.0	181
Germany	15.0	127
Greece		
Ireland		
Italy	6.0	109
Luxembourg		
Netherlands	2.3	155
Portugal		
Spain		
United Kingdom	7.7	134
Other OECD Europe		
Austria	1.0	132
Finland	0.4	85
Iceland		
Norway		
Sweden		
Switzerland		
Yugoslavia		
North America		
Canada	6.3	220
United States	56.8	210
Asia/Pacific		
Australia	1.7	100 [2]
Japan	20.0	163 [3]
New Zealand		
OECD Total	140.0	

Source: (3)

[1] Flemish region only
[2] Domestic waste only. Total packaging may be double this amount
[3] Data for Canada and Japan represent consumption of packaging, not waste. Waste data would likely be substantially lower.

1.4 Objectives of waste packaging policy in OECD countries

As a result of the growing amounts of packaging in the municipal waste stream, an increasing number of OECD countries appear to be in the process of deciding that it need not be so. That is, while increased use of packaging may correlate with the degree of economic development, the presence of packaging in the waste stream need not.

Furthermore, in recent years, waste disposal capacity has become scarce in most OECD countries. As a result, waste management policies have focused on efforts to reduce and recycle major components of the waste stream, including packaging. Measures to reduce the amount and toxicity of packaging and to encourage its recycling are currently being considered in at least 18 OECD countries: Austria, Australia, Belgium, Canada, Denmark, Finland, France, Germany, Italy, Japan, the Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland, Turkey, and the United States. In addition two groups of countries, the European Community and the Nordic Council are developing programmes to address packaging on a regional basis.

Quite generally, objectives of waste management policies in OECD countries encompass (17):

a) A reduction of the quantity of waste (by weight and by volume) and its toxicity;
b) An increase of reuse and recycling;
c) Energy recovery through incineration;
d) A reduction of the amounts of waste incinerated and landfilled.

In many countries quantitative targets are being (and have been) formulated, which are explicitly elaborated for packaging waste.

The EC made a proposal for a Council Directive on Packaging and Packaging Waste (1) in which the following elements were included: quantitative targets for packaging are included. They are: an overall recovery of packaging waste through recycling, composting or incineration to produce energy, of 90% and a recycling of 60% for each type of packaging material. The Directive is said to come into effect in 1995, giving member states an additional 10 years to fully implement it.

1.5 Main policy approaches and instruments: regulation, economic instruments and agreements

Policies that might succeed in reducing packaging waste are still being sought, but among the measures being tried, there are at least three common principles.

First, there is an effort (through a wide range of measures) to shift *de facto* responsibility for managing packaging waste away from government and onto the shoulders of those who produce and use it. An example for Germany is presented in Section 1.6. In the German approach producers of packaging are held responsible for taking back used packaging and for proper recycling or reuse. Quantitative targets have been set. In the Netherlands industry and government have agreed on a Packaging Covenant constituting targets and measures for reduction and recycling of packaging waste. Although voluntarily settled, it is legally possible to enforce this covenant.

Second, there is broad interest in measures to stimulate reuse and recycling of packaging materials. The financial incentives dealt with in this report are instrumental to this approach. Mandatory deposit-refund schemes and charges on packaging are the most prominent instruments in this approach. Mandatory deposit-refund systems are found in Canada and in the Nordic countries and in parts of the United States and

Australia. Nordic countries, some parts of Canada and Italy apply charges on packaging. Throughout the OECD many local authorities stimulate kerbside collection or bring systems for used packaging.

Third, bans exist on certain materials used in packaging manufacturing. There is broad agreement that the use of toxic substances (particularly heavy metals, and PVC) must be phased out of or reduced in packaging. Denmark has banned the domestic use of metal cans for beer and soft drinks by a prescription of types of packaging allowed for these beverages. Banning is an example of the "command-and-control" type of policy.

1.6 Involving the private sector: The Dual System in Germany

In the management of waste packaging, the active involvement of all actors concerned is of crucial importance. The Dual System in Germany is an attempt to promote an active participation of the private sector. We present an overview and analysis of the approach taken in Germany for reducing packaging waste. The "Duales System" (DS) is a bring system and kerbside collection system. It is financially facilitated by a product charge on approved types of packaging.

"Verpackungsverordnung"

The DS is designed to prevent, reduce and reprocess packaging waste from households. The DS is legally based on the "Verpackungsverordnung" that passed parliament in 1991. This directive discerns three types of packaging: 1) packaging for transport, 2) secondary packaging, 3) primary packaging. Transport packaging must be taken back after use by the manufacturer or the user for reuse or reprocessing. Secondary packaging which is often applied for protection against theft or for advertising, should remain at the point of sales where it should be returned for reuse or reprocessing. As to primary packaging, shops are compelled to take back packaging of the products they themselves have sold. The directive will come into force in several stages, from 1991 to 1993 on.

In order to support the return system, deposit-refund systems will be introduced for three types of products: beverages, detergents and paints. Deposits will range from ECU 0.25 tot ECU 1.00.

The following objectives for the DS have been set. As to collection, by 1995 at least 50% of all packaging must be collected. From then on, collection quota should raise up to 90% for each packaging material, i.e. for glass, paper, metals, plastics and other packaging material. As to sorting, from 1995 on sorting quotas for glass, ferrous materials and aluminium should reach 80%; for all other packaging materials 80%. The existing return systems for beverage bottles must be conserved. Percentage of bottles returned must not drop below the current 72% except for milk for which a percentage of 17 is fixed.

"Duales System"

The DS is set up and will be operated privately. All parties concerned (packaging industry, retailers, fillers, raw materials suppliers a.o.) have established the "Duales System Deutschland GmbH" for organisation of the collection and reprocessing system. Participants put a green dot on their packaging products identifying these as belonging to the DS. Participants pay a license fee for the green dot which varies between zero and ECU 0.10 per packaging unit.

DS will make use of the existing collection systems, such as street boxes for waste paper and used glass (bring system). For other materials (plastics, metals, composite packaging), municipal kerbside collection will be extended with an additional bin ("Wert Tonne", or "value bin") in which these materials can be separately collected.

Impact

The impact of the DS can be evaluated in terms of its environmental effectiveness, its economic efficiency and of practical problems related to implementation. Since the system is now in its early stage of implementation, statements made below are expectations only.

Expectations about the effectiveness of the system should largely be based on expectations about attitudes of the main groups of actors in the system: industry, retailers and consumers. Retailers will have a keen interest in establishing the Dual System, in order to avoid having to establish many deposit-refund systems for a large number of consumer products. If they succeed in only allowing products with a green dot in their shops, collection of primary packaging can be left to DSD. If they do so, industry will be forced to apply for the green dot, for which it has to pay the license fee. If, however, parts of industry succeed in marketing products without the green dot, which will be cheaper than the "green" products, retailers who sell these products are able to free-ride on the DS. Then, there will be a fair chance that collection and sorting quota standards will not be met, causing the obligation for retailers to establish deposit-refund systems which implies that the DS will collapse. Then, all retailers, free riders included, will have to bear the higher costs of many different deposit-refund systems.

Producers pay a license fee for the green dot. Furthermore, since they are responsible for their own packaging waste, contracts must be made with recycling firms. This might require extra payments, inducing producers to search for packaging materials that are easy to recycle. This might trigger innovations in the packaging industry.

Much will depend on the co-operation of the consumers, in two ways. First, if not all retailers participate in the system by only accepting products with a green dot, consumers may shift to these retailers and receive a price advantage. Secondly, consumers must contribute by returning packaging waste to glass and paper boxes in the streets and by correctly using the "value bin". No other incentives for consumers exist than making these provisions readily available to consumers, and by appealing to their environmental consciousness. Possibly, a different method for calculation of the waste disposal fee might provide an extra incentive. Currently, disposal fees are fixed on a yearly basis. Furthermore, they are too low, since scarcity rents of disposal space and damage from waste disposal are not included. If such fees include scarcity and damage elements and if they will be better based on individual volumes of waste offered, households might be more willing to contribute to the DS.

Whether the DS will be an efficient system depends on the allocation of sources within the system, as well as in the economy as a whole. This, in turn, depends on whether the prices of the goods involved correctly reflect scarcity. A main variable in the system is the license fee for the green dot. Since september 1993, this fee is calculated on the basis of packaging weight and operating cost of the system.

As to the overall efficiency of the system, no data are available to date. It is not possible to objectively judge whether the Dual System is more efficient than, say, a combination of deposit-refund systems and product charges (like the Danish case; section 3.2.1).

For a successful implementation a number of problems must be tackled. The participation of households is crucial. Empirical evidence indicates that collection quotas of over 50% have already been achieved. It is estimated that the 80%-objectives of the "Verpackungsverordnung", will be reached by 1995.

Another problems is the way packaging waste will be sorted in the households. Only 20% of paper waste is packaging materials. This is 84% for plastic waste and nearly 100% for other materials. Additional measures have been taken in order to prevent that DSD will have to collect and reprocess a fair amount of paper and plastics, for which the costs are not covered by the green dot license fee.

A major unsolved problem is the reprocessing of plastic waste. To date revenues of marketing secondary plastics do not cover the costs of collecting, sorting and reprocessing. New applications have to be developed, which have less overall environmental impacts than virgin production.

There is not a formal trade barrier in the obligation for the beverages industry to maintain a high percentage of returnable bottles. Neither will it necessarily reduce efficiency. On average, foreign producers will face higher transport costs which will induce them to use one-way bottles. An efficient mix of returnable and one-way bottles will be established if external costs of one-way bottles will be internalised through a charge, leaving room on the market for one-way bottles. However, in practice, foreign firms operating on the German market may face problems, especially as a result of the take-back obligation. Moreover, German firms could employ strategic behaviour in defending the domestic markets by using up the quantities allowed for non-refillable bottles.

To the extent that DSD collects materials for which there is no market in Germany and which are then exported, there is the potential to damage merchant systems for reclamation in other countries.

1.7 "Eco-emballages" in France

In France from the 1st of January 1993 any producer and any importer whose consumer products are sold in packaging has to contribute to or to be engaged in the recovery of 75 per cent of all packaging wastes by the end of the year 2002. To achieve this end, Eco-emballlages, a private company charged with recovering packaging waste, has been created. The French Government has given the company a 6 six years mandate.

Eco-emballages acts as a bridge between the followings participants in the system for reprocessing packaging waste: the producers and the importers of consumer packaging, the local authorities and the packaging materials recycler. This is accomplished by: (i) providing enterprises with common services for packaging collection and recovery; (ii) providing financial assistance to local authorities participating in the collection and program by sorting out packaging waste.

Producers and importers who take part in Eco-emballages will pay a fee on marketed packaging (ranging from 10 to 0.1 centimes according to packaging type). In return, Eco-emballages will award a certifying label, the Green Point, and will commit itself to design and set up the system for reprocessing packaging waste (paper, plastic, glass, steel, aluminum, composite packaging).

Participating local authorities will have to develop a collection system, and plan over the next six years the means for reprocessing packaging waste and meeting a 75 per cent reducing target by 2002. Eco-emballages will share the extra costs for collecting and sorting and will work to: (i) support the flow of materials for reprocessing; (ii) guarantee that these materials will be taken back; and (iii) support communication, information as well as research activities (pilot-projects, R&D for reprocessing and recycling of packaging waste.)

Finally, Eco-emballages will reach agreements contracts with the packaging material recycler, for glass,and aluminum, e.g. establishing the quantity, and the technical quality and the prices of the recycled materials.

It is important to point out that Eco-emballages will form an essential bridge between local authorities and the packaging material recyler, because it will guarantee a sufficient flow of material to make the process efficient.

Up to now, 1,700 contracts have been prepared and about 3,000 enterprises are taking part in Eco-emballages, covering half of the expected budget (400,000 ff). Since Eco-emballages was set up only recently, it has not been possible to evaluate the performance of the system.

2. Managing packaging waste and economic instruments: a conceptual background

2.1 A theoretical foundation

Introduction

Because of a combination of interrelated "failures" (information deficiencies, lack of a system-wide perspective in waste management policy and market failure), the waste collection and disposal service for municipal solid waste is not costed on the basis of marginal social costs. Actual waste management policy and practice in Member countries are likely to be less efficient and environmentally effective then it could be.

The last several decades have also witnessed a growing environmental quality awareness amongst both politicians and society. Policy-makers are now demanding that waste disposal and/or resource recovery/recycling options be both cost-effective and environmentally sound. The Polluter Pays Principle also lays down that both producers and consumers should pay the full social costs of their actions and that the assimilative capacity of the environment should not be underpriced because of the risk of over-utilisation, i.e. a non-efficient use of environmental functions.

Economic analysis can be used to show that too much waste (including packaging waste) will be produced, when the environmental damage cost (external costs) related to the waste is not reflected in the prices of the products initially produced and consumed in the market or in the price of waste disposal. The market will fail to allocate resources efficiently if prices fail to reflect full external cost. If the proper external costs of landfill, incineration and composting are not reflected in prices in the market place, too much waste will be generated putting pressure on the assimilative capacity of the environment, and a bias against most reuse and recycling activities will prevail.

Conceptual framework

For the presentation of a conceptual framework for deciding about implementation of economic incentives in packaging waste management, the following basic questions arise:

a) What volume of packaging waste should be disposed of to final receiving environments (land, air, (ground)water)?

b) Given that this target amount is less than the actual amount, what combination of recycling and/or source reduction should be employed to reach this target?

c) Given the level of recycling aimed at, how should alternative recycling technologies be chosen.

d) What policy instruments should be used to achieve these targets?

Source reduction means prevention of waste generation by reducing the use of packaging, by reducing the use of materials in packaging or by shifting packaging from one type to another, less voluminous or lighter one.

All of these questions can be answered, in efficiency terms, by adopting the economic principle of cost-benefit analysis (CBA), whereby no option is chosen unless benefits (B) exceed costs (C); and the optimal scale of activity for any choice is the point where the difference between benefits and costs is maximised. It should be recognized that B and C can considerably vary over time, so that predictions for a longer time period should be made.

Scheme 1. Economic balance for recycling

recycling is justified if:

a1) the difference in materials prices to materials users
+a2) the difference in other production costs
+ b) the difference in external costs between using virgin and recycled inputs
+ c) the difference in collection costs
+ d) the savings in final disposal costs

is positive

The scheme for reuse (the use of refillables) is only slightly different from the one presented above.

Scheme 2. Economic balance for reuse

Reuse is justified if:

- a) the difference in production costs of one-way and refillable containers
- b) the costs of cleaning refillable containers
+ c) the difference in external costs of using one-way and refillables
+ d) the difference in collection costs
+ e) the savings in final disposal costs

is positive.

Scheme 3. Economic balance for source reduction

Source reduction is justified if:

- a) the difference in production costs
+ b) the savings in collection and final disposal costs

is positive.

The economic efficiency criterion requires that the marginal benefits of reduced final disposal (= avoided damages) be equated with the marginal costs of preventing waste from reaching final disposal. Further, the costs of "further disposal prevention" comprise source reduction costs and recycling costs, such that the prevention cost function is the least cost combination of the available technologies.

In other words, whether recycling, reuse or source reduction are socially profitable depends on the relative balance of cost savings and cost increases. This finding is important since the presumption that such measures are always socially worthwhile, even if not privately profitable, is widespread. Increased recycling, for example, may actually increase resource flows through the economy, rather than decrease them if economic analysis is neglected when recycling target levels are set.

Recycling is not necessarily always a "good" thing despite the fact that recycled materials usually require less energy and cause less pollution than their virgin counterparts. Also recycling is not a limitless process: for instance, paper fibres degenerate each time they are reused. In economic efficiency terms, these

recycling activity gains, when they are present, have to be set against a number of other possible losses, and can also be augmented by at least one further social gain (disposal cost saving).

On the loss side, all recycling and reuse systems require some type of materials collection process the costs of which can be quite significant. Collection costs for recyclable materials depend critically upon whether a "bring" systems (householder takes waste to collection point) or "collect" system (kerbside pickup) is operated, and on the extent of prior separation of materials otherwise mixed together as general solid waste. Typically, but not always, bring systems are cheaper, but will tend to produces lower quantities of materials. For reuse storage and handling costs for retailers and wholesalers can be significant. Nevertheless, there is scope for raising the net revenues derived from recycling schemes by encouraging higher householder participation rates and improved scheme design and operation which lowers costs (particularly collection and processing costs). Participation for reuse is encouraged by introducing a deposit-refund scheme.

As disposal costs rise, recycling and reuse will, other things being equal, increase in financial attractiveness. Simple comparisons with respect to the relative costs of recycling and disposal are not possible. At low collection costs the most important determinant of scheme profitability is usually the revenue from materials sales. At high collection costs, recycling is systematically unprofitable. For reuse the additional costs of refillable containers, the trippage and handling costs are decisive.

The setting of environmental targets, such as percentages recycling and reuse targets, may represent feasible possibilities but still not result in net reductions in total waste flows. Target-setting under a *command-and-control* regulatory approach can easily result in a net increase in the physical use of resource, because the resources used up in the waste reducing policy (ie, source reduction, recycling or reuse) exceed the waste reduction achieved by the target.

On the other hand, the economic approach, i.e. the use of economic instruments, can be more efficient if the above mentioned factors are properly internalised. This is why the role of economic instruments in the management of packaging is increasingly considered.

2.2 Economic instruments: their role in waste management

The principles of the economic approach to environmental policy has now been generally accepted in most industrialised countries. It stresses the advantage of economic instruments which seek to modify human behaviour through the price mechanism. Economic instruments can be deployed to correct for market failure and they have the further advantages that they fit neatly into the cost-benefit approach and principle of management defined above, as well as possessing a revenue raising capacity. Economic instruments in themselves mitigate the problem of information failure and they will also require careful deployment, with due regard to systemwide effects and the need for an integrated waste management strategy.

Although, principally, the role of economic instruments is to fully internalise all social costs of waste generation and management, in second-best conditions correct pricing schemes are not always obtainable. If, for example, the costs of nature degradation through landfilling are unknown, correct waste disposal tariffs are not accountable. If so, there is a role for authorities to decide about the maximum level of waste disposal (target setting). Then, economic instruments, e.g. waste disposal charges, become instrumental to achieving such targets through the market mechanism.

A range of different economic instruments could potentially be employed, including product charges, virgin materials taxes, waste collection or disposal charges, unit pricing, deposit-refund systems, marketable permits and recycling credits. As a general rule economic instruments should be applied in such

a way that market failures are corrected in a direct way. Thus, if packaging is at the core of the analysis, product charges and deposit-refunds are relevant instruments for further investigation.

Optimal point for Government intervention

Regarding solid waste generation, the issue is *where* in the solid waste generation and disposal system is the appropriate point to apply incentive-based policy: at the point of manufacture, purchase, or at the point of disposal. In general, incentives applied "downstream" or at the point of disposal (unit pricing) are regarded as more efficient to incentives applied "upstream", at the point of purchase or manufacture.(3).

For example, it would be extremely difficult to determine the appropriate tax to place on the sale of any particular item to reflect the social cost of product disposal. The social cost of disposal depends upon how the consumer chooses to dispose of the product and this is impossible to determine at the point of purchase. Similarly, intervention at the point of purchase or manufacture may affect product uses which do not create any solid waste problem (e.g., exports). Finally, the optimal mix of reuse, recycling, source reduction, and disposal varies across communities according to: population density, geological characteristics, industrial bases, natural resource endowment, etc. In contrast to incentives applied at the point of manufacture, unit prices are easily set to account for these differences.

It should be noted that there are specific instances where it may be desirable to intervene at the point of manufacture or purchase *as a supplement* to unit pricing. For example, the social costs of disposal may be higher than what can be captured by volume or weight-based fees for products that pose serious environmental threats (e.g., household hazardous wastes).

However, in some instances "upstream" taxation of inputs may be useful to influence the composition of the product and waste, e.g. a tax on chlorine to prevent PVC in incineration. Other economic instruments can have an indirect effect on packaging: for instance, an increase in energy prices could lead to an increase in reuse and recycling as the energy requirements of reused and recycled material from aluminum, non-ferrous metals and plastics is smaller than for packaging made of virgin materials.

Applying unit charge for solid waste disposal is a more direct approach to correcting for inefficiency in the municipal solid waste system than are upstream interventions. The fundamental efficiency lies in the manner in which solid waste service fees are assessed. Typically, households pay a flat monthly fee for solid waste services (or the costs of these services are embedded in property taxes). Because fees for waste services are a small proportion of expenditure and taxes of household and because they do not vary with the quantity of waste generated, they do not alert households to the social costs of solid waste generation. As a consequence, households choose a sub-optimal mix of waste management practices (e.g., reuse, recycling, source reduction, and disposal). This inefficient price is also transmitted upstream to manufacturers as consumers demand products without regard to solid waste disposal costs.

2.3 Types of economic instruments

Product charges

Product charges are output taxes as surcharges on the price of packaging. They would be related to the potential waste disposal and pollution impact. Products fully made from recycled materials should be exempted and products partly made from recycled materials and refillable containers could face a lower charge.

Virgin materials tax

A virgin materials tax is an input tax on raw materials used for the production of packaging products. The tax would be related to the damage done by production and consumption of the packaging, plus a scarcity premium if relevant. This tax is aimed to reduce the use of virgin materials (source reduction) and favour the use of recycled materials. As to avoid double-counting, virgin materials taxes and product charges should be operated mutually exclusively, or the virgin materials tax should represent a scarcity premium only.

Waste charges

Waste charges may be levied either on collection or on disposal of waste. Waste collection charges are user charges in the first place, the revenues being used for financing collection (and disposal) of waste. If calculated individually, waste collection charges can have a regulatory impact. Waste disposal charges is an end-of-the-chain charge, increasing the costs of finally disposing of waste. They would represent any (external) costs not already incorporated in traditional costs of waste collection and disposal. They are indirectly related to disposal of packaging, as far as packaging is a component of the waste on which the charge has been imposed. Once again, double-counting may occur if product charges or virgin materials taxes do already contain elements related to external costs of landfills.

Unit pricing

One specific form of waste charge applied to municipal waste is the unit pricing. It refers to any waste management system that charges customers on the basis of the amount of waste they generate. This method of managing municipal waste has many variations; the unit price can be assessed on the basis of weight, volume, or both. In all cases, the additional cost of increased service encourages consumers to take greater care in their waste generation practices. Specifically, generators may increase their source reduction/reuse behaviour or may step up their recycling efforts-ultimately reducing the amount of mixed waste they dispose of. At the same time, unit pricing provides communities or haulers with a new source of revenue stream and, quite possibly, lowers collection and disposal costs. Unit pricing has become increasingly popular in the United States in recent years.

While unit pricing has shown promise as an alternative for managing municipal solid waste, a number of questions remain unanswered. The first area of uncertainty is in the impacts of unit pricing on a community's total costs of solid waste management. The evidence indicates that unit pricing reduces the amount of waste that must be landfilled. This in turn, lowers costs for collecting and disposing of solid waste by traditional means. However, unit pricing also increases the amount of recyclable that a community must handle, raising recycling costs. Revenue from selling recovered material might however offset some or all the increased cost of recycling. The impacts on total waste management costs depends upon which effect dominates. Further, little is known about the size of administrative, enforcement and implementation costs associated with switching to a unit pricing programme.

Finally, because unit pricing encourages households to reduce consumption of conventional disposal services, it encourages households to adopt other disposal options, some of which may be illegal or otherwise undesirable (e.g., littering and backyard burning). Anecdotal evidence suggests that, at worst, this type of behaviour is problematic only in the short run. Further, it may be fairly easily remedied by passing new statutes or stepping up enforcement of existing ones that, for example, ban backyard burning of solid waste. To-date, no rigorous analysis of the extent to which unit pricing encourages these perverse types of behaviour has been produced. Until more is known, little can be said about the net environmental impacts of unit pricing.

Deposit-refund systems

Deposit-refunds essentially are product charges which are refunded if the charged products is prevented from final disposal. The difference between these two instruments lies in the point of impact: a product charge on packaging may influence the behaviour of producers who use these products, whereas DRS operates one step further in the chain and should modify consumer behaviour. Product charges leave more freedom to the system: producers are free to shift to DRS. DRS, if mandatory, does not provide that freedom. DRS and product charges can be combined: product charges will have a lower impact on the price of products as the trippage increases. If the refund is smaller then the deposit, an implicit product charge occurs.

Marketable permits

To date, marketable permits have not been found in the field of packaging waste management. One may envisage the application of marketable permits in relation to a "legislation-driven" level of recycling, share of returnable packaging or recycled content standard. Producers who exceed these standards may earn credits which can be sold to producers who are, temporarily, not able to comply. If a market will be established, marketable permits can have an negative effect of private costs of recycling, new materials technologies, etc.

Recycling credits

Recycling credits are payments to those who reuse containers or recycle materials, saving them from waste disposal. Payments equal the saved costs of waste collection and disposal. The instrument might be applicable on the local level, in situations where municipal waste collection and disposal is financed from the general budget. Recycling credits may increase recycling capacity.

2.4 What can be expected from the use of economic instruments?

Impact of instruments

The role each of these instruments has to play within the framework of waste management economics, as elaborated above, is summarized in scheme 4 and illustrated in terms of the schemes presented in Section 2.2.

It appears that such instruments influence the prices of materials used in packaging products, the costs of producing various types of containers and the costs of final disposal of packaging waste.

The impact of marketable permits depend on the exact application, e.g. the costs of one-way containers will raise if marketing of such containers is restricted to permit holders and related to the number of permits they have.

DRS have a budget neutral impact in the ideal situation of a 100% return; the higher the return percentage the lower is the difference in production costs of one-way and refillable containers.

The role of the instruments described is the positive impact they have on the economic balances, thus on the economic justification of applying the various waste reduction measures.

Revenues

Apart from their incentive function, product charges, virgin materials taxes and waste charges yield revenues. If not financing, these revenues are a "by-product" of these instruments, since incentive impacts then are their first and foremost function. Of course, revenues cannot be ignored and an appropriate destination should be determined. There are 3 options:

a) revenues may finance parts of the waste management policy in the framework of which the revenues are raised; however, such subsidies may create market failures, instead of the failures to be removed by the operated charge;

b) revenues may be added to the general budget;

c) revenues may be returned to society, as part of a general tax reform in which the tax burden shifts from labour to materials and energy.

3. The use of economic instruments for managing packaging in OECD countries

3.1 Overview of applied economic instruments in OECD countries

A questionnaire has been sent to OECD countries, asking for information about the application and impact of economic instruments to packaging waste management. Some additional data have been derived from other recent descriptions and inventories (3, 20).

Six types of instruments have been discerned, which might influence the use and recycling of packaging. They are 1) product charges, 2) deposit-refund systems, 3) waste charges, 4) taxes on virgin materials, 5) marketable permits and 6) recycling credits. From these six types of instruments, waste charges, taxes on virgin materials and recycling credits can only have an indirect impact on packaging waste. Responses to the questionnaire imply waste charges in a few cases. Except for the Danish waste disposal charge which is discussed in this report (section 3.2), these charges have flat rates and have no direct impact on packaging behaviour. The overview presented here is restricted to product charges and deposit-refund systems. As earlier explained (in the Introduction), this does not imply that these types of instruments are necessarily more favourable the other types.

Scheme 4. Impact of economic instruments on the economic balances for waste reduction measures

PRODUCT CHARGES	
Scheme 1 (recycling):	term **a2** (difference in other production costs) decreases if the costs of producing containers from non-recycled containers increase
Scheme 2 (reuse) :	term **a** (difference in production costs of one-way and refillable containers) decreases if the costs of one-way containers increase
VIRGIN MATERIALS TAXES	
Scheme 1 (recycling):	term **a1** (difference in materials prices to materials users) decreases if the prices of virgin materials increase
Scheme 2 (reuse) :	term **a** (difference in production costs of one-way and refillable containers) decreases if the materials costs of containers increase
Scheme 3 (prevention):	term **a** (difference in production costs) decreases if the materials costs of old and new containers increase
WASTE DISPOSAL CHARGES	
Scheme 1 through 3 :	savings in final disposal costs increase if disposal is more costly (terms **c+d+e** and **b** resp., ie. savings in collection and disposal costs)
DEPOSIT REFUND SCHEMES	
Scheme 2 (reuse) :	If extension of the share of refillables is justified, DRS encourages return, enabling a drop of production costs per unit of packed product (term **a**, i.e. difference in production costs of one-way and refillable containers, for equal amounts of packed product)
MARKETABLE PERMITS	
Depends on the exact application	
RECYCLING CREDITS	
Scheme 1 (recycling) :	Term **a1** (difference in materials prices to materials users) decreases if the secondary materials prices are lower

The questionnaire and other sources show, as a general overview of the data inventory, the following results:

- Product charges on packaging are applied in six countries. In Italy the charge is imposed on secondary packaging (plastic shopping bags). The four Scandinavian countries and two provinces in Canada apply a charge on beverage containers. In Denmark also packaging of small chemicals is under the charge regime.

- Thirteen countries have reported the use of deposit-refund systems for glass containers for beverages. Six countries have a deposit-refund system for plastic drink containers, whereas three countries apply such a system to metal drink cans.

A general conclusion is that (at the moment of the inventory) product charges and deposit-refund systems, other than traditional systems for glass bottles, are not a widespread instrument. As far as they are in operation, these instruments are applied to beverages. In a minority of two cases, other products are under such a regime: the Danish charge on packaging for small chemicals, and the Italian charge on plastic shopping bags. However, quite a few countries study a more extensive use of financial incentives related to packaging.

Tables 3 through 5 present the use of product charges, the use of deposit-refund systems and new initiatives, that is, instruments currently under study, respectively.

Table 3. **Product charges on packaging in OECD Member Countries**

Country	Product	Charge rate (ECU)	Revenue (ECU)	Purpose
Canada*	Non-refillable alcohol beverage containers Non-recyclable	0.03 to 0.05/ container	n.a.	Financing environmental initiatives
Denmark	All beverage containers Packaging of small chemicals	Up to 0.60/litre n.a.	53 mil. n.a	Financing environmental policy n.a.
Finland	Disposable packaging for beer and soft drinks	Up to 0.55/litre	10 mil.	Added to general budget
Italy	Plastic shopping bags	0.06/bag	n.a.	n.a.
Norway	Non-returnable beverage containers	Up to 0.45/container	31 mil.	Added to general budget
Sweden	Beverage** containers (paper/cardboard excluded)	Up to 0.04/container	15 mil.	Added to general budget

* Parts of the country.

** Might be abolished if a new system of producers responsibility for packaging (with high recycling rates) is introduced. This system has been proposed by a packaging committee.

n.a. Not available.

Table 4. **Deposit-refund systems in OECD Member countries**

Country	Product	Material	Deposit (ECU)
Australia*	Beer, soft drinks	Glass, metal, PET	n.a.
Austria	Beverages Beer, soft drinks, wine, milk	PET Glass	0.28/bottle n.a.
Belgium	Beer, soft drinks	Glass	n.a.
Canada	Beer, soft drinks	Glass, metal, PET	Up to 0.40/bottle
Denmark	Beverages	Glass	Up to 0.55/litre
Finland	Beverages	Glass, PET	Up to 0.35/bottle
Netherlands	Beer, milk Soft drinks	Glass PET	Up to 0.25/bottle 0.45/bottle
Norway	Beer Soft drinks, wine, spirits	Glass PET, glass	Up to 0.25/bottle
Portugal	Beverages	Glass	n.a.
Sweden	Beverages	Glass Aluminium PRT	Up to 0.30/bottle 0.07/can 0.53/bottle
Germany	Beer Soft drinks, milk	Glass Plastic	n.a.
Switzerland	Beverages	Glass	n.a.
USA*	Beer Soft drinks	Glass Metal	n.a. n.a.

* Parts of the country
n.a. Not available.

Table 5. **New initiatives (under discussion) regarding economic instruments to packaging**

COUNTRY	PRODUCT CHARGE	DEPOSIT REFUND SYSTEM
Netherlands	Non-recyclable packaging	Aluminium cans Glass food containers
Portugal		Aluminium cans
Sweden	PET-Bottles *	
Turkey		Metal and plastic beverage containers

* Gradually introduced from 1/7/91 up to 1/1/1993

3.2 Two illustrative examples: Denmark and USA

3.2.1 Denmark

We present an overview and analysis of the use of economic instruments applied to packaging in Denmark. The study focuses on product charges, deposit-refund systems and the waste disposal tax.

Product charges

Description

Introduced in 1978 and amended several times since then, Denmark applies a product charge on packaging. The charge mainly affects liquid foodstuff (all beverages, vinegar, sweet oil, methylated spirit). Liable to the charge are containers of plastic and glass, metal containers, containers of cardboard and composites and one-way packaging for milk. Charge rates vary between these types of containers and with their contents. Per litre of content, the lowest rate is on one-way milk package (ECU 0.01). A 1-litre cardboard or composite pack is charged ECU 0.09; a 1-litre glass or plastic container is charged ECU 0.21 and a metal can faces a charge of ECU 0.31 per litre.

Purposes

In 1978 the charge has been introduced as a fiscal measure, the revenues being added to the public budget without specific earmarking. In 1988 the environmental character of the charge was stressed, when the responsibility went over to the Minister of the Environment, accompanied by a significant rise in charge rates. The revenues, ECU 52 million in 1990, are still not earmarked. Consequently, the charge has a twofold purpose: an environmental and a fiscal purpose.

Impact

The environmental purpose is to encourage the use of returnable packaging. For beer and soft drinks returnable bottles are mandatory. For these drinks, the charge should work as an incentive to the system to raise the number of trips, since the charge is only imposed on new and imported bottles. Consequently, the charge rate for beer and soft drink bottles is negligible. For other beverages (wine, spirits), a bring system (street containers) has been organised in order to raise the trippage. Used bottles are washed and offered to bottlers at competing prices. The trippage, however, is lower than that of the mandatory systems, raising the burden of the charge. For wine, glass bottles face increasing competition from cartons which have a considerably lower charge and lower production costs. This impact is contrary to the intended impact of stimulating the use of returnable bottles.

Plastic bottles and cartons are alternatives in one-way packaging. The former face a higher product charge, as a result of "political balancing" at the time of introduction of the charge. Danish EPA investigates whether this gap is justifiable on environmental grounds. The 1989-amendment has introduced a charge on one-way milk packaging with the formal purpose of encouraging the use of a return system. Danish EPA has stated that no such effect has to be expected, forcing the Ministry to declare that this charge is a pure fiscal tax, with no environmental objectives whatsoever. Reconsideration of the tax will take place in the framework of fiscal reform in anticipation of the completion of the Internal (EC) Market.

As a result of the fixed charge rates, there is a tendency towards the use of larger packaging. These "bag in boxes" consist of plastic or composite bags in cardboard boxes, and can be found in sizes

up to 5 litres. This is contrary to the purpose of the charge system, especially when foodstuff packed in this way has formerly been packed in recyclable containers.

The environmental effectiveness of the charges have not been assessed. The case study states that the packaging charges are a minor part of the total costs of packaging. For proper functioning return systems, other elements, such as technical and logistic conditions must be met as well. But, on the other hand, the situation without charges might have shown worse results.

Deposit-refund systems

Description

Since 1984 in Denmark beer and soft drinks may only be sold in returnable containers. Legislation requires that new types of container be tested as to the suitability of their functioning in a return system. Imported beverages may be sold in non-approved packaging, but then an deposit-refund system is mandatory. No metal packaging is allowed, however. The Commission considered these requirements as a artificial trade barrier, but the Court decided that environmental considerations should prevail.

Next to a number of glass bottles, a 1.5-litre PET-bottle is approved since 1991. The deposit for small bottles (< 50 cl) is ECU 0.20; for large bottles ECU 0.55.

Purpose and impact

The purpose of these mandatory systems is to limit waste from packaging by stimulating reuse of beverage containers. The private firm who is in charge of the system claims a return percentage of over 99%; the average number of trips is 33. This firm tries to settle the deposit not higher than the price of new bottles, the charge included, in order to protect the return system. Another protection measure has been introduced in 1991. Retailers receive a handling fee, since the deposit and refunds between the bottler and the retailer are higher (ECU 0.03) than the deposit and refunds between the retailer and the consumer. Retailers who collect more bottles than they have sold, receive an extra gain. This surplus should by and large cover the extra handling costs, which helps to ensure the retailer’s co-operation. However, since retailers are free to settle the amount of deposit (provided that it equals the refund), those who collect less bottles than they have sold are willing to raise the deposit by ECU 0.03. Then consumers try to buy at the retailers who charge the "normal" deposit, and try to return their bottles to the shops where a higher deposit is charged and refunded.

A disturbance to the system is caused by the fact that not unimportant quantities of beer are bought in Germany (in approved Danish standard bottles). Empty bottles are returned to Danish shops, causing a deficit in the money flow. Another potential conflict is the wish of retailers to keep the number of types of bottles as low as possible for logistic reasons, whereas the drink industries try to stick to their own bottle which more than often is an important element in their marketing policy.

Waste disposal charge

Description

In 1986 a charge was introduced of ECU 5.20 per ton of household waste dumped or incinerated. In 1989 the charge rate has significantly been raised to ECU 16.90 per ton. In 1990 it has been decided that all non-hazardous waste is subject to the charge which is collected at the registered dump sites or incineration plants. Waste that is given an other approved destination, such as composting, road construction or landscaping is exempted, or a refund will follow.

Purpose and impact

The purpose of the charge is to encourage waste prevention and recycling. The revenues are destined for financing environmental measures. Administration costs amount to approximately ECU 0.15 mln per year. The charges are invoiced by the Customs who apply 6 or 7 personnel for administration, collection and enforcement. Revenues amount to ECU 64 mln in 1990. Environmental authorities have planned to evaluate the system in 1993.

Since households pay a yearly fixed amount of user charge for waste collection, the charge will have no incentive impact. An experiment of household-by-household weighing of the weekly volume of waste offered should point out whether variable charges will have an effect on household behaviour.

As to possible fraud, no significant increase of illicit dumping of waste has been noticed since the charge was introduced. "Recycling" as a basis for refunding of the charge is hardly being controlled. This might lead to dispersion of pollution if amounts of waste used for road construction or landscaping do not meet the pollution standards. Furthermore, such works might be more induced by the wish for refunding than by its actual need.

3.2.2 USA

We present an overview and analysis of the approach taken in several States of the USA to aim for a reduction of packaging waste from beverage containers through mandatory deposit-refund systems.

"Bottle bills"

Ten States in the USA have introduced mandatory deposit-refund systems for beverages. Common elements of the majority of the systems are:

- they are applied to carbonated soft drinks and beer;
- they have a refund of ECU 0.04;
- they are applied to glass, metal and plastic containers;
- they require retailers to accept for refunds containers of the same brand and type that they offer for sale;
- retailers are paid a fee to cover the costs of handling returned containers.

Some bottle bills have deviating features:

- the inclusion of other beverages such as wine and spirits in the deposit-refund system;
- the encouragement of using standard containers by putting a lower deposit on such containers;
- the obligation of paying back to the State deposits that have not been reclaimed;
- California applies a system in which returned containers are handled by recycling centres or through kerbside collection and not by retailers.

Impact

The case study assesses the impacts of the deposit-refund systems in terms of four issues: 1) return and recycling rates; 2) use of returnable bottles; 3) reduction of solid waste and litter; 4) other.

As to return rates of containers results have been found to vary from 72% to 98% in nine States. Virtually all the containers returned are recycled. The majority of the post-consumer glass and plastic recycled comes from the deposit-refund systems.

At the start of the "bottle bill" systems, only 39% of the soft drink volume and 23% of the beer volume was sold in returnable bottles. In the first four States where bottle bills have been implemented, a sharp increase of the share of returnable bottles was found immediately after the implementation. On the whole, however, decline of the role of returnable bottles has continued to insignificant percentages of 7% for soft drinks and 5% for beer in 1990 (measured in numbers of drinks). Also "bottle bill" States have shown a decreasing share of returnable bottles.

Reductions of litter and solid waste volumes have been found as a result of the deposit-refund systems. Reductions amount to 83% for deposit containers and to 10% tot 39% for all litter. Solid waste reductions are less impressive: 1% to 6% as measured by weight and up to 8% as measured in volume.

Other effects include employment, prices, consumption and conservation of energy and natural resources. The effects on employment are, on the whole, positive. Gains in jobs in the beverage industry, in distribution and retailing outweigh the jobs lost in the packaging industry. The effects on prices are less certain. In the short term, increasing prices were found, but in the long run, prices might decline, since beyond a certain number of trips, returnable bottles are expected to be cheaper than one-way containers. Measured decline of drink consumption has partly been attributed to the bottle bill and partly to other factors, such as anti-drunk driving campaigns. In a number of States declines were only temporary. Finally, the use of returnable bottles leads to reductions in the use of natural resources (bauxite, iron ore, energy- hence possible job losses in the mining industry) and to reductions in air and water pollution and industrial solid waste.

Kerbside collection

In evaluating economic instruments such as deposit-refund systems, if possible, a comparison should be made to other instruments. An alternative is kerbside collection. The case study compares the impacts in terms of the amounts of material collected and of its quality, and compares costs and methods of financing.

On average, kerbside collection results in smaller amounts of material collected than deposit-refund systems. An assessment for a number of States where kerbside collection programmes are said to be rather developed shows recycling percentages of around 35% for glass containers, of 25% to 56% for aluminium cans and of 1% to 40% for plastic containers.

In general, the quality of the materials returned by way of kerbside collection is lower than that in deposit-refund systems. Particularly for glass containers the share of containers recycled is low, due to breakage before sorting by colour.

The costs of deposit-refund systems are usually higher than the costs of kerbside collection. However, in DRS financing is simpler as the deposit is an integrated part of the financial system. Financing of kerbside collection programmes goes mainly through tax revenues. This is not always automatically secured. Numerous cities, e.g. New York, have experienced delays in implementing kerbside collection for budgetary reasons, and future funding remains uncertain.

3.3 Lessons from experiences

The case studies presented in section 3.2 imply a number of experiences to be borne in mind when introducing economic instruments in comparable situations. Of course, these experiences are limited and one should be cautious to unconditionally declare lessons drawn thereof applicable in general. This section is organised as to the various economic instruments currently applied and dealt with in the case studies on Denmark and the USA.

Product charges

An integral analysis of the costs of packaging including possible alternative types should precede the introduction of product charges, in order to avoid an unwanted increase of non-charged types of packaging.

The Danish case study has shown that a product charge on glass bottles, aimed at increasing the number of trips of bottles in the deposit-refund system, has encouraged wine bottlers to pack their products in cartons which face a much lower charge. A high charge on new returnable bottles favours the use of returned bottles, but also the use of one-way containers. In terms of the schemes presented in section 2.1, this example shows that although a general analysis might indicate that reuse is economically worthwhile, every single actor in the scheme will execute its own partial analysis and may end up with different conclusions.

A proportional relation should be established between the volume of types of packaging and the product charge, in order to avoid encouraging producers to pack their products in large packaging of other types, with worse environmental characteristics.

The Danish product charge on beverage containers increases in discrete steps with volume, but is fixed for containers over 106 cl. Large types of packaging ("bag in boxes") of 3 to 5 litres enter the market now. This might be desirable since the total amount of packaging decreases if unity volumes increase, but the amount of packaging landfilled will grow since "bag in boxes" are throw-away packaging. Again, this example shows that individual actors face scheme different from the one that will hold for society at large.

Product charges should have a clearly stated purpose: either fiscal, or environmental. If not, environmental charges may fail if not incentive, causing fiscal deficits; in EC member countries charges may fall in discussions about fiscal barriers in the EC internal market.

The Danish product charge on milk cartons has been announced as an environmental charge. The revenues are part of the fiscal income of the State. The charge appeared to be too low to have any incentive impact, i.e. to notably influence the economic balance as presented in section 2.1, and the government is challenged to withdraw the charge. Then, a fiscal deficit will occur.

As to the choice of packaging financial aspects are not the only decision element; other factors such as technical, commercial and logistic aspects can be of equal importance. A complete analysis should precede the introduction of charges.

Product charges have an influence on the costs of marketing products only. Food and beverage producers may wish to balance the disadvantages of a price increase against advantages from a commercial point of view, i.e. to have a characteristic type of container which is not appropriate for a return system. For certain products return packaging may not be suitable for technical reasons. In general, retailers are opposed against new deposit-refund systems, as these require storage room that might not be available, especially in old city centres. In terms of the analysis under section 2.1, this experience indicates that economic balances to be designed before deciding about the introduction of economic instruments must be as specific, detailed and complete as possible.

Waste charges

Waste charges may have a reducing impact on the generation of municipal waste, of which packaging waste is an important component, if calculated according to volumes produced. There is little practical evidence for this statement, since, in practice, municipal waste charges are purely financing collection and disposal of waste and have a fixed rate on a yearly basis.

Practical evidence regarding the incentive impact of waste charges might be obtained through experiments. Possible systems are individually weighing waste offered or including the costs of collection and disposal in the price of waste bags. In terms of the economic balances of section 2.1, households must be directly charged for the amounts of waste they dispose of, so that they can change their behaviour according to the changes in their partial economic balance.

A waste-end charge, to be imposed at the landfill, may encourage waste handlers to search for alternative destinations. These might be illicit - dumping on non-authorized waste sites - or legal, such as using waste for landscaping or road construction.

The Danish waste charge of ECU 17 per tonne might result in a lower supply of waste to landfills. This decrease might originate from source prevention, but as well from dispersion of waste to other destinations. This must be closely monitored. From this example it is clear that the economic balances are influenced in the desired direction, i.e. the amounts of waste decrease. This is not always brought about by an increase in recycling or reuse, when other, less costly alternatives are open.

Deposit-refund systems

The items listed under product charges (section 5.1) are also applicable to deposit-refund systems, since a main purpose of product charges on packaging is to encourage the use of returnable packaging. Some experiences specific to deposit-refund systems are listed here.

A handling fee is considered to be necessary to cover the costs for the retailers. USA practice suggests a fee of ECU 0.02 per container.

It is considered realistic to pay retailers for the extra amount of work they face when collecting containers in a DRS. Such a handling fee improves acceptability and co-operation. It changes the balance for this group of actors, since it decreases the costs of collection for returnable containers.

If determining the level of the deposit is left to the retailer (provided that it equals the refund), consumers are encouraged to buy their products at the shops where deposits are lowest and turn in where refund is highest.

The economic balance for households will include inconvenience costs and financial aspects. It determines whether or not they will turn in their bottles, and if so, where. This element in the Danish system is expected to be a threat to the deposit-refund system.

Frontier problems may emerge if no trade barriers between countries exist (EC internal market). Containers bought abroad deposit free can be returned domestically for refunding, causing a deficit in the system.

In Danish frontier regions consumers are encouraged to buy beer in approved bottles in Germany and return them at home. Avoidance of paying both the product charge and the deposit, in combination with receiving a refund can render such actions profitable over large distances. (In the Danish-German case the financial gap is further widened by a different excise duties on alcohol).

The introduction of a new deposit-refund will always meet the problem of differing interests between producers and retailers, where the former are inclined to maintain their own type of bottle, whereas the latter will try to keep the different types of bottles as low as possible.

This problem has induced different solutions. The Danish answer has been to try to reduce the number of types of bottles for beer through explicit authorization. Still some 20 types exist. In California, the return of used beverage containers is partly organised via bring systems and kerbside collection and partly via retailers. From an economic point of view it shows that each of the groups of actors involved in such schemes has specific economic interests which may interfere with the interests of other actors. Producers worry about their turnover (to which specific types of containers might be instrumental), while retailers try to keep their handling costs as low as possible.

In some countries refillable PET-bottles for soft drinks are being introduced in deposit-refund systems; it is too early to judge about its results.

As it appeared from the inventory of currently applied economic instruments in OECD countries, one of the few new developments in packaging technology aimed at better environmental results is the introduction of large refillable bottles (up to 1.5 litre) made from polyethylene terephtalate (PET).

For beverage containers, deposit-refund systems (Denmark, USA) show a higher return than bring systems or kerbside collection systems. However, it depends on the outcome of economic balances as presented in section 2.1 whether deposit-refund systems yield a higher benefit-to-cost ratio than their alternatives.

PART 2

APPLYING ECONOMIC INSTRUMENTS TO PACKAGING WASTE MANAGEMENT

Chapter 1

General Considerations for Implementation and Use of Economic Instruments

1. Policy Framework

1.1 General environmental policy

Environmental policy can be pictured as a multi-layer construction wherein the top layer comprises general environmental policy principles, objectives and instruments, and wherein the bottom layer represents down-to-earth practical measures aimed at specific processes, products and procedures. A main characteristic of this multi-layer construction is that each layer is fully "projected" on the next one (top-down), i.e. that the elements of each layer are included in the next one. In each layer specific elements exclusively directed at the components in that layer can be added.

If we roughly define three layers, then all principles, objectives and instruments of general environmental policy (first layer) are also valid for air quality policy, water quality policy, waste management policy, energy policy, etc. Again, principles, objectives and instruments of waste management policy (second layer) are an integrative element of the specific waste management policies in the next layer, such as packaging waste management (third layer). Besides, policy layers on the same level (air quality policy, waste management policy) can be interrelated through certain instruments.

Main principles in general environmental policy in OECD countries include:

a) Policies should comply with the Polluter Pays Principle;

b) Prevention of pollution at source is generally preferable;

c) Integration of environmental policies should be promoted.

These principles have offered guidance for establishing objectives of policies in the field of waste management.

1.2 Waste management policy

Obviously, instruments constituted in management of packaging waste should contribute to achieving objectives of waste management policy and may not conflict with these objectives. On the other hand, instruments of waste management policy might extend their impact towards packaging waste. Moreover, instruments in related policy fields can have an indirect impact on (packaging) waste management. If, for example, the production of paper and cardboard is charged for its water pollution, product charges which are aimed to internalize external effects of the production, use and disposal of

packaging should leave out water pollution, as far as the paper and/or cardboard contents are concerned. Theoretically, waste disposal charges should not be imposed on packaging when a product charge on packaging products has been designed to incorporate all external effects. Of course, such consequences should be checked against practical considerations of implementation and enforcement. Finally, in the case of resource scarcity policy, inputs into the packaging manufacturing should not be treated differently from similar inputs in other industries.

2. Policy options

Waste management policy starts from the base line objective that the generation of waste should be optimally prevented or that waste generated should be treated in a way as efficient as possible. The following policy options exist:

a) reduction at source (prevention),

b) re-use of products,

c) recycling of materials,

d) recovery of energy,

e) management of final residuals.

Although, descending from option 1) to option 5) in this scheme, waste is prevented or is conserved in a state as valuable as possible, this is not necessarily a preferential order. Not only the value of remaining products or waste components count, but also related activities such as collection, recycling, cleaning, etc. In deciding about which option should be implemented, an integral economic analysis should be executed, including costs of production factors, costs of production processes, of related activities, of collection and disposal of waste, prices of (secondary) materials and of energy and all relevant external effects, as far as accountable.

As has been set out in Part 1, Section 2.1, recycling and reuse are not necessarily better options than waste disposal. And, if recycling or reuse are preferable options, a 100% recycling or reuse is not automatically desirable. In developing policies for packaging waste management, a crucial question is: given a specific problem, which instrument or set of instruments is the best course of action for reaching the most efficient solution?

Various economic instruments elaborated in chapter 3 below have different roles to play in the policy options mentioned above. In general, policy instruments should straightforwardly be implemented where they are expected to work.

Source reduction is supported by instruments which increase the price of packaging material or of packaging itself. Such instruments are virgin materials taxes and product charges. Waste charges could have an indirect impact, but designing packaging and waste disposal are remote activities.

Reuse of packaging is best served by measures which directly encourage collection. This is done by imposing deposit-refund systems. Measures that raise the costs of one-way packaging, such as product charges, can be supportive. Virgin materials taxes should be both imposed on the inputs into the one-way container production and on the inputs of refillable container production. Then, producers might economize in case of a high trippage. Waste charges may have an indirect impact.

Recycling is promoted if the costs of recycling relatively decrease. In specific cases a direct measure could be the implementation of recycling credits. The rules for financial aid should be complied with. Virgin material taxes and product charges on containers made from virgin materials raise the costs of producing such containers, making the production and use of containers made from recycled materials relatively cheaper. Deposit-refund systems facilitate return of packaging securing supply of materials to be recycled. If applied to one-way packaging, marketable permits might raise the costs of producing such packaging if the number of permits on the markets is limited. Waste charges may have an indirect impact.

Incineration with energy recovery is not an action specific to the packaging waste "layer" but is relevant to municipal waste at large. It is encouraged if made less costly, or if costs of alternative waste removal methods raise, for example by imposing waste disposal charges.

Good management of final residuals is necessary for environmental protection. It might be financed through a user charge which is not an instrument dealt with in this framework.

3. Definition and typology of economic instruments

3.1 Instruments for the management of packaging waste

Chapter 1.5. of Part 1 briefly describes possible instruments for management of packaging waste. Roughly, they are threefold: 1) instruments of the "command-and-control" regulatory approach; 2) economic instruments; 3) covenants. These instruments can be implemented solely, or in an instrument mix. The right instrument or mix in a given situation depends on policy, economic, legal, technical and sometimes historical factors. In many cases, instruments of similar or different types might reinforce each other. Judgment against evaluation criteria should be the basis for selection and implementation.

Each of the three types of instruments mentioned has specific characteristics. Direct regulatory instruments are unconditionally forcing, leaving no room for target groups to legally evade. For enforcement the threat of sanctions is used. Economic instruments leave to the discretion of the actors how to act. They have a choice between two courses of action, shortly circumscribed as "abate and save" and "pollute and pay". Covenants are based on consensus, securing collaboration of target groups, but generally leaving no room for forceful sanctions in case of non-compliance.

As to these characteristics, in certain situations specific instruments might prevail. If, for example, PVC or CFCs must be removed from packaging, imposing a ban on such substances is most rational. Removal must be complete, of course, so that actors should have no choice, as is the case with economic instruments. It might depend on the time period available whether a covenant between government and groups concerned is an appropriate instrument.

On the other hand, if left to private business, recycling activities cannot be forced. Economic instruments can be used for encouraging such activities.

3.2 Definition of economic instruments

Payments which aim to incorporate external costs are referred to by various terms (charges, taxes, levies, duties, fees). Charges could be seen as payments for which the payer receives a benefit in return, in direct proportion to the amount paid, and taxes are unrequited payments, i.e. no direct and exactly equivalent benefit is received in return. However, a tax based on measured emissions could reasonably be described as a charge for which benefits, i.e. permission to dispose of a certain amount of pollution into the environment, are received in return. Since there is no clear-cut distinction to be made here, it is

proposed to maintain the terms most commonly used, thus product charges, waste charges and virgin materials taxes.

In this section product charges, virgin materials taxes, waste charges, deposit-refund systems, recycling credits and marketable permits are subsequently dealt with.

Product charges

Product charges are output taxes as surcharges on the price of packaging products. They would be related to the potential waste disposal and pollution impact. Products fully made from recycled materials could be exempted and products partly made from recycled materials and refillable containers could face a lower charge, provided that reuse and recycling are favourable options.

Virgin materials tax

A virgin materials tax is an input tax on raw materials used for the production of packaging products. The tax would be related to the damage done by production and consumption of the packaging, plus a scarcity premium if relevant. This tax is aimed to reduce the use of virgin materials (source reduction) and favour the use of recycled materials. As to avoid double-counting, virgin materials taxes and product charges should be operated mutually exclusively, or the virgin materials tax should represent a scarcity premium only.

Waste charges

Waste charges may be levied either on collection or on disposal of waste. Waste collection charges are user charges in the first place, the revenues being used for financing collection (and disposal) of waste. If calculated individually, waste collection charges can have a regulatory impact. Waste disposal charges is an end-of-the-chain charge, increasing the costs of finally disposing of waste. They would represent any (external) costs not already incorporated in traditional costs of waste collection and disposal. They are indirectly related to disposal of packaging, as far as packaging is a component of the waste on which the charge has been imposed. Once again, double-counting may occur if product charges or virgin materials taxes do already contain elements related to external costs of landfills.

Deposit-refund systems

Deposit-refunds essentially are product charges which are refunded if the charged products is prevented from final disposal. The difference between these two instruments lies in the point of impact: a product charge on packaging may influence the behaviour of producers who use these products, whereas DRS operates one step further in the chain and should modify consumer behaviour. Product charges leave more freedom to the system: producers are free to shift to DRS. DRS, if mandatory, does not provide that freedom. DRS and product charges can be combined: product charges will have a lower impact on the price of products as the trippage increases. If the refund is smaller then the deposit, an implicit product charge occurs.

Marketable permits

To date, marketable permits have not been found in the field of packaging waste management. One may envisage the application of marketable permits in relation to a "legislation-driven" level of recycling, share of returnable packaging or recycled content standard. Producers who exceed these standards may earn credits which can be sold to producers who are, temporarily, not able to comply. If a market will be

established, marketable permits can have an negative effect of private costs of recycling, new materials technologies, etc.

Recycling credits

Recycling credits are payments to those who reuse containers or recycle materials, saving them from waste disposal. Payments equal the saved costs of waste collection and disposal. The instrument might be applicable on the local level, in situations where municipal waste collection and disposal is financed from the general budget. Recycling credits may increase recycling capacity. Rules regarding financial aid should be acknowledged.

3.3 Direct and indirect applicability to packaging

Some of the instrument mentioned in section 3.1 are directly applicable to packaging, that is, directly aimed at packaging choices. These are product charges and deposit-refund systems, and marketable permits. The other instruments are directed at other elements in the packaging life-cycle and can have an indirect impact on the production and use of packaging only. Virgin materials taxes affect the inputs into the packaging production. Waste collection or disposal charges influence the treatment of municipal waste in general, of which packaging is one of the fractions. The same holds for recycling credits.

Elaborating detailed and specific guidelines for the use of waste charges is beyond the scope of this project as it requires a different angle from the one adopted here. Regarding virgins materials levies no apparent reason exists why such incentives should be directed towards the inputs in the packaging industry only. A just and efficient approach then would be to envisage the application of input price incentives in general, on a material-by-material base.

Accordingly, and bearing in mind that instruments should be imposed where they are expected to have a direct impact, instruments which are directly applicable to packaging will be the subject of the guidelines to be elaborated below. This includes product charges and deposit-refund systems. Marketable permits will be left out since hardly any experience with such schemes is available.

This definitely does not imply that, in terms of economic efficiency, the instruments ignored here are inferior to the ones further developed. Any feasibility study regarding instruments to address packaging waste should acknowledge the "environment" of the packaging waste problem, and any solutions that might be found fit to being operated, including virgin materials levies, waste disposal charge and marketable permits. The restriction made here solely results from the purpose of this study, i.e. elaborating guidelines specifically applicable to packaging, when governments envisage the application of such economic instruments.

When applying economic instruments to packaging one should take into account the feasibility of steering producer and consumer behaviour in the direction that the instrument is likely to push. Product charges discourage the use of the charged packaging, inducing a shift to other materials which might be less desirable from an environmental point of view, or from the point of view of product protection. Deposit-refunds requires technology and production capacity for refillable or recyclable containers. Virgin materials taxes discourage the use of these materials and the application of reusable packaging. Waste disposal charges encourage prevention, reuse and recycling.

As to the various materials and types of packaging the following possibilities exist (17):

For glass recovery and recycling structures exist on a rather high level. It might be necessary to restrict the amount of coloured glass for recycling since there is a limited use for this materials in glass

container production. Then sorting by colour is necessary for increasing the recycled glass market. For glass containers deposit-refund systems are quite conceivable.

For cardboard from primary packaging recovery can be efficient if structures for household collection of waste paper (commercial or charity collection) already exist. In cases of abundant packaging prevention is the first option. Incineration might be the best alternative.

Aluminium and steel both have markets for recycled materials. Saving such containers from the waste stream can be promoted by a deposit-refund system.

For plastic containers recycling capacity is very small since to date no efficient technology has emerged. PET-bottles are refillable in principle; a deposit-refund system might establish a market share for this new type of container. For other types a product charge could help to shift to other materials. Energy recovery is a good alternative.

Composite materials have to date no proper recycling opportunity. A product charge might discourage the application of this type of packaging.

4. Criteria for choice

OECD Guidelines on the Use of Economic Instruments in Environmental Policy (4) present a set of criteria applicable for choice of economic instruments in general. These criteria are also valid for instruments directed at packaging waste. If more than one instrument is being considered, then the instrument or instrument mix with the best performance should be selected. Generally speaking, the scope and the effectiveness of economic instruments should be compared with command and control instruments.

Decision criteria are:

(a) Environmental effectiveness, i.e. the extent to which the instrument succeeds in reducing environmental impacts in general, in relation to the policy targets set. Surely, in the context of packaging management waste reduction is an important effect, but principally all relevant impacts should be considered.

(b) Economic efficiency, i.e. the extent to which the instrument economizes on resources, in terms of capital, labour, materials and energy.

(c) Comparison of the scope and effectiveness of economic instruments, compared to command and control regulations.

In practice, the cost-effectiveness criterium is applicable, in which instruments are either judged on their least-cost performance, given a stated effectiveness, or are judged on their environmental effectiveness, given a fixed budget. Although both situations may occur, waste management policies often define targets for reduction of packaging waste, so that the least-cost variant will prevail. A number of countries have quantitatively specified solid waste reduction targets as to the packaging contents. Examples are percentages of return for refillable containers, market shares for refillable containers and reduction of packaging contents in the households solid waste stream.

(d) Equity, or distributional effects, i.e. the way in which the instrument distributes its costs and benefits through society. This is especially relevant for packaging since it is used throughout society and for a large part connected to primary commodities and an inevitable item in

purchases. The criterium of equity may have an international component so far as countries may have decided to guarantee the freedom of international trade (EC).

(e) Administrative feasibility and costs, i.e. problems and costs attached to implementation and enforcement of the instrument. Essentially, this criterium is part of the economic efficiency criterium, but in practice it often proves to be useful to deal with it separately.

(f) Concordance with institutional frameworks, or the extent to which new instruments fit in existing policy frameworks, be it national, or international. For example, the European Commission is developing a packaging directive. The OECD has issued recommendations on comprehensive waste management policy and on the reuse and recycling of beverage containers.

(g) Acceptability, i.e. the extent to which concerned groups in society are ready to accept the new instrument. Essentially, acceptability is the result of individual or group benefit-costs analyses, thus is an element of the economic efficiency criterium. In practice, impacts on various groups are sometimes difficult to assess, and if not, more than once not simply economic by nature. It might be useful to separately give attention to this criterium.

As new instruments will have various impacts of different nature, the outcome of the decision analysis will more than once appear to be multidimensional. A specific instrument may be less costly than its alternative, but also less effective or acceptable. In the end, the decision of which instrument to select will be a political one.

Finally, it should not be overlooked that transition to new systems, brought about by new instruments generally will incur adjustment costs that may affect both economic and administrative efficiency. Such costs are less relevant in the long term.

5. Levels of implementation

For a smooth functioning of economic instrument the level or scale of implementation can be an important factor. Determining the wrong level can create distortions causing loss of efficiency. Policy frameworks on certain levels may inhibit the operation of instruments on other levels. A relevant distinction here is between the local level, the national level and the international level.

5.1 Local level

Waste charges and recycling credits are instruments that should be designed for local situations. That is not to say that deciding about their introduction could not be a national or even international competence. Waste disposal charges should internalize external effects from landfilling which generally will vary from location to the other. Waste disposal charges are meant to induce actors to shift away from landfilling their wastes. Exact targets might be locally set and waste charge rates might depend on local conditions such as landfill tariffs and the capacity and tariffs of alternative actions.

Also recycling credits should be determined locally since they depend on the way landfill costs are met and on savings in disposal costs through increased recycling.

5.2 National level

Product charges, deposit-refund systems and marketable permits if applied to products are essentially a national matter, unless supranational agreements or laws are binding. Such instruments are aimed at items which are freely transportable within national boundaries. If these instruments, for example a product charge, are implemented in parts of the national area only, buyers will be attracted to low-price areas causing inadequacies in the systems functioning.

5.3 International level: trade implications

The use of economic instruments to stimulate the reuse and recycling of packaging materials might be generally expected to have fewer and less distortive impacts on trade than the use of regulations or "command-and-control" instruments which specify the types and quantities of packaging materials to be used. In addition to being more transparent and market-based, economic instruments give incentives to producers and consumers of packaging to reuse and recycle packaging waste rather than mandate them to change their products in certain ways. If the same incentives are applied to domestically-produced and imported packaging from all sources, the differential impacts on traded products can be minimised.

However, the application of economic instruments to packaging waste -- which are here packaging charges and deposit-refund systems -- is a form of government intervention in the market and, as such, will have implications for international trade. The potential trade effects of the environmental use of economic instruments must be taken into account when they are designed and implemented by government policy-makers. Generally, the application of economic instruments to packaging waste may have two types of trade effects: 1) effects on costs and competitiveness (which would be more evident in the case of packaging charges); and 2) effects on market entry or non-tariff barrier effects (which would be more evident in the case of deposit-refund systems). In all cases, greater harmonization in the use of economic instruments with regard to packaging waste by OECD countries can help mitigate any undue trade effects. It should be noted that the potential trade effects of environmental packaging measures, including the use of economic instruments, are being studied in the trade and environment programmes of the OECD and the General Agreement on Tariffs and Trade (GATT).

Competitiveness Effects

Economic instruments applied to packaging waste, like other government environmental policies, are intended to promote the internalisation of environmental costs in product prices. Packaging charges are aimed at internalisation of the costs of waste generation and management and thus can act to raise the costs of production. When packaging charges are levied on domestic producers, this can raise their costs relative to foreign competitors who are not subject to a similar tax and could negatively affect the cost-competitiveness of their products in domestic and foreign markets. However, it is also possible that packaging charges, like other environmental policy instruments, can contribute to the competitiveness of domestic producers in stimulating innovation and new technological approaches to the development of packaging; in giving them a market edge or "front-runner advantages" in being ahead of foreign competitors in adapting to and addressing environmental concerns; and in enabling them to market their products as "environment-friendly."

If negative effects are predicted due to high tax rates, the competitiveness effects of applying packaging charges to domestically-produced goods can be offset by rebating the charge to exported products and by levying the same charge on imported products. In general, such border taxes should not be imposed on foreign products/packaging where domestic products/packaging are exempted and there should not be any differences in the taxes or charges levied on domestic and foreign products/packaging from all sources.

The rules regarding such "border tax adjustments" under the GATT are now under discussion. In general, the GATT allows charges to be levied on imports and rebates on exports when such charges are imposed on domestically-produced products; the rules regarding border tax adjustments related to charges or taxes on inputs to products are less clear. Border tax adjustments reflect the "country of destination" principle which is common in cases of taxation, e.g. that the adjustment tax should be applied on the product in the country where it is consumed (the country of destination) rather than where it is produced (the country of origin) to avoid double taxation. With regard to packaging waste, this raises questions regarding the ability to levy border taxes in cases of domestic charges applied to virgin materials (inputs to the packaging or product); border taxes levied to correspond to domestic charges on the packaging itself or on disposal of the packaging (i.e. the final product) would be more acceptable.

Non-Tariff Barrier Effects

Economic instruments applied to packaging waste can also make it more difficult for foreign producers to market their products in the country imposing the instrument, thereby acting as non-tariff barriers to trade. This might be particularly true in the case of deposit-refund systems, which can influence the types of packaging used, the marketing of the product, and its transport or circulation. Foreign producers may have difficulties gaining access to facilities for storing and returning packaging for reuse or in acquiring recycling facilities or services in foreign markets. Producers located at long distances from the market where the deposit-refund system is applied, as well as small-scale producers with little turn-over in the packaging in question, may be put at a disadvantage.

Deposit-refund systems can generally constitute non-tariff barriers to trade if the initial deposits are high compared to the value of the goods, if foreign producers consider that the costs of participating in a co-operative retrieval and recycling scheme are out of proportion to their market share, and if non-returnable containers are an important condition for the competitiveness of imports. Deposit-refund systems can also be protectionist if they are applied only to certain types of containers or packaging which are primarily used for imported products or if they are applied in a fashion which is discriminatory or unduly favours domestic producers. In general, deposit-refund schemes should be designed to be as import-neutral as possible taking these factors into account.

Chapter 2

A Checklist of Practical Issues

Product Charges

1. Definition

Product charges are output taxes as surcharges on the price of packaging products. They would be related to the potential waste disposal and pollution impact. Products fully made from recycled materials could be exempted and products partly made from recycled materials and refillable containers could face a lower charge or a charge exemption.

2. Purpose

Product charges are meant to internalise external effects from the use of packaging, creating a correct economic framework for deciding about whether or not to use the charged product. On this basis, product charges may decrease the price difference between packaging made from recycled materials and packaging made from virgin materials on the one hand, and between refillable containers and one-way packaging on the other hand. Product charges can be used to support, and possibly partly finance, deposit-refund systems.

In practice, external effects are hard to assess, so that the product charge rate must be based on other considerations (see section 4.1).

If the product charge is destined to incorporate all external effects, the rate may vary with the type of material since air and water pollution are likely to differ from one material to the other. Then, it will also include environmental effects from waste disposal and be an implicit waste charge for that matter. Double-counting should be avoided.

When defining the purpose of product charges it is relevant to distinguish different types of packaging to which the charge might be applicable since the effects of charges depend on available alternatives. What matters here is the material used and the durability of the container. Cardboard, glass, metals (steel and aluminium) and plastics differ in environmental impacts during their life cycle, in recyclability and in thermic value. It also matters whether or not containers are made from virgin or recycled materials.

Basically, product charge rates should reflect differences in external effects, for example, due to different materials used, and be equal if environmental effects are similar. Production of aluminium cans from virgin materials consumes large quantities of energy generating external effects, plastic containers are made from scarce resources and glass bottles are voluminous when landfilled.

One-way containers and reusable containers should both be charged. Containers made from recycled materials should meet a lower charge than containers from virgin materials, in order to avoid double-counting. The charge on recycled containers may not be based on environmental costs from waste disposal and litter, but only on external effects of the recycling process.

Since economic instruments should be directly brought into action where they are expected to work, product charges on packaging should first and foremost serve the purposes of promoting the use of environmentally-friendly packaging. Of course product charges might also have an impact on the other policy options. This impact should be explained and ideally taken into account in an integral analysis, although this may be difficult to achieve. In fact, the balance of all positive and negative effects should indicate whether or not product charges are to be introduced.

Recycling is promoted by a product charge if the charge on recycled containers is nil or considerably lower than the charge on virgin containers. In recycling large energy savings are possible in the case of aluminium containers.

Reuse is stimulated since reusable containers will only be charged once. The additional costs for reusables as a result of the charge decrease with the number of times the container is reused (trippage).

A product charges might have a positive impact on **source reduction**, since it encourages substitution for non-charged alternatives and innovation of containers.

Energy recovery in incineration plants may lose some production value if product charges succeed in stimulation recycling and reuse of plastic and cardboard containers. Stripped from these items, solid waste will have a lower per unit thermic value.

Regarding **management of final residuals**, successful recycling and reuse might change the quality of the waste to be landfilled. If packaging is removed from the waste stream, the leachate from landfill may improve in quality. Residuals might be a better material for composting.

3. Criteria

In evaluating the scores of product charges against relevant criteria a distinction has been made between principal and practical criteria. Environmental effectiveness, economic efficiency, equity and concordance to existing institutions and policies are considered to be principal criteria. The criteria of administrative feasibility and acceptability are practical considerations, to be discussed in sections 4 and 5.

3.1 Environmental effectiveness

In practice, environmental effectiveness is a first and foremost objective of implementing product charges. If regulatory, revenues from charges are of secondary importance. Environmental effectiveness is achieved if product charges fulfil their purpose as has been set in section 2, and product charges should primarily be judged on the basis of their performance regarding recycling and reuse.

Generally, effectiveness will increase if product charges are fine-tuned, i.e. if charge rates differ for each single product under the charge regime. Uniform charges will be less effective, but more easy to administer.

Product charges raise the costs of the charged packaging items. If such items have a primary function (bottles, cans, etc.), substitution will only take place if alternative packaging is available. If not, the charge will only be effective, if the demand for the packed product is affected by the charge. A product charge might reduce packaging in absolute terms, if of secondary importance. If alternatives are available, the packer or filler will decide on the basis of a private cost-benefit analysis for which type of packaging he will go. His decision may not go into the direction of types of packaging with similar or even larger environmental effects than the type he has abandoned. That is, authorities should review the complete array of packaging open to packers and fillers, and impose charges (or take other measures) if necessary. Then, producers might be guided towards the use of recycled containers or refillable containers which would be an environmentally effective course of action if economically justified in the way set out in Part 1, chapter 2, of this report. In this analysis, the complete chain of event is reviewed, private costs and environmental impacts of collection, recycling, cleaning, waste disposal and incineration included.

3.2 Economic efficiency

Essentially, product charges are a price signal to which users of packaging are free to react in a way that suits best their individual interests. If tuned correctly and if information is available actors will choose a least-cost solution for themselves which will result in minimal costs for society at large.

Practically seen, an instrument can be considered to be efficient if the overall costs of implementing the instrument are minimal given a certain environmental target. The efficiency criterium is relevant if various options (instruments) are open to achieving the stated objective. If not, for example in case of the necessity of banning a certain type of packaging, effectiveness overrules the cost-minimization criterium when considering alternative instruments, leaving only room for cost-minimization in deciding about the way such a ban should be implemented.

Important costs elements connected to product charges not only consist of capital expenditures and differences in running costs for all actors involved in the scheme, but also of costs for administration of the scheme.

3.3 Equity

In the case of packaging, distributive effects of product charges basically depend on two aspects: 1) the types of products affected by the charge, and 2) the destination of the revenues.

If charges on packaging affect basic products like food and beverages, lower income classes will spend a relatively larger part of their income on these products and on the related charges. Then, product charges have a regressive impact. If the revenues are added to the public budget, no additional effects on the income distribution would be expected. If earmarked, it will depend on the way revenues are spend. Supporting alternative packaging might reduce regressive effects to some extent.

Revenues of charges not being used for specific purposes might be refunded to society. If these revenues have some volume, a balanced general tax reduction could be envisaged. This shifts the burden on society of government expenditures from labour input to input of materials and energy. It is quite generally felt that this is a favourable shift, since at present the burden is heavily on labour, whereas the use of materials and energy has "unpriced" negative environmental impacts (6).

3.4 Concordance with existing institutions and policies

The application of product charges to packaging waste may, in certain cases, be accompanied by rebates to exports and corresponding charges on imported products in order to reduce adverse effects on the competitiveness of domestic producers. The imposition of these "border tax adjustments" must be in accordance with the rules of the General Agreement on Tariffs and Trade (GATT), i.e. that they are identical for domestic and imported products from all sources. Care should also be taken that the application of product charges to packaging waste does not unduly discriminate against imports by being targeted to certain types of packaging used predominantly by imported products.

Polluter Pays Principle

The polluter pays principle is a basic principle of environmental policy. The OECD has adopted the principle implying that polluters should bear the expenses of carrying out the measures for preventing and control of pollution (Recommendation C(72)128 of 1972). Also the European Community has accepted this principle (art. 130R, Single European Act.) When facing product charges, packers and fillers should pay them, or should pay the costs of alternative actions. Given agreed exceptions, no financial assistance should be offered. Furthermore, it is reasonable that administrative costs of charge schemes are financed from the charge revenues. Note that the PPP does not prejudge the designation of the polluter; it means that public intervention can take place at any level of the production-consumption chain, wherever it may be most appropriate and efficient.

Trade rules

Countries which are members of a supra-national (political) body can meet certain restrictions when planning to introduce new economic instruments. This is especially true for the European Community. Instruments should not create trade barriers. Nor should they discriminate against foreign firms - which is also an essential element of the GATT-rules - that is, product charges should neither be imposed on foreign products where similar domestic products are exempted (GATT, Art. I), nor should there be differences between charges rates on domestic and foreign products (GATT, Art. III-2).

International legislation

International legislation, for example within the body of the European Community, might restrict unilaterally introducing charges. The Packaging Directive is as yet unfinished, but will likely contain the rule that member countries are free to apply economic instruments in the field of packaging waste management, given the rules embodied in the Single European Act. Such instruments must be notified to the European Commission.

Restrictions regarding charges emerging from the Single European Act include a prohibition of introducing charges exclusively on imported products (art. 9, 12, 13, 16) and on discriminating taxation (art. 95), for example charging a type of packaging which is hardly or not at all produced domestically and for which domestic (non-charged) alternatives exist.

Existing policies in related sectors

Economic instruments considered will fit in existing policy frameworks regarding packaging waste or municipal waste in general. Mostly, economic instruments will have to contribute to the achievement of policy targets, for which other instruments (legislation, agreements) are already operational.

The operation of product charges can have effects on other segments of the public or private sector. They are likely to affect packaging industries, the retail sector and the recycling industry, which might be a subject of the national economic policy (employment, regional development) as well.

Relevant to the structure of product charges is the fact whether or not other instruments already include environmental costs, for example energy taxes. Double-counting should be avoided.

Internal fiscal regimes

As to their functioning, charges should be considered as elements in the fiscal system and should be judged against the background of fiscal legislation, which is well-developed and sometimes rigid in many countries. Being a tax in a fiscal sense can be decisive for the way charges must be operated. The charge basis, tariffs and liable groups may be regulated in laws. On the other hand, administering the charge can benefit from existing fiscal, bureaucratic and financial channels, thereby saving on administration costs.

4. Practical Considerations

4.1 Structure of the instrument

Important elements of a product charge are determining the charge base and calculating the charge rate.

Charge base

The charge base should include all relevant items under the charge regime. This could be a comprehensive list, enumerating specific packaging by type, brand and/or material. Possible alternative types of packaging should be envisaged. Existing substitutes which are currently not on the (domestic) market should not be overlooked. Also exemptions, or situations in which exemptions are reasonable, should be listed and maintained through time. There should be no room for multiple interpretations.

Charge rate

Principally, the charge rate should internalize environmental costs, not internalized already by other financial instruments, such as waste disposal charges. In practice, setting the charge rate should take into account the targets regarding the reduction of the charged products, and their price-elasticities. Price-elasticities of the demand for packaging products will depend on their function (replaceability), their costs and on availability and costs of substitutes. Charge rates can be calculated by weight or by volume; different charge rates can be established for different materials.

If calculated according to weight, glass containers might be overcharged compared to plastic, and composite packaging. If calculated according to volume which might be the right thing to do if landfill space is a decisive environmental factor plastic and composite containers might be overcharged in relation to glass and containers since the former easily reduce in volume when landfilled.

Different materials may require different charge rates. This will gain in effectiveness, but lose in administrative feasibility and in simplicity towards target groups.

4.2 Target groups

Charge liability follows directly from the chosen charge base, in the sense that producers of the listed packaging items should pay the charge. They are fully hit by the charge since packaging is normally their sole product. They are the ones who would decide about developing alternatives. They are expected to pass on the charge to packers and fillers who will decide about avoiding the charge by choosing for a substitute. Charging packaging producers has the advantage of a small group of liable actors, which simplifies administration and control. Imported products should be charged at the border.

Producers of packaging would probably be opposed to differentiated charge rates, since correctly internalizing environmental costs may considerably change their relative market position. They very well might be in favour of a virgin materials tax which would treat them more equally. This element should be accounted for when discussing acceptability of the schemes.

Liable actors should be incorporated in a list which should be regularly updated.

There might be exceptions to charge liability. Regarding product charges one might think of the delivery or use of products for laboratory experiments. If the charges are only nationally implemented, exports could be exempt from the charge. This, of course, increases administrative complexity.

4.3 Data requirements

For deciding about targets and for a clear picture of the way product charges will operate in practice, knowledge of the following data can be helpful:

On waste:

- municipal solid waste quantities
- share of packaging waste in the solid waste volume
- current rates of recycling and reuse
- costs of recycling and reuse
- costs of disposal and litter
- other externalities

On markets:

- volumes of the various commodities on the markets; competition
- the functions of the packaging under consideration, and in particular its marketing value
- numbers of actors and the way they are organised
- an economic profile of the firms in terms of size, turnover, profitability, employment
- possible international character of the market: flows of imports and exports
- state-of-the-art of the technology of products and processes, and likely future developments
- Substitutes available for packaging products under the deposit-refund system

- A spatial profile of the market, if relevant in case of substantial transport costs

Updates should be made on a regular basis.

4.4 Administrative organisation

If it is decided that charges are similar to fiscal taxes, they will formally be under the authority of a government ministry. The executive authority might be a government service already charged with administering taxes. If legislation allows, it might be efficient to commission this task to a public corporation active in the relevant industry sector. A drawback could be that such corporations (branch organisations) might be reluctant to co-operate since they have a representative function, knowing that industry quite generally is not in favour of regulatory environmental charges.

Invoice, control and enforcement require management and manpower. Invoice gains considerably in efficiency if it can be organised in combination with invoice of VAT. For a structured control it is recommendable to list all possible actions which imply evasion of paying the charge. It should be borne in mind that to date not much experience has been achieved with really incentive charges and that the higher the charge rate is, the more liable actors will be inclined to try to avoid charge paying. For the same reason a strict enforcement will be necessary. Sanctions will have to be formulated in the law that regulates the charges.

If various charge rates are applied to a large array of products, administrative costs will likely be high.

When all elements of implementation and enforcement have been defined, a cost calculation should provide an assessment of the costs of execution of the instrument which will be covered by the revenues of the charge.

5. Implementation

Implementation of the instrument in practice requires deciding on:

- phasing
- announcement
- information

5.1 Phasing

Two ways of introducing the charge are conceivable: 1) immediately setting the charge rate at the desired level; 2) gradually increasing the charge rate up to the desired level. The first option might be the right thing to do from a theoretical point of view, but might incur substantial adjustment costs, although benefits are gained in terms of less environmental impact. The second option gives actors concerned an opportunities to adapt to the new charges. This requires phasing. If charges have an incentive purpose, liable actors are expected to change behaviour and use products or materials not under the charge regime. This requires time. In the meantime, a high charge rate takes up funds that otherwise could have been used for necessary investments in new packaging technology. It might be advisable to establish a charge system with increasing charge rates through time.

5.2 Announcement

Early announcement, if possible a year or more before the actual introduction of the charge, may have an a priori impact and increase the effectiveness of an appropriate phasing of the new instrument. A feasibility study including all relevant aspects of the instrument considered could precede the introduction of new economic instruments.

5.3 Information

Announcement and introduction of new charges should be accompanied by abundant information. Target groups should be informed about the structure of the charge, about products under the charge regime, about charge rates and phasing and about all relevant procedures. It should be emphasized in the information campaign that, in case of incentive charges, these charges are not aimed at providing the government with new tax funds, but that the incentive impact prevails. Such a statement can be reinforced, of course, if revenues can be refunded to society. The destination of revenues should be clearly stated.

Information should also be directed at possible alternative products, materials or technologies available for firms concerned.

Informing the public about the positive results of the charge will increase acceptability and participation.

6. Evaluation

After one or more years of operation, an evaluation study should indicate whether the new charge fulfils its functions. If so, operation should continue. If not, necessary changes, for instance to the charge rate, can be developed and implemented. A final possibility is withdrawal of the charge.

Evaluation should be carried out by judging the performance of the product charge against the criteria, as discussed in section 3. They are principal criteria:

-- environmental effectiveness: has the charge resulted in achieving the objectives of the system, such as reducing the charged packaging, substitution by recycled containers, design and introduction of new types of packaging, etc?

-- economic efficiency: what are the costs of compliance, for producers, and how are they passed on through forward linkages?

-- equity: could an assessment be made of the effects of the charge on the income distribution?

-- existing policies: have policy frictions emerged, both on the national and on the international level?

They are practical criteria:

-- administrative feasibility: an assessment of the costs for execution and enforcement of the charge should reveal whether or not they are reasonable; has the system sufficiently been controlled?

-- acceptability: how are the reactions to the charge; has there been unexpected evasive behaviour?

7. Key issues

A number of issues could be catalogued which are expected to be decisive for the chances of designing, implementing and enforcement of product charges for packaging. The following list is by no means exhaustive.

"Country-of-origin" principle

After the completion of the Internal Market in Europe, border controls will be removed. If regarding the organisation of the fiscal regime the "country-of-origin" principle will also be valid for environmental charges, unilateral implementation of product charges will only be possible for domestically produced commodities. If the "country-of-destination" principle will apply, complete coverage of the system is feasible, although control is difficult, in particular for shopping abroad by consumers. Introduction of product charges should be an issue at the European level.

Acceptability

If strong resistance should emerge, the system will be difficult to enforce. Collaboration, both from producers and from consumers, is of paramount importance.

Charge base and charge rates

The environmental effectiveness being the first and foremost purpose of the charges, correctly determining the charge base and the charge rates are of decisive value. An experiment might be of use.

Regressivity

A reliable assessment of the regressivity of the charge, which probably will be small, is important because of the general political resistance against regressive taxation.

Fiscal pressure

Product charges tend to raise the fiscal pressure which has little acceptability. The destination of the revenues needs attention, in order to prevent the opinion that the charge is all but an ordinary tax measure.

Deposit-Refund Systems

1. Definition

Deposit-refunds essentially are product charges which are refunded if the charged products are prevented from final disposal by returning them to the refunder. Except for the refunding, the difference between these two instruments lies in the point of impact: a product charge on packaging may influence the behaviour of producers who use these products, whereas DRS operates one step further in the chain and should modify consumer behaviour. Product charges leave more freedom to the system: producers are free to shift to DRS. DRS, if mandatory, does not provide that freedom. DRS and product charges can be combined: product charges will have a lower impact on the price of products as the trippage increases. If the refund is smaller then the deposit, an implicit product charge occurs.

DRS can be a private initiative or government-initiated (mandatory). Private initiatives are seldom feasible since environmental considerations are left out of the analysis, unless they are economically force by e.g. product charges.

2. Purpose

The purpose of DRS is to induce buyers of the products in the system to return the empty packaging for some kind of reprocessing. This is a valid action if social costs are lower than those of alternative actions, notably landfilling. Two types of reprocessing are available: 1) reuse, 2) recycling. It largely depends on the type of material which kind of reprocessing is most relevant.

Glass containers and containers made from durable plastic (such as PET) can be considered for reuse. Non-durable plastic containers and steel and aluminium cans can better be recycled. In economic terms this difference is gradual: in reuse it is cleaning that matters, whereas in recycling costs of scrapping and container production are relevant. In reuse, containers stay within the system, in recycling, scrapped material might find destinations outside the packaging sector.

Of course, returning empty containers should have an environmental justification. Returning containers saves in disposal costs and litter. In terms of available policy options, DRS can have the following impacts.

Since economic instruments should be directly brought into action where they are expected to work, DRS on packaging should first and foremost serve the purposes of recycling and of reuse. DRS will have side-effects on other policy options. The impact should be explained and taken into account in a integral analysis. In fact, the balance of all the positive and negative effects should settle the matter of whether or not introducing deposit-refund.

DRS directly affects **reuse** and **recycling** in a positive way, since it helps to make containers available for such actions. Alternative collection systems such as "bring" systems and kerbside collection normally have lower rates of return than DRS.
A DRS will have a positive impact on **source reduction**, since substitution of one-way alternatives is obliged.

Energy recovery in incineration plants may lose some production value if DRS substitutes one-way plastic containers for refillables ones, or if cardboard containers are replaced by reusable containers. Stripped from these items, solid waste will have a lower per unit thermic value.

Regarding **management of final residuals**, successful recycling and reuse might change the quality of the waste to be landfilled. If packaging is removed from the waste stream, the leachate from landfill may improve in quality. Residuals might be a better material for composting.

3. Criteria

In evaluating the scores of DRS against relevant criteria a distinction has been made between principal and practical criteria. Environmental effectiveness, economic efficiency, equity and concordance to existing institutions and policies are considered to be principal criteria. The criteria of administrative feasibility and acceptability are practical considerations, to be discussed in sections 4 and 5.

3.1 Environmental effectiveness

In practice, environmental effectiveness is a first and foremost objective of implementing DRS. Environmental effectiveness is achieved if DRS fulfil their purpose as has been set in section 2, and DRS should primarily judged on the basis of their performance regarding recycling and reuse.

Environmental effectiveness increases if the trippage (in case of reusable containers: number of times the same container can be reused) of the reusable containers and the rate of return increases. Per unit of packed product, less packaging is landfilled then, which saves in space for waste sites and, possibly, in pollution by leacheating or incinerating packaging materials like plastic.

If a DRS aims at recycling rather than reuse, effectiveness is only secured if containers returned are recycled into marketable products.

3.2 Economic efficiency

Essentially, DRS are a financial signal to which buyers of packed products are free to react in a way that suits best their individual interests. If estimated higher than the costs of inconvenience, consumers will return the empty containers and get refunded. If mandatory, producers will probably try to get a maximal rate of return of the containers, provided that the (scrap) value of returned containers is higher than the refund. If a certain share of one-way containers is allowed, producers will seek an optimum which depends on the costs of both schemes. If the DRS is not mandatory, but economically forced by product charges on one-way packaging, a different financial scheme will emerge. Producers will compare the private economic balances of both one-way and reusable containers and decide accordingly. The government should ensure that external costs are fully taken into account in order to arrive at a socially acceptable outcome.

Important costs elements connected to DRS not only consist of capital expenditures and differences in running costs for all actors involved in the scheme, but also of costs for administration of the scheme.

Especially set-up costs for necessary installations can be high, or even prohibitive. If running costs are acceptable, governments may decide to interfere in overcoming initial capital outlay.

Relevant benefits and costs for assessing the net social benefits of DRS are:

-- benefits from reduced waste collection and disposal;
-- benefits from reduced litter;
-- benefits from reduced input in container production;
-- costs due to increased storage, handling and processing;
-- inconvenience costs for householders.

Costs of storage, handling and processing normally will be substantial. Careful analysis is due for determining whether benefits outweigh the costs in this scheme, and whether the balance is most favourable, compared to the balances of alternative schemes.

3.3 Equity

Basically, DRS does not affect income distribution since a full refund is possible on every deposit. Lower income groups might be more inclined to return empty containers than the better off. If so, the impact of DRS is progressive.

3.4 Concordance with existing institutions and policies

The following issues are relevant when discussing concordance of DRS with existing institutions and policies: 1) trade rules; 2) polluter pays principle; 3) international legislation.

Trade issues

Care should be taken to design deposit-refund systems for packaging waste to be as import-neutral as possible so as not to seriously disadvantage foreign producers. Deposit-refund systems can be protectionist if they are applied only to certain types of containers or packaging which are primarily used for imported products or if they are applied in a fashion which is discriminatory or unduly favours domestic producers. Deposit-refund systems can increase the difficulties of market entry by foreign producers who may have problems gaining access to systems for storing and recycling packaging materials; they can also disproportionately raise the costs of foreign producers who must use greater quantities of packaging to transport goods over long distances.

Polluter Pays Principle

The polluter pays principle is a basic principle of environmental policy. The OECD has adopted the principle implying that polluters should bear the expenses of carrying out the measures for preventing and control of pollution (Recommendation C(72)128 of 1972). Also the European Community has accepted this principle (art. 130R, Single European Act). It is reasonable that a deposit is paid on products which will cause environmental costs which are not covered in some another way. If not, a refund should follow. The level of the deposit should not differ largely from the estimated environmental costs the packaging will cause when landfilled or littered.

International legislation

International legislation, for example within the body of the European Community, might restrict unilaterally introducing mandatory deposit-refund systems. The Packaging Directive is as yet unfinished,

but will likely contain the rule that member countries are free to apply economic instruments in the field of packaging waste management, given the rules embodied in the Single European Act. Such instruments must be notified to the European Commission.

4. Practical considerations

4.1 Structure of the instrument

Calculation the deposit and refund

Principally, the deposit should include the commercial costs of the container, plus the environmental costs associated with the disposal or with littering. Refunds should equal the avoided environmental costs plus the scrap value of the container.

In practice, the deposit and refund should be set as to fulfil the goals of the scheme and to avoid unwanted effects. If the deposit/refund is too low, the rate of return of the containers will be too low. On the other hand, the refund should not be higher than the scrap value of the container in order to encourage producers to collect the empty containers. The scrap value depends on the costs of reprocessing used containers compared to the costs of new containers. If reprocessing is expensive (high costs of system set-up, storage, handling) and new containers are cheaply produced, scrap values are likely to be negative, causing a break-up of the system. Containers will generally will have a positive scrap value are glass bottlers, containers made from durable plastics (PET) and aluminium cans.

Thus, if the deposit/refund is too high, several effects may occur:

a) the increased price of the packed product (deposit included) reduces demand below the level that is socially desirable;

b) if the refund largely exceeds production costs of new containers, these containers may go directly for refunding;

c) if refunds are higher than the scrap value of the container, producers have no economic incentive to organize an effective return system.

A deposit/refund which is too low may result in:

a) a low rate of return, rendering the system inefficient;

b) financial deficits in running the system, since these must be covered from the unredeemed deposits.

There seems to be a bracket for a feasible level of deposits and refunds. It is a matter of experience to correctly settle the level.

In the relation between retailers and consumers deposits and refunds should be the same, whereas deposits should be equal for a large area. If deposits exceed refunds consumers are discouraged to buy the packed product. If deposits (and refunds) differ from place to place, consumers are induced to buy where the deposit is low and to return the container where the refund is high.

In the relation between retailers and producers, retailers might be offered a handling fee by introducing a small difference between deposit and refund. This handling fee should cover collection and storage costs. An other source of income for the retailer arises when he collects less containers than he has sold. If more containers are returned than has been sold, the retailer will face a deficit. This can be corrected by establishing the deposit the retailer pays the producer on a higher level than the deposit the consumer pays the retailer. Then the retailer receives a fee for any surplus container handled.

The producer has to decide whether he actually will refill the returned containers. This depends on the trippage (number of times the container is refilled) and the costs of refilling compared to the costs of buying disposable containers, if the DRS is not mandatory. Due to economies of scale the larger the scale of production, the more commercially feasible a deposit-refund scheme can be. If disposable containers are the cheapest way, additional instruments, e.g. a product charge, might be necessary in order to secure the goals of the deposit-refund scheme, or the DRS might be declared mandatory.

Unredeemed deposits

Basically, two options are open for the destination of unredeemed deposits. The first option is to let the retailer keep these deposits, e.g. as a source of income for compensating handling and storage costs. This might be an disincentive for the retailer to readily accept returned containers. The second option implies that such windfalls should go to the State. The retailer could be offered a handling fee with each container returned for compensating his costs.

Financing the new deposit-refund scheme

New deposit-refund schemes require substantial investments in designing and producing new, durable containers, cleaning and refilling equipment and storage capacity. This might be a barrier for firms to enter the scheme. A solution might be found in temporary financing of these investments by the State. This might be done by means of grants, soft loans or accelerated depreciation.

4.2 Target groups

Organisation of the deposit-refund scheme

A number of parties are involved in the production and use of packaging: packaging industry, producers of the packed product (packer/filler), transport firms, retailers, consumers. When introducing a deposit-refund scheme decisions are to be made on (1) which party should administer the scheme and (2) which party should organize collection of the returned containers.

It is efficient to administer the scheme as high up in the "chain" as possible which means at the packers/fillers level. A small number of administrations create economies of scale. This is also effective, since the deposit-refund scheme will be uniform for a large area which prevents possible inequities (restricted introduction of the scheme, differences in deposits/refunds). If the number of packers/fillers is large (e.g. in the beer market in some countries) it might be efficient to charge a private firm with the management of the deposit-refund scheme.

Points of collection of the empty containers should be available in a high density in living areas. Then, the retailer is a logical place. If this is too cumbersome, separate collection points could be conceivable.

Acceptability

A number of factors determine the acceptability of deposit-refund schemes for consumers, i.e. determine the percentage of containers that will be returned:

a) the absolute level of the refund;
b) the refund relative to the price of the packed food or beverage;
c) the distance to the collection point;
d) the market segment of the packed product: some of the more expensive liquors are consumed in the wealthier parts of society, that may be less inclined to return the empty bottles;
e) preferences for certain types of packaging.

The choice of packaging material by the producer is determined by four factors mainly:

a) functions of the packaging;
b) costs;
c) consumer preferences;
d) retailer acceptance.

The cost factor has been discussed in section 4.1. Packaging functions and consumer preferences can interfere with standardization and the introduction of deposit-refund systems. The same holds for consumers preferences, additional to the general inconvenience of having to return the containers. Retailers will generally be reluctant to accept new deposit-refund schemes, since handling returned bottles requires extra work.

Retailers are in the position to abandon the sales of certain brands when deposit-refund systems are introduced in certain segments of the market. Their decisions will be based on the following factors:

(a) consumer preferences;

(b) costs of storage; sometimes, e.g. in inner cities, available storage space might be a constraint: more storage room will reduce room for shelves, thereby reducing retailers assortment.

(c) costs of handling (collection, administration);

(d) opportunities for being compensated for (parts of) the costs mentioned above (destination of non-redeemed deposits, handling fee, or scrap value of non-refillable containers, if positive).

Finally, packaging producers are likely to be against introducing DRS, because their turnover will negatively be affected.

4.3 Data requirements

For deciding about the targets and for a clear picture of the way deposit-refund systems will operate in practice, knowledge of the following data can be helpful:

On waste:

- municipal solid waste quantities
- share of packaging waste in the solid waste volume

- current rates of recycling and reuse
- costs of recycling and reuse
- costs of disposal and litter
- other externalities

On markets:

- volumes of the various commodities on the markets; competition
- the functions of the packaging under consideration, and in particular its marketing value
- propensity of consumers to return the packaging; inconvenience costs
- numbers of actors and the way they are organised
- an economic profile of the firms in terms of size, turnover, profitability, employment
- possible international character of the market: flows of imports and exports
- state-of-the-art of the technology of products and processes; expected trippage, and likely future developments
- Substitutes available for packaging products under the deposit-refund system
- A spatial profile of the market, if relevant in case of substantial transport costs

Updates should be made on a regular basis.

4.4 Administrative organisation

New deposit-refund systems might find their legal basis in environmental legislation. An alternative basis can possibly be found in covenants (industry agreements) in which government and industries agree on introduction of such systems. Mandatory DRS require that there is an obligation for parties concerned to accept the empty containers offered, and to refund.

Containers in the system and foodstuff (or other commodities) to which the system applies must be described. If the system is adjunct to a ban on one-way containers (which might be recommendable in order to strengthen the system), the basis of the system should contain an exact description of the permitted containers. The number of different types of containers should be kept to a minimum in order to simplify handling at the retailers level. These containers must be easily identifiable.

The executive organisation could be privately managed. Income of this organisation is provided by the deposits of the non-returned containers. It is important to note that the objective of the deposit-refund system. i.e. a high percentage of return, and the continuity of the executive organisation might be conflicting goals. If no positive financial management is possible, additional funds may be found in an increase of the deposit, or a product charge on the containers.

Enforcement of deposit-refund systems would not seem to run into large problems. Consumers will complain if retailers refuse to accept containers in the system, as will retailers in case of a producers refusal. Whether refillable containers are used and whether deposits are set at the right (prescribed) level can be easily checked in shops.

5. Implementation

Implementation of the instrument in practice requires deciding on:

- phasing
- announcement

- information

5.1 Phasing

Two ways of introducing the deposit-refund system are conceivable: 1) immediately setting the deposit at the desired level; 2) gradually increasing the deposit up to the desired level. There seems to be no ground for phasing in the case of DRS. An acceptable rate of return is necessary from the very start of the system. So are funds for running the system. After refunding, a high deposit has no negative economic effects to consumers. Producers and retailers might benefit from high unredeemed deposits, to help them overcome adjustment costs.

5.2 Announcement

Timely announcement before the actual introduction of the deposit-refund system will promote a smooth introduction. Industry needs time to get themselves organised. An information campaign is a positive element in the implementation. A feasibility study including all relevant aspects of the instrument considered could precede the introduction of new economic instruments.

5.3 Information

Announcement and introduction of new deposit-refund systems should be accompanied by abundant information. Target groups should be informed about the structure of the system, about products under the DRS, about levels of deposit and about all relevant procedures which will be run by the administrative organisation. Consumers should be made aware of the products in the DRS.

Informing the public about the results of the DRS will increase acceptability if they are positive.

6. Evaluation

After one or more years of operation, an evaluation study should indicate whether the new system fulfils its functions. If so, operation should continue. If not, necessary changes, for instance to the deposit level, can be developed and implemented. A final possibility is withdrawal of the DRS.

Evaluation should be carried out by judging the performance of the DRS against the criteria, as discussed in section 3. They are principal criteria:

-- environmental effectiveness: has the DRS resulted in achieving the objectives of the system, such as reducing the amount of packaging in the waste stream?

-- economic efficiency: what are the costs (set-up, running costs, administration costs, inconvenience), for groups concerned?

-- equity: could an assessment be made of the effects of the DRS on the income distribution?

-- existing policies: have policy frictions emerged, both on the national and on the international level?

Practical criteria are:

-- administrative feasibility: an assessment of the costs for execution and enforcement of the DRS should reveal whether or not they are reasonable; can they be covered by unredeemed deposits; has the system sufficiently been controlled?

-- acceptability: how are the reactions to the DRS; has there been unexpected evasive behaviour?

7. Key issues

In the case of deposit-refunds key issues for success seem to be:

Rate of return

The rate of return of empty containers is the backbone of deposit-refund systems. If too low, the system is inefficient. It should be improved, or abandoned.

Acceptance

Accepting the system by all groups concerned is of paramount importance. Abundant information should help.

Set-up and running costs

If set-up costs are insurmountable, additional funds should be available for a short transition period. A system which is desirable from a social point of view should not be frustrated by temporary financial problems. Whether such a system is desirable, seems to depend largely on its running costs and on the savings on disposal and litter.

Perverse effects

Especially when in a monopoly position, producers may use the new DRS for price increases which are not justified by factor prices. In border regions, consumers might travel abroad and buy products which are not under a DRS.

Trade barriers

Mandatory deposit-refund systems can constitute non-tariff barriers to imports which may have difficulties gaining access to the necessary return and reuse facilities, and can unduly discriminate against imports when applied in a manner which favours domestic products.

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Notes

1. Official Journal of the European Communities, No. C263, vol.35. , 12 October 1992.

2. For a complete analysis see: David Pearce and Kerry Turner, "The Economics of Packaging Waste Management: a conceptual overview".

3. See Goddard, Haynes C., 1991, "Economic Incentives for Managing Household Solid Waste: Upstream Versus Downstream Policies." A paper presented at Conference on Research Developments for Improving Solid Waste Management, sponsored by the Air and Waste Management Association and the U.S. Environmental Protection Agency, Cincinnati, Ohio, February 4, 1991, and Stavins, Robert N., ed., 1991, *Project 88/Round II: Incentives for Action: Designing Market-Based Strategies* (Washington, D.C., May 1991). A public policy study sponsored by Senators Timothy E. Wirth (Colorado) and John Heinz (Pennsylvania), pp. 48-55.

4. U.S. EPA has compiled data on 109 communities in the U.S. with volume-based systems for financing collection and disposal of municipal solid waste. The ages of the programmes range from five months to almost 77 years old. EPA has identified two California communities that have programmes over fifty years old; Richmond's programme began in 1916 and Berkeley's in 1924. Studies indicate that unit pricing of solid waste reduces the amount of waste disposed in landfills. Applying the case study method, EPA (1990) estimates for two small U.S. communities, Perkasie, Pennsylvania and Ilion, New York, that unit pricing caused households to:

   -- reduce solid waste generation by at least 10 per cent;
   -- reduce the amount of solid waste disposal services purchased by more than 30 per cent;
   -- double the amount of waste recycled.

   Furthermore, switching to a unit pricing programme reduced total solid waste management costs by more than 10 per cent in both communities. (See U.S. Environmental Protection Agency, Office of Solid Waste. *Charging Households for Waste Collection and Disposal: The Effects of Weight on Volume-Based Pricing on Solid Waste Management*, EPA/530-SW-90-047, September 1990)

   More recently, the World Resources Institute (1992) statistically analyzed data from ten communities for the effect of unit pricing on the amount of waste sent to the landfill. The analysis gives evidence that if a community moves from a per-bag price of zero to $1.50, it can expect a reduction of 18 per cent in the amount of waste sent to the landfill. The same community can expect reductions of up to 30 per cent if it simultaneously introduces a curbside recycling programme (World Resources Institute (WRI), Robert Repetto, Roger C. Dower, Robin Jenkins, and Jacqueline Geoghegan, 1992, "Pay-by-the-Bag Household Collection Charges to Manage Municipal Solid Waste," in Green Fees: *How a Tax Shift Can Work for the Environment and Economy*, Washington, D.C.: World Resources Institute, 1992).

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