

Increasing the Efficiency in Packaging Material Chains

The Nordic Policy Experience



Spyros Bousios

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Master's Thesis

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Name: Spyros Bousios

UU Number: 3243249

Master's Program: Sustainable Development – Track Energy & Resources

University: Utrecht University – Copernicus Institute – the Netherlands

Supervisor: Prof. Dr. Ernst Worrell - Department of Science, Technology and Society
– Utrecht University – Copernicus Institute

Summary

In order to deal with the material dissipation problem, the energy requirements of material production and waste processing and the subsequent GHGs emissions, great changes are needed in the material production and consumption patterns worldwide. The packaging sector is of great importance within this context, considering the large share of its products in Western Europe's municipal solid waste and the significant CO₂ emissions attributed to it, the pressure that it exerts on the environment and the significant savings potential that is available.

The objective of this project is to provide an in-depth insight on the experiences accumulated by the Nordic countries (Denmark, Finland, Norway and Sweden) regarding policy measures aimed at the improvement of material efficiency in the packaging field. An integral component of the project is the effectiveness assessment of these policies in terms of targets' attainment and of the overall effect on packaging material consumption trends. Furthermore, a comparison with the Dutch experience on packaging policies is conducted in order to provide a different perspective on the Nordic results, while the Greek case is used in an attempt to determine the potential for the utilization of the Nordic policy experiences in countries where no comparable results have been achieved yet.

The general trend for most of the packaging materials examined in each one of the Nordic countries is a combination of increases in per capita consumption with declines of the material intensity of use. Denmark is the only Nordic country that managed to reduce its overall packaging per capita consumption during the period examined (1998-2007), while Norway has demonstrated the most alarming developments in the form of high consumption increases coupled with rises in the material intensity of use. On the other hand, the recycling and total recovery rates are generally improving and the majority of the EU targets introduced by the Packaging Directive and/or the national policy frameworks have been easily attained ahead of time.

Extended producer responsibility schemes are at the core of the national policy in the majority of the Nordic countries but, despite generally helping the countries achieve high waste recovery rates, they do not appear to offer much in the direction of waste prevention/minimization. Other popular policies implemented include administrative instruments such as recovery targets and landfilling restrictions and economic instruments such as taxation schemes for packaging items/materials, landfilling/incineration charges and deposit-refund systems. In general, economic instruments have been used successfully for a wider variety of purposes (ranging from waste minimization to increased waste recovery) than the administrative ones, while a lack of measures aiming specifically at the higher levels of the waste hierarchy and the packaging chain is observed in most of the Nordic countries.

The comparison of the Nordic results with those of the Netherlands indicated that the Dutch case is characterized by a much higher packaging consumption (still

increasing at a significant rate) and by the loss of the comparative advantage over the Nordic countries in terms of packaging recycling that existed during the early stages of the period examined. A number of factors are proposed in order to explain these results including the lack of government leadership in the Netherlands, the unwillingness to implement economic instruments, the perpetual restructuring of the Dutch policy system and the uneven and –at times- ambiguous responsibility allocation among the various actors involved.

Finally, a set of actions based on the author’s personal experience and the results achieved by the Nordic policy initiatives has been proposed for the improvement of the Greek policy framework, which is characterized by the very low degree of implementation of its theoretical provisions.

One more point that became clear in the course of this project is the need for an EU initiative aiming at the harmonization of the member states’ packaging waste data compilation practices. The Packaging Directive is allowing the member states to follow varying approaches towards this issue and the result is differences among the countries ranging from packaging definitions to data collection methods and various assumptions made. This creates questions about the reliability and comparability of the data reported, and limits the potential for a clear overview of the current state of affairs in the European packaging sector.

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List of acronyms

(E)PS = (Epoxy)Polystyrene

BAMPOP = Bureau for the Alternative Management of Packaging and Other Products
(*Greece*)

CAEM = Center for Alternative Environmental Management (*Greece*)

CHP = Combined Heat and Power

CSAMP = Collective System for the Alternative Management of Packaging (*Greece*)

EDG = Environment Directorate-General of the European Commission

EEA = European Environment Agency

EKC = Environmental Kuznets Curve

EPR = Extended Producer Responsibility

EU = European Union

EUROPEN = European Organization for Packaging and the Environment

FTI = Förpacknings- och Tidningsinsamlingen (*Packaging and Newspaper Collection, Sweden*)

GDP = Gross Domestic Product

GHGs = Greenhouse Gases

HCDG = Health & Consumers Directorate-General of the European Commission

HERRA = Hellenic Recovery and Recycling Association

HeRRCo = Hellenic Recovery Recycling Corporation

HDPE = High-Density Polyethylene

HoReCa = Hotel/Restaurant/Café

IU = Intensity of Use

Klif = Klima- og forurensningsdirektoratet (*Climate and Pollution Agency, Norway*)

LCA = Life Cycle Assessment

LDPE = Low-Density Polyethylene

NGOs = Non-Governmental Organizations

NOAMPOP = National Organization for the Alternative Management of Packaging and Other Products (*Greece*)

OECD = Organization for Economic Cooperation and Development

PALPA = Suomen Palautuspakkaus

PAYT = Pay As You Throw

PET = Polyethylene Terephthalate

PP = Polypropylene

PRO = Producer Responsibility Organization

PTR = Pakkaustutkimus (*Association of Packaging Technology and Research , Finland*)

PVC = Polyvinylchloride

PYR = Pakkaualan Ympäristörekisteri (*the Environmental Register of Packaging, Finland*)

R&D = Research & Development

REPA = Registret för producentansvar och återvinningssystem för förpackningar

SCB = Statistiska centralbyrån (*Statistics Sweden*)

SFT = Statens forurensningstilsyn (*Pollution Control Authority, Norway*)

SPY = Suomen Pakkausyhdistys (*Finnish Packaging Association*)

SSB = Statistisk Sentralbyrå (*Statistics Norway*)

SYKE = Suomen Ympäristökeskus (*Finnish Environment Institute*)

UN = United Nations

UNECE = United Nations Economic Commission for Europe

WPO = World Packaging Organization

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1. Introduction

1.1. Research background

It is widely acknowledged that materials have been one of the most significant building blocks of human societies throughout the course of history. The ability to utilize different types of materials in different times has been of the utmost importance for the advancement of mankind, a fact emphasized by the division of early human history in ages such as the Stone or the Iron ones. During more recent times, the developments in science, industry and trade paved the way for the use of new material types along with or instead of older ones. Moreover, an increase of the quantities required in order to fulfill our needs was witnessed, escalating up to the unprecedented material flows that are surrounding us nowadays. Finally, non-renewable materials have become more and more prevalent compared to the past [Geiser, 2001].

The 1970s, and in particular the year 1972 (when the *Limits to Growth* report was published), marked a turning point; questions began to arise at an increasing rate concerning the planet's capability to sustain the human population, considering its continuous increase and the lifestyle of large parts of it. One of the results was that the "dissipation of materials" problem came into focus and the public was faced with its two aspects: the subsequent depletion of the global stock of high-quality materials and the distribution to the environment of low-quality materials in the form of pollution and wastes [Geiser, 2001].

It has become, therefore, apparent that there is a need for great changes in the material production and consumption patterns worldwide. Such changes, apart from dealing with the dissipation problem, will also aim towards the decrease of the energy requirements for material production and waste processing and, subsequently, will work towards limiting GHGs' emissions; it is needless to say how pressing all of these issues are in the struggle for a more sustainable future. The question that comes up next is how these changes in material use are going to come about. It is understood that leaving the responsibility solely with the markets is a recipe for failure. It is at this point that the governments step into the arena and undertake the task of devising and implementing appropriate policies in an effort to influence behaviors (both of the business community and of the public) and to overcome barriers and failures.

The underlying idea behind this project sprang after studying an older masters' thesis project undertaken in Utrecht University [Rouw, 2009]. Some indications were found in it of possible successful policy interventions leading to the reduction of packaging materials amounts consumed in some Nordic countries. This study will try to determine if actual substantial evidence of such a success do exist. An extensive knowledge of the packaging policies field in the selected countries has to be acquired in order to do so and the results of the policies implemented have to be evaluated using an array of criteria. It is hoped that at the end of this evaluation effort some

conclusions will be drawn regarding the factors that may promote successful packaging materials management mechanisms as a part of the greater idea of promoting the altered material production and consumption patterns mentioned above.

1.2. Research objectives

The objective of this project is to provide an in-depth insight on the experiences accumulated by the Nordic countries regarding policy measures aimed at the improvement of material efficiency in the packaging field. Overviews of measures (currently or formerly implemented) concerning the packaging material chains should be created for each of the selected countries so as to attain this goal. Moreover, an integral component of the project is the effectiveness assessment of these policies in terms of targets' attainment and of the overall effect on packaging material consumption trends. The countries selected for this project are Denmark, Finland, Sweden and Norway. It should be mentioned that although Norway is not a European Union (EU) member state, it participates in the European Environment Agency (EEA) and has been involved in a wide array of EU initiatives and projects.

Furthermore, a comparison with the Dutch experience on packaging policies will be conducted in an effort to determine which country has in place the most robust set of policy initiatives promoting the efficient use of packaging materials and to identify strengths and shortcomings of the various national efforts. Finally, the example of a country with a history of low environmental policies penetration in public administration, i.e. Greece, may help in identifying the potential for the transfer of policy experience from "success stories" to cases where no comparable results have been achieved so far.

1.3. Research question

What are the actions undertaken by the selected Nordic countries in the policy field since the introduction of the EU Packaging Directive in order to achieve improved packaging material efficiency and to what extent have they been effective?

Sub-questions

- a. How have the national packaging waste management policies of the selected countries developed in order to adapt to the requirements of Directive 94/62/EC?
- b. On which phases of the packaging material chain have the policy measures primarily focused?
- c. What has the effectiveness of the policy measures been in terms of targets' attainment? Did the targets set lead to improvements in packaging material efficiency?
- d. How do the results achieved by the selected countries compare to those of the Dutch packaging policies?
- e. What is the potential for the utilization of the Nordic experience with packaging material efficiency policy measures in the case of Greece?

1.4. Thesis outline

Chapter 2 will initially offer some insight on the material use issue; its primary goal, however, is to provide an –as wide as possible- array of information on packaging. In order to do this, it includes definitions and facts concerning the various types, their functions and the materials used, it mentions recent trends in the packaging industry and it briefly discusses the environmental impact of packaging, while also introducing the notion of the packaging chain and of material efficiency within it. Another area on which this background chapter focuses is that of packaging policy measures; the basic principles of waste management are presented and a categorization of the various policy measures implemented is made. Descriptions of the most commonly utilized policies in each category will be also offered. Finally, an introduction to the EU Packaging Directive concludes this section.

Chapter 3 will cover the analysis of the methodology applied in order to answer the research question and its subquestions, while Chapters 4-8 are dedicated to the examination of the Nordic countries. A comparative presentation of the results recorded in them during the period examined will be initially offered so as to give a first glimpse at what was achieved by the policies implemented and at the performance of each country relative to its counterparts. This will be followed by the in-depth assessment of each country separately; the policy background is presented in every case and the results achieved are shown, discussed and, wherever possible, attributed to specific measures.

Chapters 9 and 10 concern the two additional non-Nordic countries participating in this project. The first one presents the Dutch case, comparing the results achieved in the Netherlands with those of the Nordic countries and offering some remarks on what factors may have had an effect on the differences demonstrated. Chapter 10 is providing an overview of the packaging policy field in Greece and presents the relevant figures in its case; a framework consisting of potential solutions for the improvement of the national policy package is also proposed here, based on the experiences of the Nordic countries as discussed in the previous chapters. Finally, Chapter 11 will present the conclusions of this project and offer some recommendations on future research work.

2. Background

The theoretical background necessary for the better comprehension of the policies implemented in the countries of interest –and for their subsequent evaluation- is provided in this chapter. Some basic elements of material use research will be initially presented, followed by an introduction into packaging. An exposition of the various packaging types, of the materials used and of the packaging functions is offered, accompanied by an introduction into the packaging chain. The trends in the industry are briefly discussed afterwards and then a mention of the environmental impacts of packaging is made. The discussion on available policy measures and the underlying principles behind them is an important element of this chapter, which is concluded with a reference to the European Packaging Directive.

2.1. Basic elements of material use

One of the notions much discussed in the field of material consumption research is that of *dematerialization*, a working definition of which is the following: “*dematerialization refers to the absolute or relative reduction in the quantity of materials used and/or the quantity of waste generated in the production of a unit of economic output*” [Cleveland & Ruth, 1999].

Another relevant term used by researchers in this field is the *intensity of use (IU)*, which refers to the demand for a material per unit of gross domestic product (GDP) [Rouw, 2009]. The intensity of use is expressed through the following formula:

$$IU = X_i / GDP \text{ (Equation 1)}$$

Where: IU = intensity of material use, X_i = the consumption of a specific material during year i, GDP = gross domestic product (= the total output of an economy)

Both the material composition of products and the product composition of the economy output can have an influence on the intensity of use. A cluster of factors responsible for the changes in the aforementioned compositions, and subsequently also in the intensity of use, has been identified by Cleveland and Ruth [1999]:

- Technical improvements that decrease the quantity of materials used to produce a good or a service
- Substitution of older materials by new ones with more desirable properties
- Changes in the structure of the final demand
- Saturation of the bulk markets for basic materials
- Government regulations that alter material use.

A variation of the inverted-U curve named after the Russian American economist Simon Kuznets has been used as a tool by researchers in material studies. Kuznets discovered that this curve described the relationship between income inequality and income levels; an Environmental Kuznets Curve (EKC) was later constructed based on the hypothesis that the same relation appears also when resource depletion/pollution is plotted against income levels [Rouw, 2009]. The EKC has been

used in material studies in order to examine the relationship between material use and income levels. A *decoupling* process is being demonstrated in such cases, where the material IU initially increases and then decreases after a certain level of development has been reached, while the GDP continues to rise. Various explanations for this decoupling have been put forward by researchers, including the increasing demand for services in the economies or shifts of demand in high income levels towards less material-intensive goods and services, the improvements in material efficiency and the substitution of materials [Williams et al., 1987].

Three stages of economic development can be distinguished in the shape of the inverted-U curve. The first stage is that of a starting economy which is in need of large quantities of materials and resources for infrastructure development; during this period the material use growth exceeds economic growth. This is followed by a stage of greater development, when more advanced technologies are introduced but the material demand remains quite high. Finally, a mature stage follows, characterized by technological innovations that increase material efficiency [Rouw, 2009]. There is a smaller need for basic infrastructure during the latter phase and a shift towards a service economy (which is less material-intensive) is observed [Cleveland & Ruth, 1999].

It should be mentioned at this point that the developments in material IU do not necessarily correspond to those in absolute material use. The IU could be declining at the same time as the absolute material use is on the rise. The notion of *weak/strong dematerialization* has been proposed in order to describe this phenomenon. When only the IU is declining, then the situation can be described as one of weak dematerialization, while the opposite is true when both the IU and the absolute use levels are dropping [de Bruyn & Opschoor, 1996]. This concept is of particular importance under the light of present-day conditions; in these, the combination of factors such as population growth and affluence can raise material consumption by so much that technological innovation is unable to bring about a reduction in absolute material use. The well-known “rebound effect” is also an occurrence implying that resource-saving technological developments do not necessarily lead to decreased resource consumption [Cleveland & Ruth, 1999].

2.2. Basic elements of packaging

2.2.1. Definition and types

The EU Packaging Directive (94/62/EC) defines packaging as “*all products made of any material of any nature to be used for the containment, protection, handling, delivery and presentation of goods, from materials to processed goods, from the producer to the user or consumer*”.

According to Chan et al. [2005], two major types of packaging can be distinguished: i) *industrial packaging*, which deals with the preparation and protection of merchandise for shipment and storage, and ii) *consumer packaging*, which is

designed to enhance sales acceptance. These broad categories can be further divided into three types of packaging, namely *primary* (used mostly for consumer purposes), *secondary* (used mostly for outer/retail purposes) and *tertiary* (used mostly for transportation purposes). The definitions of these categories' contents, according to the EU Packaging Directive, are the following:

- Primary (or sales) packaging is “*packaging conceived so as to constitute a sales unit to the final user or consumer at the point of purchase*”
- Secondary (or grouped) packaging is “*packaging conceived so as to constitute at the point of purchase a grouping of a certain number of sales units whether the latter is sold as such to the final user or consumer or whether it serves only as a means to replenish the shelves at the point of sale; it can be removed from the product without affecting its characteristics*”
- Tertiary (or transport) packaging is “*packaging conceived so as to facilitate handling and transport of a number of sales units or grouped packaging in order to prevent physical handling and transport damage; it does not include rail, road, ship and air containers*”.

2.2.2. Packaging functions and materials

There is no classification of packaging functions that can be considered as universally applicable. Chan et al. [2005] have combined the views of other researchers and proposed the following list of functions:

- *Protection*: to protect the product from the outside environment and damage while transporting and handling; the degree of protection depends on the value and fragility of the product and on the economic justification for absolute protection
- *Promotion*: packaging (especially primary) many times contains features with a sales orientation
- *Communication*: information flow is important in all types of packaging, e.g. in order to avoid handling incorrect goods and damaging goods due to inappropriate handling or to improve the efficiency of supply chains in international trade
- *Convenience*: packaging handlability is key in order to avoid handling/distribution disorder and product rejection by the consumer
- *Apportionment*: it is necessary to provide products in packaging that caters to the needs of the consumers in terms of size and amount contained
- *Volume and weight efficiency*: a poor utilization of the distribution chain may be the result of inefficient design of the volume and weight relation.

The most popular packaging materials are paper & board, glass, plastics, wood and metals. According to European Union data on packaging consumption (in EU15 countries) during the years 1998 and 2006, it is established that the consumption levels of paper & board and plastics are rising, while glass consumption has been gradually decreasing [Rouw, 2009]. On a global level, paper & board is the packaging

material with the largest sales volume, followed by plastics, metals and glass. Rigid plastics were the fastest-growing sector in the market during the early '00s, a development caused by factors such as the rising demand for PET bottles, the substitution of other materials, the rising consumption of convenience-oriented products and the penetration of packaging into food markets [World Packaging Organization (WPO), 2008].

Paper & board

Five major categories of paper & board packaging can be distinguished: corrugated cardboard, folding boxboard, solid fiberboard, beverage cartons and the remaining items (mostly wrappings). Some types of composite packaging can be identified, such as laminates that are essentially folding boxboard with an additional layer of polyethylene (PE) added in order to achieve better conservation of the product. Moreover, beverage cartons are divided into septic (11% PE + 89% board), used to contain dairy products, and antiseptic (5% aluminum + 20% PE + 75% board) for products with a longer storage life [Rouw, 2009].

Metals

The most widely used metals for packaging purposes are steel and aluminum. Beverage containers and canned food packages are common applications of metal packaging materials.

Plastics

Synthetic packaging materials are divided into the following categories: low-density polyethylene (LDPE), high-density polyethylene (HDPE), polypropylene (PP), (epoxy)polystyrene ((E)PS), polyethylene terephthalate (PET) and polyvinylchloride (PVC), with the first five accounting for about 97.5% of all synthetic post-consumer packaging waste [Rouw, 2009].

Composites

This category is a result of recent developments in packaging technology, following trends towards more complicated material combinations. The Packaging Directive defines composite packaging as “*consumer packaging comprising two or more different packaging material types fused or joined together in a single medium so that they cannot be separated by the consumer*”.

Rouw [2009] has provided an overview of various types of products and the packaging materials of choice in their cases as presented in Table 1.

<i>Product</i>	<i>Packaging material</i>
Carbonated beverages ¹	glass, PET, steel, aluminum
Non-carbonated beverages	glass, cardboard, PET, PE, aluminum
Dairy products (not milk)	PS, PP
Wet food ²	glass, steel
Non-food liquids ³	LDPE
Susceptible dry food ⁴	cardboard, PP, LDPE, metallocene ⁵
Non-susceptible dry food	LDPE, PP, aluminum, PET, metallocene, HDPE
Dry non-food	cardboard, LDPE, PVC, PP, metallocene

Table 1: Packaging materials of choice for various packaged products

A similar categorization was provided for various types of transport packaging and the materials of choice for them.

<i>Type of transport packaging</i>	<i>Packaging material</i>
Carrier bags	PE
Industrial bags ⁶	PE, paper
Transport boxes	cardboard, PE
Grouping films	PE
Transport films ⁷	PE
Pallets	wood, PE

Table 2: Packaging materials of choice for various types of transport packaging

2.2.3. The packaging chain

An understanding, at least in broad strokes, of the life cycles of packaging materials is deemed necessary in order to discuss in detail the various policy interventions that will be examined. A general view of the phases comprising such a life cycle is presented in Fig. 1.

The main steps included in this cycle are the following:

- Extraction of resources
- Production of the primary packaging material
- Production of the actual packaging (molding process)
- Packaging filling
- Packaging consumption (after which the packaging can be reused, having undergone a cleaning process and having returned to the filling facility)

¹ In need of containers with good barrier characteristics for CO₂

² Jam, jelly, food packed in steel cans

³ No specific requirements applicable to food packaging (e.g. influence on taste)

⁴ Higher barrier characteristics than non-susceptible food

⁵ Molecular structure including transition metals, used for the production of PE resins

⁶ Used for transporting intermediate and bulk products, while carrier bags are used for transporting consumer waste resulting in different required strength properties

⁷ Used to pack products on pallets, while grouping films are used for bundling smaller amounts of rigid packaging resulting in different required strength properties

- Waste collection (from where the packaging material can be directed to recycling and, eventually, return to the molding process)
- Waste management (from where used packaging materials that have not been recycled or reused can follow one of three possible routes: disposal through landfilling or incineration, auxiliary firing substituting other fuels or incineration with energy recovery).

It should be noted that not all options with a potential for improving material efficiency are mentioned in this figure, with a characteristic example being “good housekeeping” practices [Worrell et al., 1995].

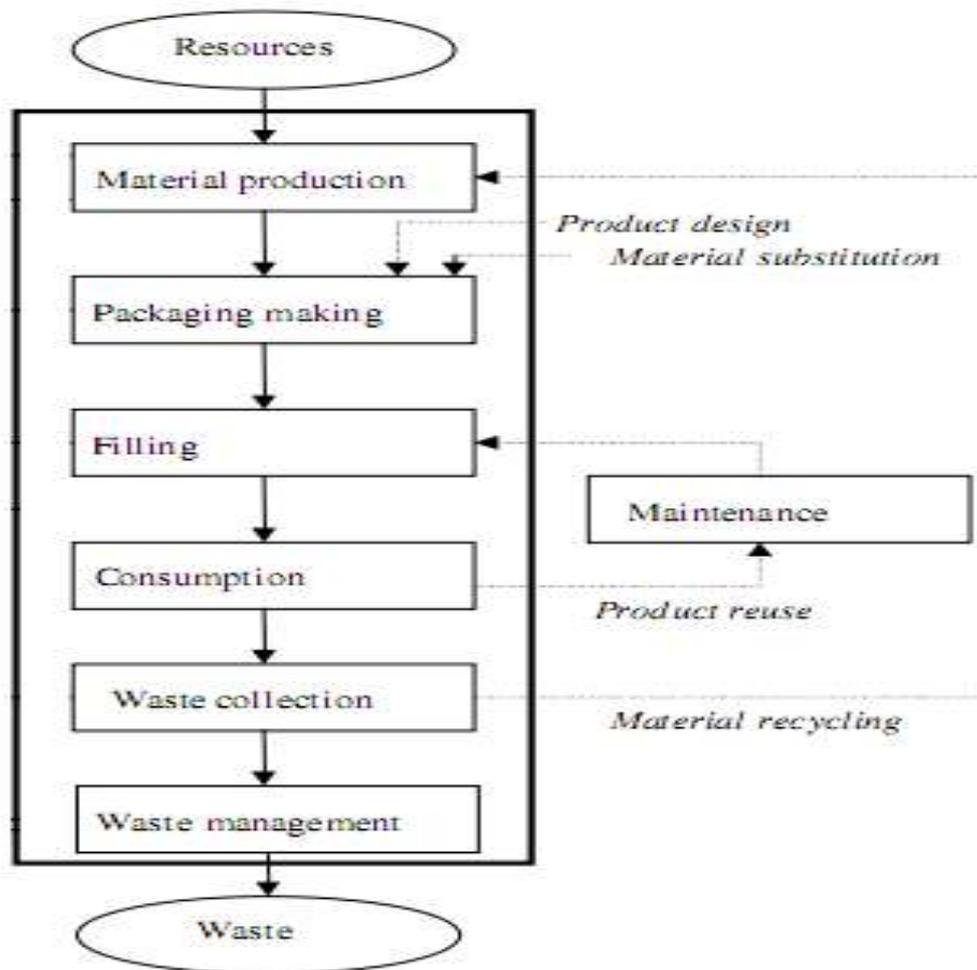


Fig. 1: Life cycle phases of packaging materials [Worrell et. al., 1995]

2.2.4. Trends in the packaging industry

One of the factors of very high importance for the developments in the packaging market -through both its direct and indirect effects- is the global level of economic activity. It influences directly the demand for transport packaging, while it plays an indirect role in adjusting the investments available for R&D into packaging materials [WPO, 2008]. Apart from the economic trends, there is an array of other influential parameters, which will be briefly presented here.

Demographic trends

The continuous rise of the world population, which is expected by the UN to exceed 9 billion in 2050, is of course affecting the market. The same applies for more localized demographic developments, such as the rapid increases of African and Asian populations and the foreseen rise of India as the most populous country by 2050, surpassing China.

On another level of demographic changes, the ageing of the world population, which is being caused by a combination of decreasing fertility rates and increasing life expectancies, is also considered to have a substantial influence. Concerns are expressed about the way in which the demands of retirees for high levels of social provision will affect the overall potential of economies for sustained growth [WPO, 2008].

Lifestyle trends

The packaging industry considers changes in the everyday lives of consumers, which influence their purchasing decisions, as an important driving force for new developments in the market itself. The trend towards smaller households (rising numbers of single-family and single-person units) is creating the need for smaller pack sizes according to the WPO. The same effect is caused by the transformation of family meals to a rarer occurrence due to factors such as irregular working hours and the women being employed in higher numbers than before. Moreover, the market for convenience food is expanding and the ready-meal offer is improved and targeted towards broader and wealthier consumer clusters; also, increasing health awareness is driving consumers towards buying more products such as juices, bottled water, packed fresh foodstuff, etc. Finally, the emergence of “on-the-go” lifestyles is also boosting out-of-house consumption along with the sales of ready-prepared foods [WPO, 2008].

Brand issues

The need of competing companies to differentiate their products in the eyes of the consumers is also a factor carefully considered by the packaging industry, since packaging is a much utilized means for drawing the buyer’s attention. Additionally, the increasing power of global brands in specific markets (e.g. in soft drinks or beers) is related to the success of new types of packaging through their adoption by such “global brands”, resulting in large sales volumes and the subsequent adoption by other competitors or smaller “copycat” brands [WPO, 2008].

New developments in packaging materials

High-performance packaging is continuously being developed, offering options such as high-barrier materials and active and/or intelligent components enabling it to adapt to changes in the contents and the environment and extend shelf-time. Moreover, nanotechnology and digital printing enhance information provision

concerning the pack and its contents and promote supply chain efficiency [WPO, 2008].

Environmental issues

Governments around the world (most prominently EU members) are planning and implementing policies aiming to increase material reuse and discourage the generation of packaging waste due to increasing environmental concerns. The industry is obliged to respond to such challenges, which are supplemented by -an also increasing-consumer awareness expressed through the demand for environmentally-friendly packaging and products. Steps towards this direction are being taken in the form of lightweighting and downgauging [WPO, 2008].

2.2.5. The environmental impact of packaging

A first step towards understanding the magnitude of the impact packaging has on the environment is realizing how large the volumes produced and consumed really are: about 40% of the municipal solid waste in Western Europe (EU15 + Norway and Switzerland) are packaging waste. Moreover, an estimated 4% of the same region's CO₂ emissions are attributed to the production and consumption of packaging materials [Hekkert et al., 2000]. It should also be kept in mind that the consumption levels are still on the rise with no change in this trend expected in the foreseeable future.

The environmental pressure of packaging use is related to the utilization of resources, the energy used, the emissions generated and the waste produced. An eco-indicator has been developed through the following steps in order to assess the pressure that 1 kg of a material exerts on the environment: i) inventory taking of all processes within the life cycle of a product, expressed in terms of resources, land use and emissions, ii) determination of the damage caused by these processes upon resource stocks, ecosystems and human health, and iii) weighting the damage factors using the input provided by experts who answered relevant questionnaires [Rouw, 2009].

It can be seen (Fig. 2) that packaging is the most influential sector in terms of environmental impacts, with the largest part of this effect being attributed to plastic materials. It seems, therefore, logical that it is of the utmost importance to minimize packaging consumption as much as possible; actually, a large potential for packaging material savings seems to exist. CO₂ emissions could be reduced by 9% if lighter primary packaging was used and by 10% if material substitution took place, while a 32% reduction could be theoretically achieved by using reusable primary packaging instead of one-way [Hekkert et al., 2000]. When transport packaging is considered, the CO₂ reductions reach 12% due to lighter packaging, 12% due to material substitution and 16% due to reusable packaging utilization [Hekkert et al., 2000b].

An argument presented by researchers is that the use of packaging in a way that increases its environmental burden can result in several occasions to an overall

reduced environmental impact of the product-packaging combination. Such is the case when spoiled and discarded products have a greater effect on the environment than the accompanying packaging. The examples proposed include fresh vegetables, whose shelf-life is considerably extended when packed; packs that can be reclosed and which, despite containing more environmentally damaging materials, thus offer better preservability; even the use of laminates that are more durable and eliminate the need for refrigeration, resulting in energy savings. In this way, it is argued that policies aiming solely at packaging minimization, waste reduction and more widespread recycling do not necessarily achieve milder effects on the environment since they do not take into account the combined effect of the product-packaging system [Rouw, 2009]. Such considerations, however, are beyond the scope of this project, which analyses only the effectiveness of measures related to material efficiency in the packaging sector.

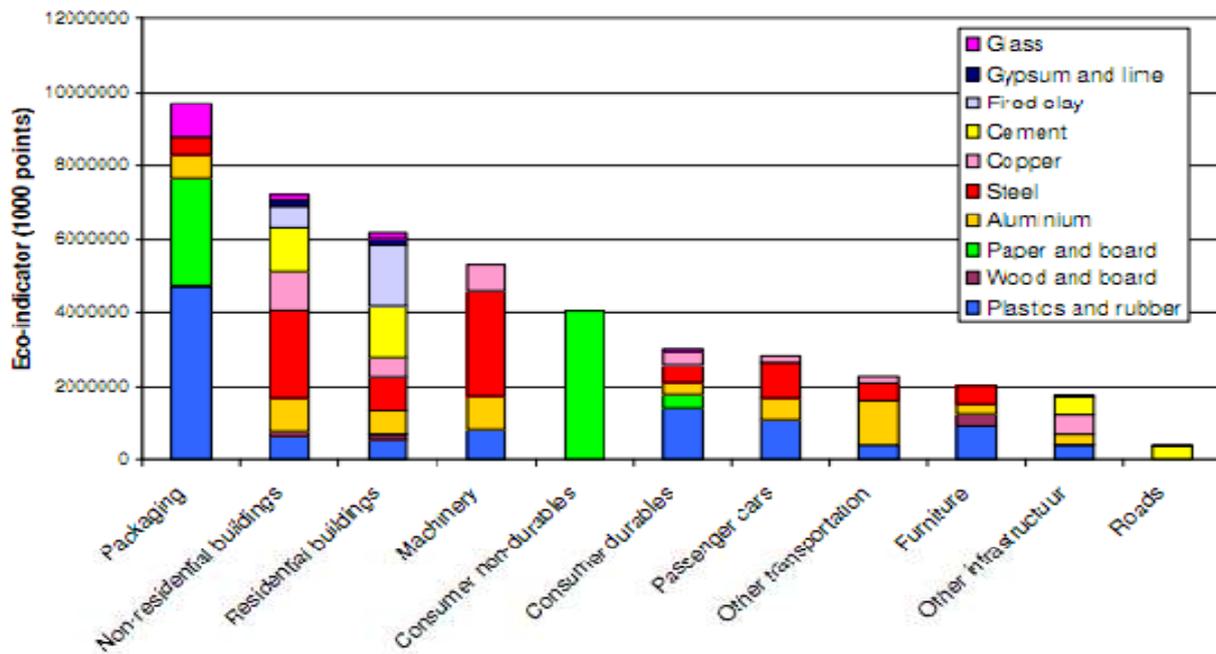


Fig. 2: Environmental impact per material application area [De Bruijn & Bressers, 2003 – cited in Rouw, 2009]

2.2.6. Packaging policy measures

The current state of affairs can be summarized as follows, taking into account the points made thus far: the consumers' needs drive the packaging industry towards the development of more complex and convenient combinations of materials, while, at the same time, the public starts to demand less packaging and the use of more environmentally friendly materials due to its increasing environmental awareness. Moreover, packaging consumption is perpetually on the rise, a fact indicating that the efforts of the market and society to bring about more environmentally friendly consumption patterns are not successful. Therefore, the situation seems to require an intervention by the governments -in the form of policy measures- in order to achieve

what the other societal pillars seem to be unable to do: increasing the material efficiency in the packaging chain.

2.2.6.1. Material efficiency and the packaging chain

Several definitions of material efficiency in industrial production have been proposed. According to Worrell et al. [1995], it is defined as “*the amount of primary material that is needed to fulfill a specific function*”, while Peck and Chipman [2007] consider it as “*the amount of a particular material needed to produce a particular product*”. The ratio between useful material output (M_o) and material input (M_i) has also been proposed in order to express material efficiency [Dahlström & Ekins, 2008]:

$$\text{Material efficiency} = M_o / M_i \text{ (Equation 2)}$$

Meanwhile, fulfilling the same function, while using a reduced amount of material, can be regarded as an improvement of material efficiency [Worrell et al., 1995]. A distinction between three ways of achieving such an improvement can be made [Peck & Chipman, 2007]:

- Reducing the amount of material contained in the final product (lightweighting)
- Reducing the amount of material that ends up in the waste stream after having entered the production process
- Reducing the amount of virgin material by recycling post-consumption waste back into production.

Worrell et al. [1995] mention various possibilities for improving material efficiency along the packaging chain. Such possibilities include good housekeeping, material-efficient product design, material substitution, product recycling, material recycling and quality cascading.

On a final note on the subject, it is necessary to mention material productivity and to distinguish it from the aforementioned material efficiency. Material productivity is expressed as the ratio between economic output (Y_o) and material input [Dahlström & Ekins, 2008]:

$$\text{Material productivity} = Y_o / M_i \text{ (Equation 3)}$$

Considering this definition of material productivity, it can be seen that it is the reverse of the material intensity of use.

2.2.6.2. Basic principles of waste management

The EU waste management policies are currently structured on the basis of some key guiding principles [Tojo et al., 2006]:

- The *prevention principle*: the prevention of damage to the environment prior to its occurrence is better than the reparation of damage already made
- The *precautionary principle*: the lack of full scientific certainty before the face of irreversible damage threat does not justify a lack of action

- The “*polluter pays*” principle: the side responsible for the pollution should be the one bearing the cost of the consequences
- The *extended producer responsibility (EPR) principle*: the responsibility for the environmental impact of products should be placed with their manufacturers due to their capacity to make changes at the source
- The *proximity principle*: waste should be disposed of as close as possible to where they are produced
- The *subsidiarity principle*: only those tasks that cannot be addressed at the lower levels of government (i.e. local governments) should be dealt with at the higher levels.

The waste hierarchy can be considered as an operationalization of the aforementioned principles. Directive 2006/12/EC on waste describes this hierarchy in the following way:

“Member States shall take appropriate measures to encourage:

- (a) First, the prevention or reduction of waste production and its harmfulness...
- (b) Second: (i) the recovery of waste by means of recycling, re-use or reclamation or any other process with a view to extracting secondary raw materials; or (ii) the use of waste as a source of energy.”

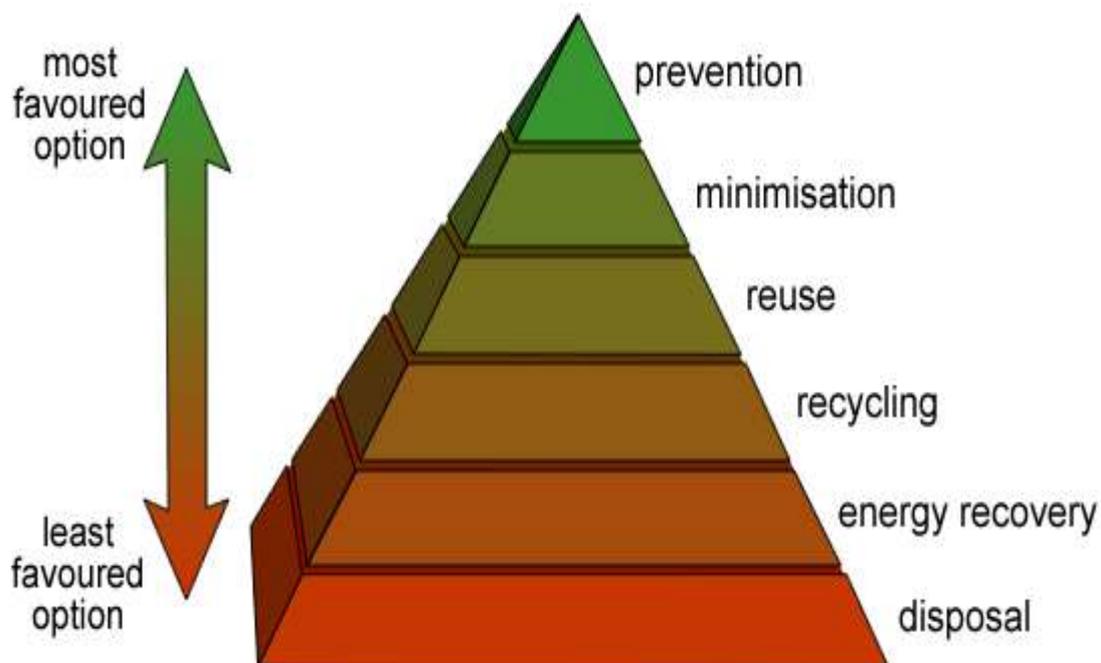


Fig. 3: The waste hierarchy

Prevention

Prevention is defined (in the packaging context) as “*the reduction of the quantity and of the harmfulness for the environment of*

- *materials and substances contained in packaging and packaging waste,*
- *packaging and packaging waste at production process level and at the marketing, distribution, utilization and elimination stages,*

in particular by developing ‘clean’ products and technology” [Directive 94/62/EC].

According to Rouw [2009], prevention can be divided into qualitative and quantitative. Qualitative prevention refers to packaging design improvements, which may not necessarily result to a reduced volume of packaging waste but can ensure a better quality of waste. Examples of this type of prevention include the avoidance of toxic substances use, the increased reusability of materials or the elimination of the use of materials that hinder reuse. On the other hand, quantitative prevention can be seen as the reduction of the amount of packaging newly introduced to the market without making compromises with regard to its intrinsic functions (protection and promotion of products). The previous mentions of the combined environmental effect of the packaging-product system should be kept in mind because they indicate the limitations that quantitative prevention faces; packaging can be reduced to such an extent that a balance still exists between the sufficient product protection and the minimized environmental impact of the product-packaging combination.

Reuse

Reuse is defined as “*any operation by which packaging, which has been conceived and designed to accomplish within its life cycle a minimum number of trips or rotations, is refilled or used for the same purpose for which it was conceived, with or without the support of auxiliary products present on the market enabling the packaging to be refilled; such reused packaging will become packaging waste when no longer subject to reuse”* [Directive 94/62/EC].

The underlying idea behind packaging reuse is that the energy required for collecting, cleaning and refilling the used packaging is less than that needed for the production of new packaging, while, additionally, the demand for virgin materials is decreased. Both material and energy savings increase in line with the number of trips.

Whether reusable packaging use can become more widespread is, to a large extent, dependent on the foodstuff market trends. The steady, or even declining, prices of basic foodstuff -contrary to the rising costs of industrial goods and workforce- put pressure on producers and retailers alike. In order to withstand it, new strategies are being adopted in sales (handling minimization, reductions in staff and services provided), logistics/distribution (transports of scale, minimization of stocks kept in outlets, highly centralized ordering) and listed goods (poorer quality, longer

preservation). Such strategies are counterproductive for the introduction of reusable packaging, which requires more services for retake and redistribution, greater storage capacities, responsible handling of deposits/refunds, etc. [Golding, 1999]. The emergence of discounters, with their distinct characteristics (no reusable packaging listed, minimum staff employed, minimized storage capacity in the outlets, etc.) has put reuse systems under extra stress in countries where these are not legally required. On the other hand, reusable packaging is better suited for the HoReCa sector where prices are higher and profit margins wider. It is not unusual for restaurants and pubs to have long-term contracts with breweries, which ensure a controlled and profitable regional distribution [Golding, 1999].

Finally, an array of other factors -apart from the aforementioned retail sector trends- with a beneficial or detrimental influence on packaging reuse systems has been recognized. Localized product distribution and high return rates are both success factors; the former ensures low transportation impacts and can be achieved through the existence of networks of filling plants, while the latter is important since -as it was already mentioned- the environmental impact of reusable packaging decreases the more times it is reused. A number of conditions can put stress on reusable packaging utilization. Low transportation costs and/or open markets tend to lead to greater availability of non-local goods; the prevalence of exports orientation and/or centralized manufacturing aiming at economies of scale has a similar effect. Consumer behavior can also be important considering factors such as the preference on imported goods and new-looking or brand-unique packaging, the change of needs with a pace more rapid than that of packaging adaptation, out-of-home consumption and the need for a greater range of pack sizes [ECOLAS-PIRA, 2005].

Recycling

Recycling is defined as “*the reprocessing in the production process of the waste materials for the original purpose or for other purposes including organic recycling but excluding energy recovery*” [Directive 94/62/EC]. The collected packaging materials are used in the production of new packaging, effectively achieving reductions in energy and material use.

Energy recovery

Energy recovery is defined as “*the use of combustible packaging waste as a means to generate energy through direct incineration with or without other waste but with recovery of the heat*” [Directive 94/62/EC].

2.2.6.3. Policy measures categorization

Moving on from the principles behind the EU waste management policies and the waste hierarchy stemming from them, it is time to focus on the policy measures that are used by governments in order to uphold the aforementioned principles. According to Tojo et al. [2006], three types of such policy instruments can be distinguished: *administrative, economic and informative*.

<i>Administrative instruments</i>	<i>Economic instruments</i>	<i>Informative instruments</i>
<u>Source separation:</u> <i>separation of specific waste fractions at the source promoted by various forms of infrastructure and/or incentives</i>	<u>Taxation:</u> <i>imposition of taxes on waste disposal, which makes recovery a relatively cheaper option</i>	<u>Eco-labeling schemes:</u> <i>providing information to consumers in order to help them select environmentally-friendly products and services</i>
<u>Extended Producer Responsibility:</u> <i>shifting the responsibility for the post-consumption phase to producers, while simultaneously incentivizing them to improve their products' design</i>		
<u>Collection/reuse/recycling targets:</u> <i>depending on the type of target they can facilitate the separation of specific waste fractions, waste prevention and efficient resource use</i>	<u>Waste pricing:</u> <i>motivating the public to undertake waste reduction and recycling efforts through waste management fees sensitive to such efforts</i>	<u>Marking of products</u>
<u>Minimum recycled material content standards:</u> <i>aimed at securing the demand for recycled materials</i>	<u>Deposit-refund systems:</u> <i>Encouraging the return of non-“consumed” materials and the establishment of recycling or reuse systems for the returned materials</i>	<u>Information campaigns:</u> <i>Offering insights into new waste management systems and their operations</i>
<u>Landfilling restriction targets:</u> <i>facilitates reuse and recycling</i>		

Table 3: Waste management policy instruments categories

The administrative instruments category covers various measures concerning the fulfillment of certain tasks, such as the achievement of certain recycling rates, the elimination of the use of certain substances or the prohibition of landfilling. In cases where such policies are mandated by law, the targeted entities have no choice but to obey unless specific exemptions are included in the legislation.

Economic instruments generally provide monetary incentives (subsidies, refunds, etc.) when the entities targeted carry out successfully tasks that the instruments aim at promoting, or disincentives (e.g. taxes) when they do not undertake the actions required. What distinguishes economic instruments from administrative ones is the fact that in the case of the former the addressees have the opportunity to choose whether they wish to fulfill the tasks prescribed or not, while no such option exists with the latter.

Informative instruments are oriented towards the collection and provision of information and are based on the assumption that the human behavior is related to the level and quality of information available. The transfer of knowledge, the communication of reasoned arguments and persuasion are essential building blocks of such policies [Tojo et al., 2006].

The following paragraphs will offer, based on the work of Tojo et al. [2006], a brief introduction to the main measures of interest for the packaging policy field that are included in each of the aforementioned major clusters.

Administrative instruments

Source separation: This instrument requires the separation of specific fractions of waste at the source, a task which can be performed at the consumers' residences (the provision of bags, containers, etc. is required) or at local collection points. Various forms of infrastructure and incentives are in use in order to promote source separation, including curbside collection systems, "bring" systems, "pay-as-you-throw" approaches and deposit-refund systems. Source separation is a prerequisite for achieving higher recycling and reuse rates and its primary addressees are the general population (households). The results achieved by such initiatives are usually dependent on the convenience for the consumers (e.g. curbside collection tends to be more effective than "bring" systems), the incentives offered to them and their awareness level [Lindhqvist, 2000]. Source separation is considered to be one of the most local-specific solutions available to policy makers.

Extended Producer Responsibility (EPR): OECD provides the following definition of Extended Producer Responsibility [ECOLAS-PIRA, 2005]:

"A policy in which the producer's financial and/or physical responsibility for a product is extended to the post-consumer stage of the product's life cycle. It specifically focuses on reducing the environmental impacts of a product at the post-consumer phase. There are two key features to an EPR policy: i) The responsibility for a product at its post-consumption phase is shifted upstream in the production-consumption chain to the producer, and ii) it provides incentives to producers to incorporate environmental considerations into the design of their products".

There can be various approaches to the EPR concept. The defining characteristic is always the aforementioned shifting of responsibility for waste management from the government to the industrial sector, which aims at internalizing the costs of waste management. This can be achieved through various combinations of mandated recycling targets, data collection and reporting requirements, obligations to use specific technologies, demands for information provision to the public and waste managers on how to best manage post-consumer products and stipulations concerning the take-back of discarded products [Fishbein et al., 2000]. Moreover, Fishbein et al. [2000] argue that the extension of producer responsibility to the post-consumer stage creates a link between the end-of-life and the product design periods: when the

governments bear the weight of waste management there is no incentive for the business sector to design less wasteful products.

Producer responsibility is by default implemented together with source separation. A distinction can be made between the physical responsibility (organization of the physical management of the discarded products) and the financial responsibility (financing of the activities). Producers usually establish organizations that fulfill the mandate on their behalf (Producer Responsibility Organizations or PROs). PROs are not always actively involved in every stage of the process and a significant amount of work can be subcontracted to private companies or local authorities. On the other hand, some producers decide to organize take-back systems for their own products only and undertake the full responsibility for the entire effort. Giving take-back responsibilities to the producers aims at providing incentives for prevention, enhancing reuse and/or recycling and promoting the environmentally sound treatment of residues.

The main advantages of producer responsibility schemes are the fact that they promote the consideration of life cycle impacts in the design phase, the encouragement of collaboration throughout the supply chain and the high recycling rates that can be achieved through their implementation. On the other hand, known weaknesses include the practice of charging the costs to the consumers through increased product prices, the unsuitability for sparsely populated countries because of the long transportation distances (not defensible from an environmental perspective), or the need for collective schemes (PROs) to be set up [ECOLAS-PIRA, 2005].

Collection, reuse/refill and/or recycling targets: With regard to collection, quantitative targets for source separation can be either absolute or relative, with the challenge in the latter case being the determination of the common denominator (actual amount of waste disposed of, sales figures, etc.). Their objective is to facilitate the separation of specific fractions from the waste stream as a first step towards the reuse and recycling of components and materials.

Reuse/refill targets are extensively applied in the case of beverage containers, differentiated usually on the basis of beverage type or container material. Finally, recycling targets are widely used for packaging waste. Both categories aspire to promote efficient resource use, with reuse/refill targets further addressing waste prevention. Mandatory recycling targets combined with measures against landfilling serve as a mechanism of limiting incineration levels [OECD, 2007].

Minimum recycled material content standards: Mandating the use of certain amounts of recycled materials in new products is seen as a way of securing the demand for such materials. Different, but quite similar in nature, approaches can also fall under this category, with an example being the requirement for public authorities to use as much recycled materials as possible.

Landfilling restriction targets: This measure is introduced in order to address either the growing amounts of waste or their hazardous content. Since it inevitably requires source separation of the streams that should not be landfilled, the instrument facilitates reuse and recycling, especially when combined with collection/reuse/refill/recycling targets.

Economic instruments

Economic instruments are considered to have several advantages compared to administrative ones:

- They allow flexible responses to price signals and encourage innovation
- They are cost-effective and guarantee that improvements are made in the cheapest and most efficient manners
- They decrease externalities by attributing the costs to those who pollute
- They generate revenue, which can be used in order to finance other environmental investments
- They can be successful in addressing problems where command-and-control approaches have previously failed.

A distinction is being made between price-based and quantity-based economic instruments. Price-based instruments attribute a price to activities that did not have one in the past in an attempt to incorporate the external costs or benefits of an action. Individuals and companies will respond by adopting the behavior bearing the lower cost for them and, if the price signals are properly set, the subsequent result will be -in the case of environmental policy- an improved use of resources. On the other hand, quantity-based (or indirect) instruments create a market for distributing permits to carry out an activity related to resource use or environmental damage. The damage can theoretically be controlled by setting a limit on the total amount of permits issued. Such a system is more flexible in comparison to taxation, since actors who can easily adapt to new behaviors will make big changes and then sell their extra permits to others for whom adaptation is more expensive. Finally, one more category of economic instruments exists in the form of “market friction” instruments, which improve the current market functions by means of information provision and reduced transaction costs.

Taxation: The imposition of taxes on waste disposal makes waste recovery methods relatively cheaper and, therefore, more attractive. A widely enforced example is that of the landfilling tax, which is paid on top of normal landfilling fees by businesses and local authorities who want to use such sites. It is designed in a manner that encourages addressees to produce reduced amounts of disposable waste and use alternative forms of waste management. Another case is that of the waste

disposal tax, introducing different taxation levels for waste treatment techniques depending on their environmental soundness.

Waste pricing (“pay-as-you-throw” approach): The “pay-as-you-throw” (PAYT) approach is the exact opposite of the flat-rate system, in which all citizens pay the same level of waste management fees regardless of the amounts produced and their financial background. The waste management fee calculation in PAYT is sensitive to waste reduction and recycling efforts by the citizens, thus providing a motivation to undertake such actions. It should be noted, however, that only a part of the total waste management fee can be based on the PAYT approach, since the fixed costs of municipal waste management institutions should be largely paid proportionately by all their users. Determining the fixed/variable fee ratio is a key element of waste pricing programs and, in general, high levels of fixed fees reduce the effectiveness of PAYT programs [Tojo et al. 2006].

Another important element of such schemes is the choice between a volume-based and a weight-based approach. The latter offers great precision in attributing the costs to the waste producers –since the exact weight of the waste produced is determined upon collection- but its implementation is expensive, requires the use of techniques that are still largely under development and poses the need for a considerable amount of preparatory work in terms of administration. These shortcomings make the volume-based approach more popular for the time being, despite its reduced precision due to basing the costs calculation on numbers of bag/bins of waste. Regardless of which of these approaches is selected though, PAYT schemes can be considered as a direct implementation of the “polluter pays” principle, since citizens who generate reduced amounts of waste are no longer expected to subsidize the costs of those who generate large amounts of waste.

A factor that can compromise the effectiveness of PAYT schemes is the possible illegal dumping of waste as a result of the variable rates. An example of such practices is the diversion of waste streams to recycling facilities that are not suitable for them. Behaviors of this nature create a need for penalties, e.g. in the case where a recycling system’s operation is disturbed by an increased amount of unsuitable waste. Generally, it can be said that the success of these schemes is largely dependent on the existence of effective recycling/alternative management programs; even then, it is more possible in areas with detached houses instead of large apartment blocks, since the residents of the former have a sense of personal waste management and can more easily understand the financial benefits.

Deposit-refund systems: This instrument is quite common in the beverage containers field. The item is charged with a deposit, which is added to the price of the product and eventually refunded when the item is returned. Private households are in this way encouraged to return materials that they have used but not “consumed”, while the industry is motivated to set up recycling or reuse systems in order to put the returned materials into good use. Apart from the obvious target of increasing

reuse/recycling, deposit-refund systems are also oriented towards reducing litter and promoting recyclable products. It is needless to say that a decisive factor for the success of such schemes is the level of the deposit; convenience for the consumers and the availability of a sufficient amount of information are also key elements of effective systems.

The packaging industry has expressed various concerns over the usefulness of deposit-refund schemes for beverage containers. It is argued that deposit laws divert beverage packaging from existing collection systems and force the industry and consumers to deal with two separate waste collection systems, resulting in increased congestion, fuel consumption and pollution [EUROPEN, 2009]. It is also suggested that the vast majority of street litter is not drinks-related and, therefore, deposit policies have little impact on littering. Another position expressed by the industry is that this instrument makes consumers pay higher prices, results in barriers to trade and forces producers to deal with the consequent competition distortions. Finally, an array of factors suggesting that mandatory deposit systems bear higher costs compared to household collection schemes is presented: i) duplicated logistics costs, ii) setting up and operation of clearing systems to reconcile cash flows between retailers, iii) need for special security printing in order to prevent fraud, iv) need for secure storage of empty containers in order to prevent theft, and v) purchase and maintenance of collection machines [EUROPEN, 2009]. Opposing opinions are also expressed, however; the BEAR Report, for example, states that in 1999 a combination of various collection methods in 10 US states where deposit-refund systems were implemented resulted in the recycling of 490 beverage containers/cap. annually at a cost of 1.53 ¢/unit, while in 40 states which relied solely on curbside collection and “bring” systems the respective figures were 191 containers/cap. annually at a cost of 1.25 ¢/unit [C.W. Beck, 2002].

Informative instruments

Eco-labeling schemes: They are voluntary informative instruments aiming to improve the environmental performance of products and services by providing easy-to-understand information to consumers, thus enabling them to select environmentally-friendly products and services. They reward products for meeting certain environmental criteria, which are set for various product groups based on life cycle thinking. The independent organizations that run such schemes allow producers to put the label on their products when those are designed in ways that conform to the criteria. The use of the label requires the payment of licensing fees, which are the source of financing for the independent organizations’ activities. Criteria for the end-of-life phase are the most difficult to set, since in many cases the producers have no control over their products at this point. However, requirements concerning waste exist for some products groups, such as recyclability/reusability, recycled material content, reduction/elimination of harmful substances, etc.

Marking of products: This category can contain both mandatory and voluntary initiatives. Examples include marks on products that should be source-separated, symbols indicating that consumers are entitled to a refund on products covered by deposit-refund schemes, or marks on plastic packaging indicating the type of plastic material in order to facilitate source separation and recycling activities down the line.

Information campaigns: Setting up information campaigns is quite common when a new system for the alternative management of waste (e.g. source separation) is introduced. Such campaigns are combined quite often with the provision of equipment necessary for the participation to the system (bags, bins, etc.). PROs may initiate campaigns in order to communicate their collection responsibilities to the consumers and, eventually, improve their chances of fulfilling their obligations. Local governments may also be involved in campaigns of this nature, providing information about the local waste management systems in their websites, posters or leaflets distributed to the households.

2.2.7. The European Packaging Directive

A brief description of what Directive 94/62/EC prescribes should be provided at this point, since this project revolves around the efforts undertaken by a number of European countries in order to conform to its requirements.

The Directive states that its aim is to harmonize the differing national measures concerning the management of packaging and packaging waste in order to i) prevent any impact on the environment or reduce such impact, and ii) ensure the functioning of the internal market and avoid obstacles to trade and distortion/restriction of competition within the Community. Its scope covers all packaging placed on the market in the Community and all packaging waste regardless of the material used. It is declared that the best means for preventing packaging waste, which is the first priority of packaging waste management, is to reduce the overall volume of packaging. Packaging reuse, recycling and other forms of packaging recovery are recognized as additional priorities of the aforementioned management.

Targets are set for each EU member state with regard to the recycling (material recovery) and the total recovery of packaging waste (Tables 4 and 5, see Chapter 3 for further information on what each target entails). These targets are confined within certain ranges so as to take account of the different situations in member states and to avoid creating competition distortions and barriers to trade. A medium-term deadline is set for attaining these targets and a longer-term one for targets to be determined later on, with a view to substantially increasing them. The possibility of exemptions for some countries was allowed in order to cater to their specific circumstances. Lower targets were accepted in their cases on the condition that they would meet the standard targets within a later deadline.

According to the Directive, the management of packaging and packaging waste requires setting up return, collection and recovery systems in the member states. These systems should be open to the participation of all interested parties, being

designed so as to avoid discrimination against imported products and barriers to trade/distortions of competition, while also guaranteeing the maximum possible return rates.

It was deemed necessary to define essential requirements governing the composition and the reusable/recoverable nature of packaging. The presence of noxious metals and other substances in packaging should be limited in view of their environmental impact (emissions or ash from incineration, leachates from landfilling). The prevention of the presence of noxious heavy metals in packaging and their non-release into the environment were also considered essential.

In addition to the former, the Directive maintains that member states should take the measures necessary in order to establish databases on packaging and packaging waste. These databases should be set up in a harmonized way in order to contribute to the monitoring by the Commission of the implementation of the Directive. The information provided by them should in particular concern the magnitude, characteristics and evolution of packaging use and packaging waste generation at the level of the individual states. Member states must provide the Commission with data by means of formats adopted by the Commission and, in turn, shall require from all relevant economic operators to provide the competent authorities with reliable data on their sector.

All member states were obliged to bring into force the laws, regulations and administrative provisions necessary in order to comply with the Directive before 30/6/1996. Directive 94/62/EC was amended by the Directive 2004/12/EC whose main provision was setting up new targets for the recycling and recovery of packaging waste. Directive 2004/12/EC had to be incorporated into the national legislation of the member states by 18/8/2005.

	Recovery	Recycling				
	50%-65%	Overall: 25%-45%	Glass: min.15%	Paper & board: min.15%	Metals: min.15%	Plastics: min.15%
EU12	End 2001	End 2001	End 2001	End 2001	End 2001	End 2001
Greece Ireland Portugal	End 2005	End 2005	End 2005	End 2005	End 2005	End 2005
Cyprus	End 2005	End 2005	May 2004	End 2005	May 2004	End 2004
Czech Republic	End 2005	May 2004	May 2004	May 2004	May 2004	End 2005
Estonia	May 2004	May 2004	May 2004	May 2004	May 2004	May 2004
Hungary	End 2005	May 2004	End 2004	May 2004	May 2004	End 2005
Latvia	End 2007	May 2004	May 2004	May 2004	May 2004	End 2007
Lithuania	End 2006	End 2004	May 2004	May 2004	End 2004	End 2004
Malta	End 2009	End 2005	May 2004	May 2004	May 2004	End 2009
Poland	End 2007	May 2004	May 2004	May 2004	End 2005	End 2005
Slovakia	End 2007	May 2004	May 2004	May 2004	End 2007	May 2004
Slovenia	End 2007	May 2004	May 2004	May 2004	May 2004	End 2007
Bulgaria	End 2011	Before 2007	Before 2007	End 2007	End 2007	End 2009
Romania	End 2011	Before 2007	Before 2007	End 2007	End 2007	End 2011

Table 4: EU packaging total recovery and recycling targets – 1st stage (Directive 94/62/EC)

	Recovery	Recycling				
	60%	Overall: 55%-80%	Glass: min.60%	Paper & board: min.60%	Metals: min.50%	Plastics: min.22.5%
EU12	End 2008	End 2008	End 2008	End 2008	End 2008	End 2008
Greece Ireland Portugal	End 2011	End 2011	End 2011	End 2011	End 2011	End 2011
Cyprus	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Czech Republic	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Estonia	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Hungary	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Latvia	End 2015	End 2015	End 2015	End 2015	End 2015	End 2015
Lithuania	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Malta	End 2013	End 2013	End 2013	End 2013	End 2013	End 2013
Poland	End 2014	End 2014	End 2014	End 2014	End 2014	End 2014
Slovakia	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Slovenia	End 2012	End 2012	End 2012	End 2012	End 2012	End 2012
Bulgaria	End 2014	End 2014	End 2013	End 2008	End 2008	End 2013
Romania	End 2013	End 2013	End 2013	End 2008	End 2008	End 2013

Table 5: EU packaging total recovery and recycling targets – 2nd stage (Directive 2004/12/EC)

3. Methodology

The first step towards conducting an analysis of packaging waste generation for each of the countries included in this project is data collection. The Environment Directorate-General of the European Commission offers a comprehensive overview of packaging waste generation, material recycling and energy recovery by means of incineration at waste incineration plants for overall packaging and per material (glass, paper & board, metal, plastic, wood, other). The provision of data on wooden packaging became mandatory only in 2003 and, since the amount of data available is not substantial and some inconsistencies have been observed, it has been decided to exclude wooden packaging from this study. In some cases, however, where it is considered that the presentation of the situation regarding wooden packaging would help clarify some points in the analysis, the available data will become a –secondary– element of the discussion. The “other packaging materials” category –which includes items made of ceramics, plant fibers, etc.– is also omitted from this project for the same reasons that led to the exclusion of wooden packaging.

The EU member states have to provide their annual data eighteen months after the end of the reference period (e.g. the data for 2003 should be submitted by 30/6/2005). Therefore, the data available for this project covered the period 1998-2007. Although datasets for 1997 were also available, it was preferred not to take them into account due to their inconsistency with those of the following years [EUROPEN, 2009b].

An issue of considerable importance with regard to the data reported by the countries to the EU is the degree to which they are comparable with each other. The only requirement set by the Commission concerns the common format with which these figures are to be submitted to it so as to facilitate comparisons between them and offer the ability to track developments in certain categories throughout specified time periods. The member states are, therefore, free to decide individually about the preferred ways of gathering the data included in their annual reports and various issues arise because of the different practices followed in each country. An example indicative of the differing approaches towards the same problem is that of the private imports of beverages, a phenomenon rather common in the countries examined; in most cases these private imports are not registered at all, creating an uncertainty about the actual quantities of glass bottles and metal cans that enter the market. Norway, however, adds an extra amount of glass packaging to the amounts marketed in order to account for these imports, a practice not encountered in any other country; the same practice is in fact not followed even in Norway when metal packaging statistics – which could in the same fashion account for privately imported metal beverage cans– are compiled. Another issue where differences are found between the reporting countries is that of the waste amounts collected and sent for recycling/energy recovery. In some cases these figures are the result of data provided by the waste collectors through surveys or questionnaires, sometimes the collectors or the receiving facilities (e.g. glass production plants) report precisely the amounts handled by them, while in other occasions waste analyses are performed in various locations and

scaling-up takes place in order to compile the nationwide statistics for a specific material. Finally, some differences can be detected even regarding the items considered to constitute packaging in different countries; Sweden, for example, includes in its statistics some items (e.g. disposable tableware) that are not considered as packaging in any other Nordic country. Such issues suggest that the best approach towards these figures is not to consider them as the undisputable absolute amounts of waste generated and recovered in each country; it is much “safer” to use these figures as a means to detect trends and long-term changes in consumption or recovery, and as indicators that can point out the strengths and weaknesses of each country’s national policy relative to its counterparts.

The EU datasets make a distinction between two options for the generated packaging waste that leave the waste stream; these are either recycled (material recovery) or incinerated in waste incineration plants with energy recovery. The sum of the masses that are directed to these processes constitutes the total recovery of packaging waste. The same principle is applied for the purposes of this project’s analysis.

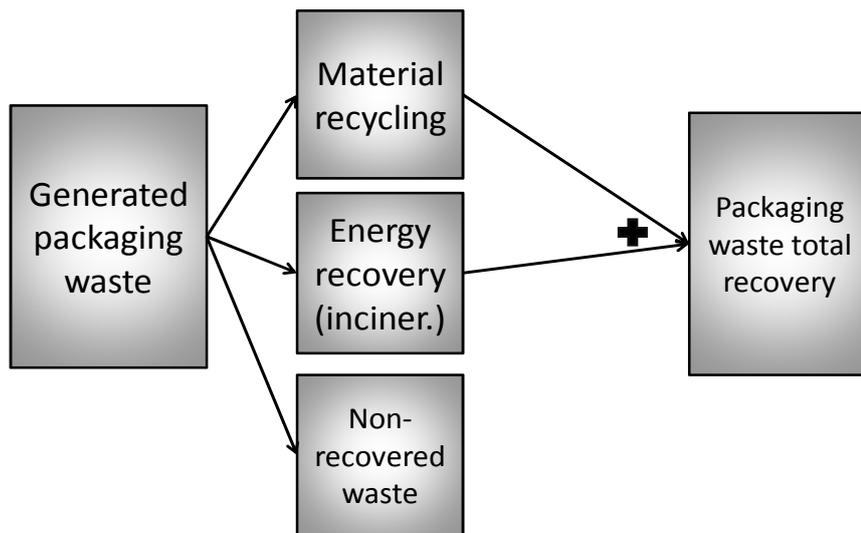


Fig. 4: Packaging waste material recovery, energy recovery and total recovery

The next step in this project is dedicated to creating graphs depicting the packaging waste generation development –overall and per material- throughout the specified period. Since packaging has a relatively short lifetime (no more than a year), it can be assumed that the annual waste generation corresponds to the annual packaging consumption [Worrell et al., 1995]. The “baseline consumption” will be calculated in every case for the same period in order to provide a better insight into the aforementioned developments. Rouw [2009] has looked into the relation between packaging consumption and several variables. Her analysis included factors such as the GDP, the population, the GDP/cap., the number of households, the number of

single-person households and the average number of household members, and she has concluded that the variable with the strongest relation to packaging consumption is the national population. It has been decided -based on these findings- to use the population as the basis for setting up the “baseline consumption”, which is calculated using the following formula:

$$C_i = C_0 * (P_i / P_0) \text{ (Equation 4)}$$

Where, C_i = baseline packaging (or packaging material) consumption in year i (i ranges from 1999 to 2007), C_0 = packaging (or packaging material) consumption in 1998 (base year), P_i = population in year i , P_0 = population in 1998

A graphic representation of the packaging consumption per inhabitant –overall and per material- is also provided at this point in order to further illustrate the developments. Moreover, graphs are plotted depicting the achieved recycling and total recovery rates -for overall packaging and per material- throughout the specified period, combined with the national or EU targets (depending on what is implemented by each country) for these rates.

Finally, the developments in the intensity of packaging material use are presented in terms of weight per unit of national income (kg/1,000 € GDP). Presenting the intensity of use in terms of weight is more suitable for various reasons; data on weight are more easily available [Cleveland & Ruth, 1999], while the coverage of the whole economy by the packaging sector means that the composition of products and materials is very complex, making the calculation of the intensity of use in terms of volume exceedingly difficult [Rouw, 2009]. This approach, however, faces some shortcomings, as the economic or environmental impacts of some materials could be underestimated. For example, plastic packaging can appear to be of smaller economic importance compared to heavier materials, despite its widespread use.

In order to understand how these developments are related to the policy measures implemented in the case of each Nordic country, a policy history will be provided for every one of them. The initiatives undertaken so as to comply with the prescriptions of the EU Packaging Directive will be discussed, including laws, other policy measures, relevant institutional actors and agreements. This discussion will not be limited to the overall packaging level but will also go into detail regarding the various materials. The quantitative policy evaluation, which will focus on target attainment and the comparison of the developments with the baselines mentioned above, will be facilitated in this way. A qualitative analysis will also be made, based on the assessment of factors appearing to have an influence on the presented quantitative results, such as the levels of the targets set, the responsibility allocation, the influence of different types of instruments, etc.

It is understandable that not all developments can be attributed to the influence of policy initiatives. A number of factors that can invoke changes upon material consumption patterns have been named in Chapter 2 and they should be considered

wherever possible. The saturation of the bulk markets for basic materials is of course related to the stage of economic development of each country; given that this project focuses on EU15 countries (and Norway) it can be safely assumed that a high level of economic development is already achieved and the shift to less material-intensive goods and services has been made along with the saturation of bulk markets for basic materials, exerting, therefore, no significant influence upon the findings of this report. The changes in the structure of the final demand are also mentioned as possibly influential for the packaging consumption developments; such a causality relationship can be studied through the analysis of the relationship between the number of single-person households (which consume higher amounts of smaller packaging) and packaging consumption or that of the relationship between household distribution (average number of persons per household) and packaging consumption. Rouw [2009] has performed such analyses, finding no evidence suggesting that a concrete relationship exists between packaging consumption and the aforementioned factors, thus allowing us to assume that no significant influence of this nature exists in the cases examined in this project. The issue of material substitution is tackled by analyzing the Kuznets curves of the various materials; materialization/dematerialization processes will be detected in this way, while depicting the development of each material's share in the packaging market will help in pointing out cases where the use of some materials is declining in favor of others. Finally, the issue of the influences stemming from technical improvements in the packaging sector would extend the scope of this project too much, considering the number of separate markets that have to be studied, and it is, therefore, not tackled.

No cost analysis of the packaging policies is included in this project, due to a lack of data regarding the actual costs. This research effort is thus limited to the determination of packaging policy effectiveness, leaving policy efficiency outside of its scope.

The combination of the quantitative and qualitative assessments will generate some conclusions regarding the Nordic country which has managed to implement the most effective packaging policies and will offer some insight into the success factors. In the next step, the results achieved by the Nordic countries will be compared with those of the Netherlands, again with the aim of determining where the optimum combination of packaging policy measures has been implemented. Finally, the situation in Greece will be presented –both in terms of policy initiatives and results achieved- and an effort will be made to construct a “road map” based on the experiences of the rest of the countries and the possibility for their transfer in the Greek context.

4. A comparative presentation of the Nordic countries

This chapter will provide an overview of the developments regarding packaging materials consumption in the Nordic countries since the EU Packaging Directive came into effect. Additionally, the developments in the field of packaging waste recycling and total recovery will be summarized here. The aim of this presentation is to offer -in a condensed and comparative way- an initial insight into the outcomes of these countries' efforts towards packaging waste minimization, recycling and total recovery, and to provide a stepping stone for the upcoming country-specific and detailed policy analysis.

4.1. Packaging consumption and material intensity of use, 1998-2007

The first datasets to be presented concern the developments in packaging consumption and packaging material intensity of use in the Nordic countries between two separate points in time; the first is 1998, the earliest year after the introduction of the Packaging Directive for which reliable reporting exists, while the second is 2007, the last year for which reports were available at the time this research took place. By looking into the situation at the starting and end points of this decade-long period, an initial overview of how these parameters evolved throughout the whole decade will be offered.

A piece of necessary information should be provided regarding the data sources before moving on with the presentation. As mentioned already in Chapter 3, the primary source of data on packaging waste generation, recycling and total recovery for this project has been the collection of national reports available through the Environment Directorate-General of the European Commission. This has been the case, with no exceptions, for Denmark, Sweden and Finland (and for Greece and the Netherlands later on). Norway, however, started submitting national reports to the Commission only in 2006. In order to cover the period prior to this, the use of data compiled by the national statistics agency SSB (Statistisk Sentralbyrå), which offers two datasets on generated packaging waste in the country for 1997 and 1998, was considered. These figures, however, proved to be relatively unreliable since they were based on surveys, sorting analyses of mixed and sorted waste and estimation techniques (extrapolation, intrapolation), while the quality of the estimations has also been contested⁸. It was, therefore, preferred to use data provided by Klif⁹ (Klima- og forurensningsdirektoratet, the Norwegian Climate and Pollution Agency), which covered the period 1999-2007. These figures have been compiled in a consistent way throughout the aforementioned period based on the reports submitted by the responsible material companies and are the same data –prepared by the same agency-

⁸ Personal communication with Håkon Skullerud, Senior Executive Officer, Division of Environmental Statistics, SSB

⁹ Personal communications with Pål Spillum, Head of Section for Waste Recovery and Hazardous Waste, Klif and Hege Rooth Olbergsveen, Senior Engineer, Section for Waste Recovery and Hazardous Waste, Klif

that began being submitted to the Commission after 2006, thus being directly comparable with the figures prepared by the other Nordic countries.

The following tables summarize the situation regarding the overall and material-specific packaging consumption development between 1998 and 2007. The amounts for overall packaging consumption are presented both in per capita and absolute terms, with the latter used as a means for providing a perspective on the order of magnitude of packaging waste generation.

	<i>Total packaging consumpt. 2007¹⁰ (ktonnes)</i>	<i>Total packaging consumpt. change 1998-2007 (%)</i>	<i>Total packaging consumpt. 2007 (kg/cap.)</i>	<i>Per capita total packaging consumpt. change 1998-2007 (%)</i>
DK	850.7	+1.53	156.2	-1.31
FIN	480.6	+13.3	91.08	+10.6
NO ¹¹	500.9	+29.0	107.0	+22.5
S	1,128	+18.1	123.8	+14.6

	<i>Paper & board 2007 (kg/cap.)</i>	<i>Per cap. paper & board change 1998-2007 (%)</i>	<i>Glass 2007 (kg/cap.)</i>	<i>Per cap. glass change 1998-2007 (%)</i>	<i>Metal 2007 (kg/cap.)</i>	<i>Per cap. metal change 1998-2007 (%)</i>	<i>Plastic 2007 (kg/cap.)</i>	<i>Per cap. plastic change 1998-2007 (%)</i>
DK	95.2	+15.8	19.3	-41.9	6.44	-37.4	35.2	+8.26
FIN	50.3	+5.23	13.1	+23.6	8.98	+40.1	18.7	+6.34
NO	60.5	+15.7	13.4	+25.4	3.03	+34.5	30.1	+35.8
S	75.3	+16.9	19.9	+2.76	7.63	-9.60	21.0	+32.7

Tables 6-7: Overall packaging consumption development between 1998 and 2007 - Material-specific packaging consumption development between 1998 and 2007

A number of observations can be made after examining the data presented in the tables above. Generally, it can be said that the Nordic countries –with the exception of Denmark- appear to have been unable to reduce their overall packaging material consumption during the period at hand. As expected in light of this statement, the situation appears to be similar when we look into the different packaging materials. A minor exception to this trend comes from metal packaging, whose consumption levels are declining in two of the countries.

¹⁰ Excluding always wooden and other packaging

¹¹ In the case of Norway the changes refer to the period 1999-2007 (also in the following tables)

Denmark proves to be by far the most packaging-consuming Nordic country, with a packaging waste generation about 26% higher than that of the next on the list. It appears, however, to have been also the only relatively successful at controlling the packaging consumption increase member of the group, having achieved a slightly higher than 1% (per capita) reduction for the decade-long period. In terms of specific materials, what draws immediately the attention is the large reduction in glass packaging consumption, a result encountered only in Denmark. This observation is accompanied by a similar one regarding metal packaging. The highest levels of paper & board and plastic packaging consumption among the group members are not surprising -since it is expected of the country with the highest overall packaging consumption to be high also in the various materials consumptions- and especially for paper & board a trend of considerable increase is observed.

Finland is located in the opposite end of the overall packaging consumption spectrum, being the only one dropping below 100 kg/cap. annually; a significant increase of packaging waste generation is, however, recorded since 1998 and the per capita consumption of every single material has increased during the decade. Particularly noteworthy, because of their magnitude, are the rises in glass and metal packaging, with the former being the second highest in the group and the latter the highest one. Additionally, Finland uses more metal packaging per capita than anyone else, an interesting fact considering its lower overall consumption. On the other hand, paper & board and plastic packaging consumption increases appear to be quite moderate, being the lowest among the group members.

In the case of Norway, the increase in overall packaging consumption per capita is by far the highest in the group; the respective consumptions of every packaging material have risen considerably (within a range of 16%-36%) and plastic and glass packaging consumption rises are higher than those of the Nordic counterparts. The figure for overall packaging consumption in 2007 (107 kg/cap.) is not high compared to Sweden or –even more so- Denmark, but the trend demonstrated is nevertheless alarming and indicative of a failure in the field of packaging waste minimization.

Finally, Sweden is the second-largest packaging-consuming country in the group and its per capita waste generation levels rose by close to 15% throughout the decade; the large increase in plastic packaging consumption (+33%) is particularly noteworthy. Sweden is also leading in the paper & board packaging consumption rises, although the differences with other Nordic countries are quite small. On the other hand, the only recorded consumption decline outside of Denmark can be found here in the form of a moderate decrease in metal packaging waste generation.

Denmark qualifies as the most interesting case after this first set of data, being the only one to have slightly reduced the overall packaging consumption and presenting significant declines in some material categories; the reasons that create such a high packaging demand in its case are also of interest. The other countries are far less

successful, with Finland standing out for its very low packaging waste generation and Norway for its large increases in every consumption category.

Tables 8 and 9 will offer some insight into the packaging material intensity of use developments from 1998 through 2007.

	Total packaging IU 2007 (kg/1,000 € GDP)	Total packaging IU change 1998-2007 (%)
DK	4.38	-14.6
FIN	2.94	-16.1
NO	2.36	+7.37
S	3.49	-10.8

	Paper & board IU 2007 (kg/1,000 € GDP)	Paper & board IU change 1998-2007 (%)	Glass IU 2007 (kg/1,000 € GDP)	Glass IU change 1998-2007 (%)	Metal IU 2007 (kg/1,000 € GDP)	Metal IU change 1998-2007 (%)	Plastic IU 2007 (kg/1,000 € GDP)	Plastic IU change 1998-2007 (%)
DK	2.67	+0.28	0.54	-49.7	0.18	-45.8	0.99	-6.27
FIN	1.62	-20.1	0.42	-6.23	0.29	+6.29	0.60	-19.3
NO	1.33	+1.42	0.30	+9.93	0.07	+17.9	0.66	+19.1
S	2.12	-9.04	0.56	-20.1	0.22	-29.7	0.59	+3.19

Tables 8-9: Overall packaging intensity of use development between 1998 and 2007-
Material-specific intensity of use development between 1998 and 2007

It is observed that –apart from Norway- the overall packaging IU is in a ubiquitous decline; the same is true, with only a few exceptions, for the material-specific IUs. This development is not surprising, considering that the countries examined are highly developed western European nations; less material-intensive goods and services are expected to account for an increasingly significant portion of the GDP in such economies, as already discussed in Chapter 2. The Norwegian case is highly unconventional in this sense; its raised IUs are one more indication of packaging waste minimization efforts that have produced poorer results compared to the other group members.

Denmark demonstrates –as expected- high reductions in the glass and metal packaging categories, while the paper & board IU has, interestingly, remained pretty much steady throughout the decade. In Finland, the highly increased use of metal packaging observed previously corresponds with the increased IU for this material, while significant reductions in the IUs of overall packaging, paper & board and plastic are demonstrated. Meanwhile, Sweden presents some average results, with a

comparatively lower overall packaging IU reduction, rather good figures in most material categories and a small increase of the plastic packaging IU, which complements the high increase of the per capita consumption observed in Table 7.

4.2. Packaging recycling and total recovery, 2001-2007

The next step in this introductory overview is the presentation of the packaging recycling and total recovery developments. Two points in time are selected in this case as well; 2001 is chosen because it corresponds with the Packaging Directive's deadline for member states to attain its targets (1st stage), thus becoming an EU milestone year, while 2007 is used again because it is the last year for which national reports were available. The 2001 Norwegian recycling rates for paper & board and plastic packaging were not included in the data received by Klif and, therefore, they are not presented here. It should be noted that the total recovery for glass and metal packaging is equal to the recycling rate, since these materials are not considered to be incinerated in waste incineration plants.

Tables 10 and 11 present the data regarding packaging recycling and total recovery in 2001 and 2007.

	<i>Packag. recycling 2001 (%)</i>	<i>Packag. total recovery 2001 (%)</i>	<i>Paper & board recycl. 2001 (%)</i>	<i>Paper & board total recov. 2001 (%)</i>	<i>Glass recycl. 2001 (%)</i>	<i>Metal recycl. 2001 (%)</i>	<i>Plastic recycl. 2001 (%)</i>	<i>Plastic total recov. 2001 (%)</i>
DK	57.2	90.2	64.9	98.2	76.0	40.2	13.9	95.7
FIN	47.2	62.1	58.0	74.0	49.7	42.2	14.8	43.9
NO	65.3	79.8	-	83.4	88.0	56.0	-	69.3
S	63.2	65.6	68.7	68.9	84.0	68.7	17.2	31.5

	<i>Packag. recycling 2007 (%)</i>	<i>Packag. total recovery 2007 (%)</i>	<i>Paper & board recycl. 2007 (%)</i>	<i>Paper & board total recov. 2007 (%)</i>	<i>Glass recycl. 2007 (%)</i>	<i>Metal recycl. 2007 (%)</i>	<i>Plastic recycl. 2007 (%)</i>	<i>Plastic total recov. 2007 (%)</i>
DK	61.2	102	60.5	99.6	128	86.8	21.8	97.7
FIN	70.8	81.1	87.6	95.5	81.1	70.3	18.4	43.0
NO	69.1	90.8	82.2	93.3	99.3	66.3	29.8	84.5
S	71.5	77.7	73.5	73.5	94.5	47.2	41.7	78.3

Tables 10-11: Packaging recycling and total recovery (overall and per material) in 2001 - Packaging recycling and total recovery (overall and per material) in 2007

Denmark has a minor increase to show in overall packaging recycling paired with a more substantial one in total recovery, which was already very high in 2001. One of the most notable pieces of information presented above is, in fact, that the total recovery in Denmark exceeds 100%. The Danish recycling rate at the end of the decade was the lowest among the countries compared, while the opposite is true for total recovery. Paper & board recycling slightly decreased compared to 2001, with Denmark ranking last in this category too, although the almost 100% total recovery rate for this material is again quite higher than the group average. Glass recycling rates are the best of the group, exceeding 100% by far and having improved much during the 2001-07 period. The doubling in metal packaging recycling is also striking, giving Denmark the first place among the Nordic countries, while the rates for plastic packaging appear somewhat improved with a nearly 100% total recovery once again. When everything is considered, the Danish case is characterized by average recycling rates (with the exceptions of glass and metal packaging) accompanied by close to –or even above- 100% total recovery, indicative of a widespread utilization of waste incineration.

Turning to Finland, we can observe that although it trailed behind the rest in overall packaging recycling in 2001, it managed to become one of the forerunners in this field by 2007. The same statement is true also in the case of paper & board packaging recycling, a factor to which could be attributed the overall lead of Finland. Improvements, more or less significant, are also demonstrated in most other categories, with the exception of the plastic packaging total recovery rate, which is about half of that in Sweden or Norway. Despite these improvements, Finland remains firmly last in glass recycling throughout the period at hand, a place held also for plastic recycling in 2007.

Sweden was placed high in all recycling categories back in 2001, but by 2007 had managed to stay ahead only in plastic packaging recycling. The overall and paper & board packaging recycling rates were somewhat raised; glass packaging recycling was more significantly improved but the metal recycling rate decreased by much and became the worst among the countries examined. On the other hand, the plastic packaging recycling rate was much improved in 2007 compared to 2001. The total recovery rate is very close to the recycling one (and the lowest of the group in 2007), since there is no energy recovery of paper & board packaging.

Finally, a direct comparison between Norway and the rest of the countries cannot be conducted in all categories due to some unavailable figures as mentioned above. The 2001 overall and glass packaging recycling rates were the best in the group; the former increased slightly and was close to the 2007 forerunners, while the latter approached 100% by 2007 and fell behind only Denmark. Metal packaging recycling was also quite high in 2001 but the progress made from that point on was less significant than that of Denmark or Finland. The total recovery is high in every category and Norway is the only country that comes close to Denmark in overall packaging recovery. In general, all rates have improved throughout the period

examined and, although they are not the best in any category, they usually come close to the top and could indicate that some effective policy measures were implemented.

5. Policy evaluation: Denmark

The analysis of the packaging policies implemented in each of the countries and of their subsequent effects will start with the case of Denmark. The first part of this chapter will offer an overview of the policy background, including an introduction to the Danish waste model and its packaging waste management aspects, and will describe all packaging measures currently in effect in Denmark. The second part of the chapter focuses on the results achieved by Denmark and the developments regarding packaging consumption, intensity of use, recycling and total recovery; the results will be compared with the targets set and, where possible, the effect of specific policies upon them will be defined.

5.1. Policy background

1978	Beverage containers tax
1987 (and revision in 1993)	Waste tax
1988	Value tax on disposable tableware
1990	Mandatory glass collection schemes (voluntary since 1982) – Cardboard packaging separation by the industry
1994	Voluntary agreement on transport packaging – Weight tax on paper and plastic carrier bags
1997	Combustible waste landfilling ban
1999	Packaging taxation scheme
2002	New deposit-return system

Table 12: Policy measures currently in effect in Denmark (non packaging-specific measures that are relevant for packaging waste management are also included)

5.1.1. The Danish waste model

The defining characteristic of the packaging policy field in Denmark, which sets the country apart from its counterparts in this group, is the fact that the main actor is the state itself. The Environmental Protection Agency (Miljøstyrelsen) declares that the fundamental principle of the “Danish waste model” is that the coordination of waste management is a public sector task [Miljøstyrelsen, 1999]. The responsibility for the management of all waste lies with the local councils, which can choose to maintain it or contract the task to an intermunicipal waste company; an additional option is to use private companies as waste management operators. Usually, large local authorities choose to manage their waste individually, while the majority of the smaller local authorities cooperate with each other and establish the aforementioned intermunicipal companies. Other significant characteristics of the Danish model are the prominent role of the source separation principle and the municipal task of ensuring that the waste hierarchy is respected. Since 1999, with the introduction of the Waste 21 policy agenda covering the period 1998-2004, the focus of the system shifted from quantities towards qualitative objectives, such as treatment quality, reduced environmental impact and increased resources utilization.

Taking a more detailed look into the responsibilities allocation we can see that while municipal schemes for household waste can be operated by any of the three entities mentioned above, the management of industrial and commercial waste is normally contracted to private companies. Such companies are also the usual contractors for waste collection services, regardless of the type of waste. Recycling activities are usually carried out by private actors, although several intermunicipal companies operate within this field in order to guarantee environmentally sound processes. Waste incineration is practically a public sector task and the plants are usually run by municipal/intermunicipal companies; some of them, however, operate under a different ownership status (e.g. owned by power distribution companies) [Miljøstyrelsen, 1999]. Finally, waste disposal sites may be owned only by public authorities.

The key role played by the local authorities within the Danish model can be made even more evident when their duties are summed up. Each municipality has to prepare waste management plans -short- and long-term ones, covering 4 and 12 years respectively- and put regulations detailing the schemes established in the community in place. These schemes aim at guaranteeing that the waste generated in the municipality are managed in an environmentally acceptable way. It has been already mentioned that they must ensure compliance to the waste hierarchy, including provisions for the recycling of certain waste types in accordance with specific requirements. Finally, they must collect and register information on waste amounts, waste treatment plants, etc. and be in charge of compliance supervision [Miljøstyrelsen, 1999]. When a municipal scheme is established, citizens and enterprises alike are under the obligation to use it and no competing systems are allowed to exist wherever a municipal one is already operational.

5.1.2. Packaging waste management

No separate management system for packaging waste exists in Denmark, where the focus is instead placed upon the best possible utilization of recyclable materials from all waste (including packaging). The implementation of the Packaging Directive's provisions is ensured by two Statutory Orders: 298 (30/4/1997) and 619 (27/6/2000); targets concerning packaging materials were initially described in Waste 21 and updated in the next waste management plan (2005).

In order to attain the targets set by the Directive, Denmark has primarily focused on the collection and recovery of transport packaging; it is considered to be made up of large, homogeneous and rather clean waste streams, making its management cheaper than that of household waste [European Environment Agency (EEA), 2005]. The Danish have had experiences in the past with insufficient waste treatment systems set up on a private basis, which, added to the difficulties in funding treatment facilities, has made both the state and the industry reluctant to transfer the responsibility for packaging waste management from the former to the latter. Therefore, the local authorities remain a central figure also in packaging waste management, although the business sector has several responsibilities. Above all

stands Miljøstyrelsen, which reserves a regulatory role with regard to waste policies in Denmark. It has been responsible for the transposition of the Directive into national legislation and its tasks presently include the monitoring of the targets' attainment, the monitoring of compliance (in cooperation with the municipalities) and the reporting of packaging data to the Commission. Miljøstyrelsen is being assisted in this last task by the national statistics agency of Denmark (Danmarks Statistik), which provides necessary data in terms of quantity and value regarding imports, exports and production [Kaysen & Jakobsen, 2003].

Local authorities are required -within the context of their role as the party responsible for the collection and further disposal of waste- to include initiatives for the minimization and recycling of packaging waste in their waste management plans [Environment Directorate-General (EDG), 2001]. Additionally, they must prepare regulations obligating enterprises and public/private institutions to recycle certain types of waste, as well as establish collection systems for glass and paper & cardboard household waste in places with more than 2,000 and 1,000 households respectively [The Environment Exchange, 2001]. There is also a municipal obligation to inform households and businesses about collection schemes and fee structures. The collection is carried out primarily through "bring" systems with containers for glass and paper, while in most municipalities there is also a collection system available for plastics from households/companies. Glass from the retail sector, restaurants, etc. is collected directly from the companies.

The business sector's contribution to packaging waste management has several aspects. The producers of packaging materials must minimize the environmental impact of their products, producers and importers shall be ready to submit documentation of compliance to the packaging requirements and businesses have to maintain a register of their waste (including packaging).

The voluntary agreement on transport packaging

The major feature of the business sector's participation in packaging waste management is the voluntary agreement of 1994 regarding the recycling of transport packaging. The ground for such an initiative was partly prepared by a number of widely publicized disclosures of corporate violations of environmental regulations. The increased environmental awareness of the public since the early 1980s also contributed to this effect. Another influential factor was the government's search for the most cost- and environmentally-effective solutions in order to meet the requirements of the -forthcoming at the time- Packaging Directive [EEA, 1997]. The industry was under an implicit and unclear threat of strict legislation and/or of use of other fiscal instruments, resulting in its willingness to participate in such a scheme, although no additional benefits were offered apart from the promise of no direct regulation of individual firms. The local authorities participated as a major shareholder in industrial waste collection and recycling; they saw the agreement as

one with a unifying effect and its targets as a basis for subsequent standard regulations [EEA, 1997]. The key negotiating actors in the process were the following:

- Miljøstyrelsen (signatory)
- Kommunernes Landsforening (the National Association of Local Authorities)
- Dansk Industri (the Federation of Danish Industries, signatory)
- Emballageindustrien (the Paper & board Federation, signatory)
- Plastindustrien (the Plastic Industry Federation, signatory)
- CO-industri (the Central Organization of Industrial Employees)
- Danmarks Naturfredningsforening (the Danish Society for the Conservation of Nature).

The implementers of the agreement are not necessarily its signatories, as this task falls under the responsibility of the municipalities, retailers and some industries (those that have to manage the waste). It is a non-binding gentlemen's agreement, with no legal penalties for non-compliance. There is, however, an ever-present veiled threat of regulation combined with strong moral and political pressure. Although the municipalities reserve the right to appeal to courts or the Home Ministry against the industry, disputes are usually settled through dialogue. Finally, the monitoring is assigned to a working group of the members and focuses on issues such as the recycled volumes of waste, the material types, the imported to locally-produced waste ratio, etc.

5.1.2.1. Policy measures implemented

The pre-Directive era

Long before the introduction of the Packaging Directive an array of policy initiatives was implemented in Denmark regarding packaging consumption and management. A deposit system for beverage containers was established in the 1970s, setting a mandatory requirement for the use of refillable beer and carbonated soft drinks containers, while all other beverages could be sold in one-way packaging; the legislation was later amended so that the deposit system would also include mineral water. Banning one-way packaging was justified by comparing the environmental burden of cans and one-way glass bottles to that of reusable bottles [Golding, 1999]. In addition to this, a tax on all new beverage packaging was put in effect in 1978. The ban on one-way containers was lifted in 2002 under the pressure of the EU and the whole system was revised and took its current form, which will be further described later on.

A development with implications concerning packaging management was the introduction of a waste tax in 1987, which in 1993 became differentiated in order to reflect the waste hierarchy by supporting recycling (tax exemption) and encouraging incineration with energy recovery [EEA, 2005]. In 1988 a value tax on disposable tableware came in effect [Miljøstyrelsen, 1999]. In 1990 the collection schemes for glass became mandatory (they were voluntary since 1982), and the industry was

obliged to start separating cardboard from the rest of its waste as a measure to support the recycling of packaging. Furthermore, the voluntary agreement on transport packaging was signed shortly before the introduction of the Directive, while a weight-based tax on paper and plastic carrier bags began being implemented during the same year [Miljøstyrelsen, 1999].

The current situation

One element of the contemporary Danish waste management policy (including packaging) is the ban imposed on the landfilling of waste suitable for incineration, which has been implemented since 1997. Denmark has an extended network of waste-to-energy plants and this measure obviously aims at the reduction of final disposal through the elimination of combustible waste landfilling.

The introduction of the new packaging taxation system in 1999 should be regarded as one of the most important recent developments. The whole system is based on LCAs and covers eighteen product groups [ECOLAS-PIRA, 2005]. It provides weight-based and differentiated according to the type of material charges, which are paid once for each piece by the filler. The underlying idea behind the system is to tax materials in relation to both their ecological impact and the quantities brought to the market; such provisions constitute an effort to steer decision makers towards using reduced amounts of packaging and substituting materials with better ones. In this way, this scheme is considered to be very important for Denmark's effort to minimize packaging waste generation.

<i>Material type</i>	<i>Tax imposed (DKK/kg)</i>
Textiles, paper & board (primary)	0.95
Paper & board (secondary)	0.55
Plastic (primary, except EPS and PVC)	12.95
Plastic (secondary, except EPS and PVC)	7.75
EPS, PVC	20.35
Aluminum	33.30
Tinplate, steel	9.25
Glass, ceramic	1.85
Wood	0.55

Table 13: Packaging taxation charges per type of material in Denmark (1 DKK = 0.13 €) [The Danish Ministry of Taxation, 2003]

Packaging taxation is not limited to the aforementioned system. It has already been mentioned that a tax is imposed on beverage packaging since 1978; the fees charged currently are based on the volume and the material of the item. The reason for making the tax volume-based is to encourage the use of refillable containers, since a weight-based system would promote lightweight containers instead [ECOLAS-PIRA, 2005]. The fact that it is imposed only on new packaging is an additional provision towards the same direction. The tax has stabilized reuse systems (alcoholic beverages, beer, soft drinks) after the abolishment of the one-way packaging ban and has helped

introduce a reuse system for wine bottles. Even retailers (discounters) who follow radical one-way packaging strategies in other countries, run reuse systems in Denmark [Golding, 1999]. The combination of the beverage containers taxation with the existing deposit system has led to about 95% of beer and soft drinks being sold in refillable containers with a return rate of about 99% [ECOLAS-PIRA, 2005].

Other taxation initiatives currently in effect include the previously mentioned disposable tableware and paper/plastic carrier bags taxes, and the weight-based tax on plastic foil foodstuff packaging made from soft PVC (implemented since 1999). Finally, it should be mentioned that the 1987 waste tax is still in place and, although not packaging-specific, it influences greatly the post-consumption management of packaging materials.

Furthermore, in an informative instrument case, recyclable foodstuff packaging shall be labeled if it is covered by a return system [EDG, 2001].

The deposit-return system

Before concluding this section on the current state of affairs regarding packaging policy in Denmark, a mention should be made of the deposit-return system, which - combined with the beverage containers taxation- constitutes a prominent element of the effort for increased packaging reuse.

The ban on one-way packaging for beer and carbonated soft drinks was lifted in 2002 and the producers were given the permission to use disposable packaging. A common mandatory deposit-return system was established in order to ensure that the disposable packaging is collected, exclusively operated by Dansk Retursystem (a private non-profit organization) that will continue having the responsibility for it up to 2013 at minimum. The return machines in supermarkets were modernized in order to improve the sorting of refillable bottles and to prepare for the arrival of disposable packaging under the new system. Today, Dansk Retursystem handles bottles and cans containing beer, carbonated soft drinks, mineral water (since 2008), energy drinks (since 2005), iced tea, ready-to-drink beverages and cider products [The Danish Government, 2004]. Its mission is to minimize their environmental impact in connection with the collection of one-way packaging and to offer convenience to all those involved in receiving and handling the returned packaging [Dansk Retursystem, 2010].

Dansk Retursystem is involved in two business areas: i) refillable bottles, and ii) one-way packaging. In the former it is responsible for the payment of a handling fee to more than 5,000 grocery stores and for improving the efficiency of receiving the bottles on the premises of around 2,000 grocery stores; in the latter, its responsibility revolves around the collection of cans and non-refillable bottles, which are then sent for recycling. Dansk Retursystem also administrates the refunding of deposits paid for one-way packaging on behalf of the importers, producers and stores.

The organization is financed by fees paid by importers and producers for the packaging they put on the Danish market. The level of the fees charged fluctuates annually so that the organization does not have profits or losses. Their calculation is based on the importers' and producers' registered sales volumes in the previous year combined with their expectations for the forthcoming year. Logistics fees cover administrative overheads, handling fees and efficiency improvements in grocery stores, while collection fees cover the costs of collecting and counting one-way packaging [Dansk Retursystem, 2010]. Refunds that have not been claimed by the consumers are used to finance system improvements.

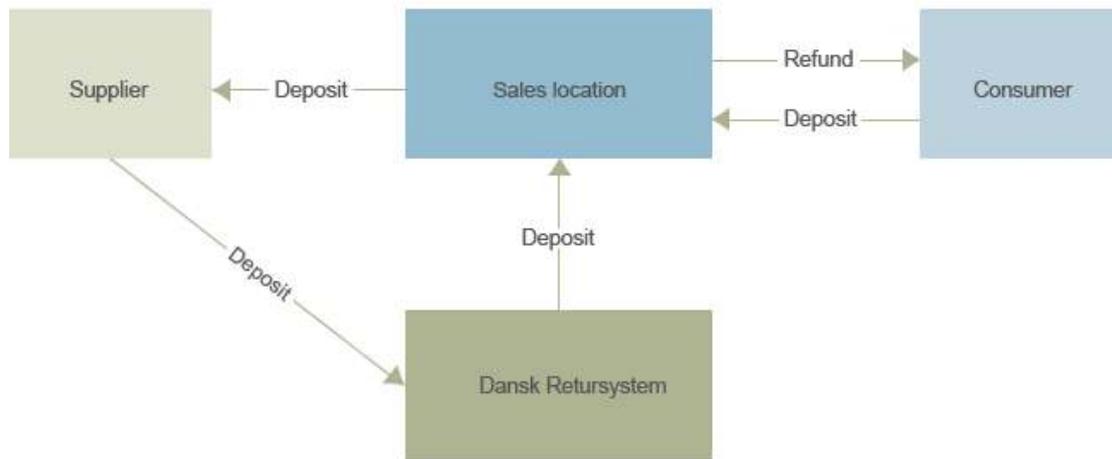


Fig. 5: The Danish deposit-return system [Dansk Retursystem, 2010]

Packaging waste management financing

The municipalities are responsible for the financing of collection systems. The citizens pay tariffs -usually fixed annual ones, increasing over time- that are used also in order to finance the paper and glass “bring” systems, while the private companies have to use the available municipal collection systems and pay for them. The aforementioned taxes on packaging are considered government income and are directed towards the national budget; the government (Miljøstyrelsen), however, often finances R&D projects concerning packaging.

5.1.2.2. Material flows

A division exists between sales and transport packaging and each category is subdivided into different materials. Most materials are present in both categories.

Paper & board

Four subdivisions are considered in this case: paper, corrugated cardboard, ordinary cardboard and molded or pressed paper pulp. Generally, no separate collection of fiber packaging materials from households takes place and sorting facilities receive fiber packaging mixed with other paper qualities [Kaysen & Jakobsen, 2003].

Glass

The recycling of glass packaging is made possible through recycling end-of-life beer and soft drinks bottles, by recycling wine and spirits bottles, as well as by recycling packaging glass collected in municipal schemes. Glass is collected directly from the companies in the retail sector, restaurants, etc., while from private households it is primarily brought to centrally placed containers or recycling stations. Sorting facilities sort out reusable bottles (they go for rinsing), recyclable bottles (they are crushed in cullets) and cullets (the recyclable ones go to a glass factory and the non-recyclables are landfilled). Only one producer of glass packaging exists in Denmark and provides valuable production information annually [Kaysen & Jakobsen, 2003]. The production figures are compiled in numbers of units and a conversion in weight units has to take place, creating some uncertainties about the final results. Additionally, data uncertainties exist due to the private imports of wine and other alcoholic beverages that are not included in the marketed quantities.

Metal

It is subdivided into three categories: aluminum, tinplate and other materials. Most of the produced metal packaging is packed in Denmark and then exported. No separate collection of metal packaging from households takes place but they can bring metal packaging waste mixed with other items to centrally located recycling stations; the mixed metals are transported to sorting facilities. On the other hand, there is collection of metal transport packaging from the industry. 90% of the metal packaging waste not recycled is assumed in the statistics to be incinerated and 50% of that quantity is assumed to result in scrap iron from the incineration process, which is also recycled [Kaysen & Jakobsen, 2003]. The collected metal packaging waste data are based on information acquired from scrap metal companies that cover about 80% of the scrap metal market. Data about households are based on analyses conducted in several recycling stations, followed by scaling-up.

Plastic

Nine groups are distinguished in this category: PVC, PP, PS, EPS, plastic laminate, PET, HDPE, LDPE, others. The voluntary agreement with the industry for the collection of transport packaging constitutes the major effort for the recycling of these materials [Kaysen & Jakobsen, 2003].

5.2. Achieved results and analysis

The developments in Denmark with regard to packaging consumption, intensity of use, recycling and total recovery will be presented and discussed in the following paragraphs.

The Danish authorities have chosen in some cases to substitute the targets prescribed by the EU Packaging Directive with more ambitious ones. Such is, for example, the case of glass packaging, for which the targets have been consistently

higher than those of the Commission. The Danish national targets for packaging waste are presented in the following table. It should be kept in mind that where no national targets exist, EU targets are applicable (see Tables 4-5).

	<i>Recycling in 2001 (%)</i>	<i>Recycling in 2008 (%)</i>
Paper & board	55	min.60
Glass	65	80
Metal	15	50
Plastic	15	22.5
Overall packaging waste	-	55

Table 14: Danish national targets for packaging waste

5.2.1. Overall packaging consumption

The following section presents the development of the overall packaging consumption in absolute and per capita terms between the years 1998 and 2007 along with the overall packaging intensity of use during the same period.

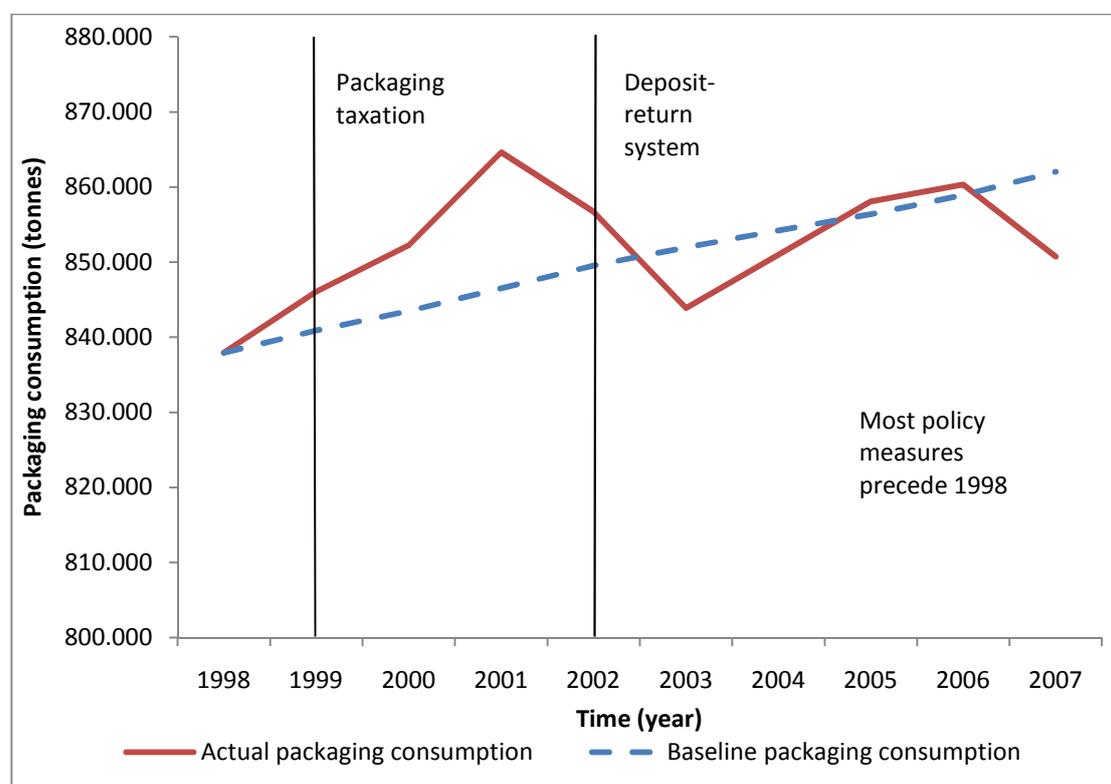


Fig. 6: Actual vs. baseline packaging consumption in Denmark, 1998-2007

The Danish overall packaging consumption at the end of the decade was about 11,000 tonnes lower than the calculated baseline (Fig. 6). Denmark overcame the initial increase up to 2001 and since then the actual consumption has been maintained very close –or even below- the one expected based on the population growth. A similar situation is described by Fig. 7, where the steep decrease between 2001 and 2003 is present again, as well as the slight decrease (-1.3%) of the per capita consumption observed in the end of the decade compared to 1998. Finally, the

packaging intensity of use development in Denmark moves along the lines of the theories analyzed in Chapter 2 regarding the decoupling process observed in developed economies.

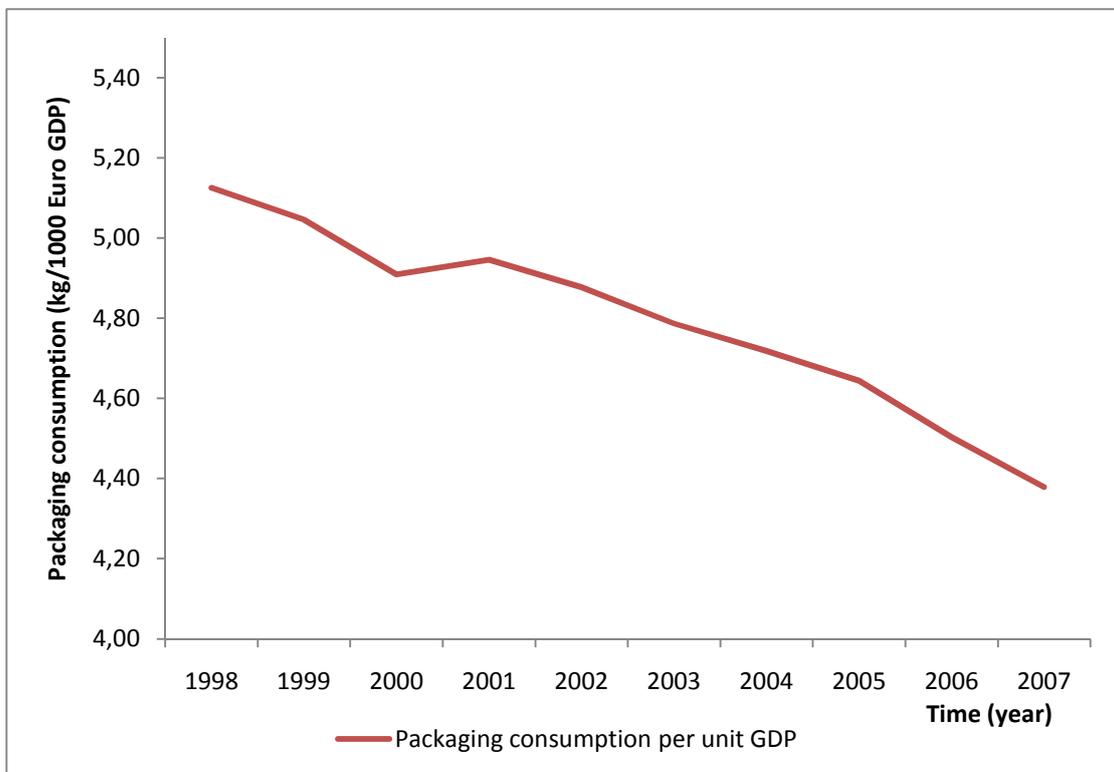
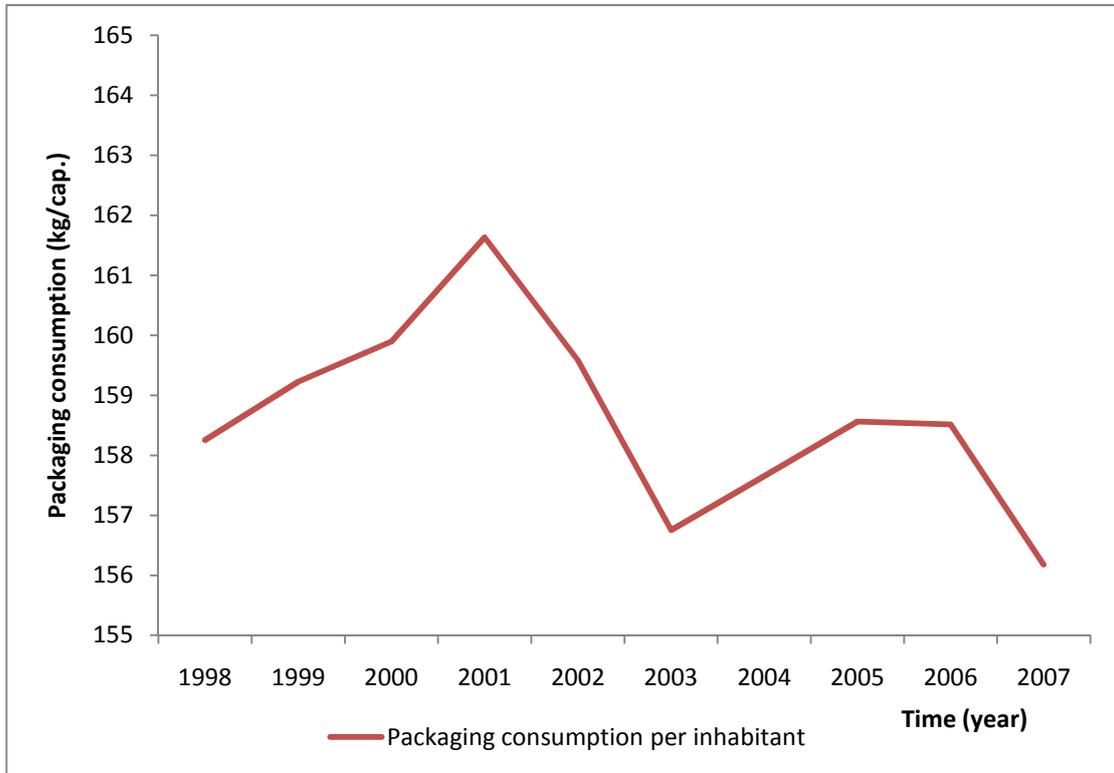


Fig. 7-8: Packaging consumption per inhabitant in Denmark, 1998-2007 - Packaging consumption per unit GDP in Denmark, 1998-2007

It has been stated in Chapter 4 that Denmark is the most packaging-consuming country among the group members; an array of possible factors have been proposed in order to justify this fact [Kaysen & Jakobsen, 2003]:

- The per capita consumption of specific foodstuff product groups is higher in Denmark. One example is alcohol: in 1998 the Danish consumption was 9.8 L/cap. compared to 7.0 L/cap. in Finland, 5.7 L/cap. in Sweden and only 4.5 L/cap. in Norway, while the EU27 average was 9.2 L/cap. [Health and Consumers Directorate-General (HCDG), 2008]
- The average household size in Denmark is relatively small; in 2002 there were 2.2 persons per household compared to 2.9 persons per household in Sweden in 2001 [United Nations Economic Commission for Europe (UNECE), 2004]
- The life expectancy in Denmark is somewhat lower, while older people consume less than younger ones (2005-10: Sweden = 80.9 years, Norway = 80.2 years, Finland = 79.3 years, Denmark = 78.3 years [United Nations, 2007])
- Lunch preparation takes place primarily in the household instead of in the catering sector, which uses larger packages
- The European returnable distribution boxes rental system is not very popular in Denmark
- There is extended foodstuff production that requires a variety of different ingredients, which are packed independently.

Not all of these statements can be considered of equal value; the attribution of a share of the increased packaging consumption to factors such as the lower life expectancy or the lunch preparation habits of the Danish could be somewhat far-fetched, while the relation between the average household size and packaging consumption is not as direct as implied (see Chapter 3). On the other hand, the increased consumption of specific packed products and the structure and activities of the Danish industry appear to be more valid arguments, coupled with the inclusion in the national packaging statistics of a greater variety of items used in transportation applications compared to the other countries.

5.2.2. Overall packaging recycling and total recovery

The following section will illustrate the recycling and total recovery rates' development in Denmark against the targets set during the 1998-2007 period.

The packaging recycling rates were much higher at the beginning of this period than the minimum target prescribed by the Directive; the 1998 figure was in fact double than the minimum recycling target that should had been attained by 2001. The recycling levels, however, remained stable for a significant part of the decade, with small increases recorded from 1998 to 2001 (about seven percentage points) and again after 2004 (five percentage points). This relatively small progress, combined with the introduction of the new target for 2008, resulted in Denmark exceeding the levels required only by a small margin of some six percentage points in 2007.

Packaging total recovery close to 90% (well above the EU targets) was achieved already in 1998 and by the end of the decade a rate slightly higher than 100% had been reached. This unusual development is attributed to the extremely high rates of glass packaging recycling that will be discussed later on.

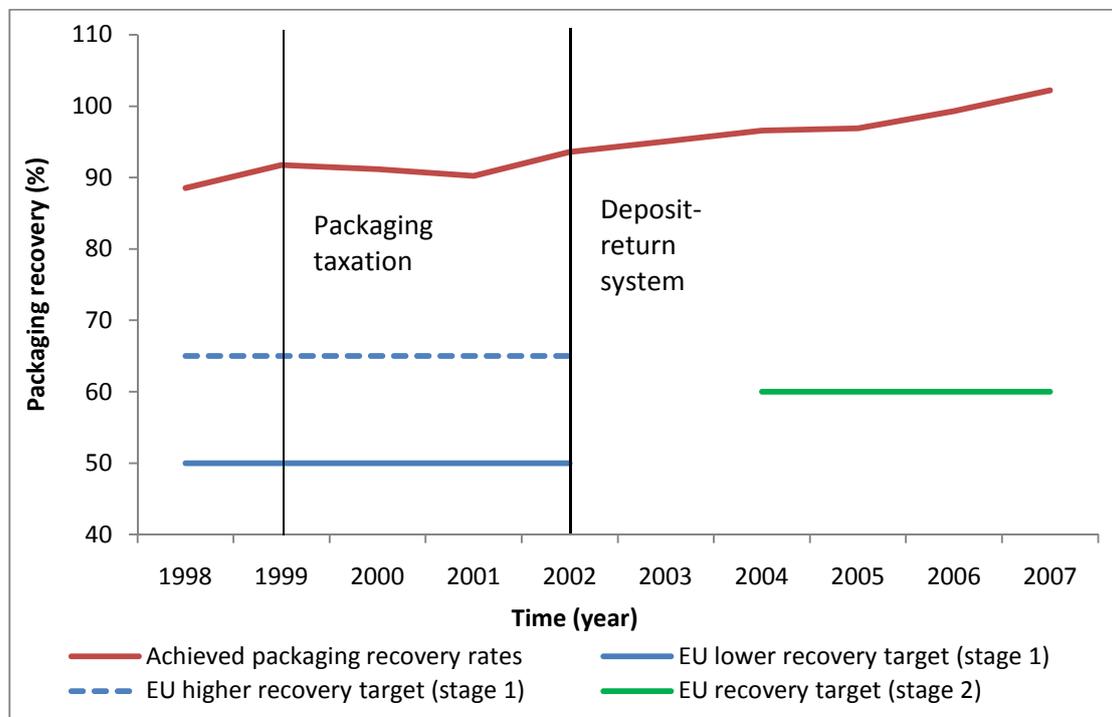
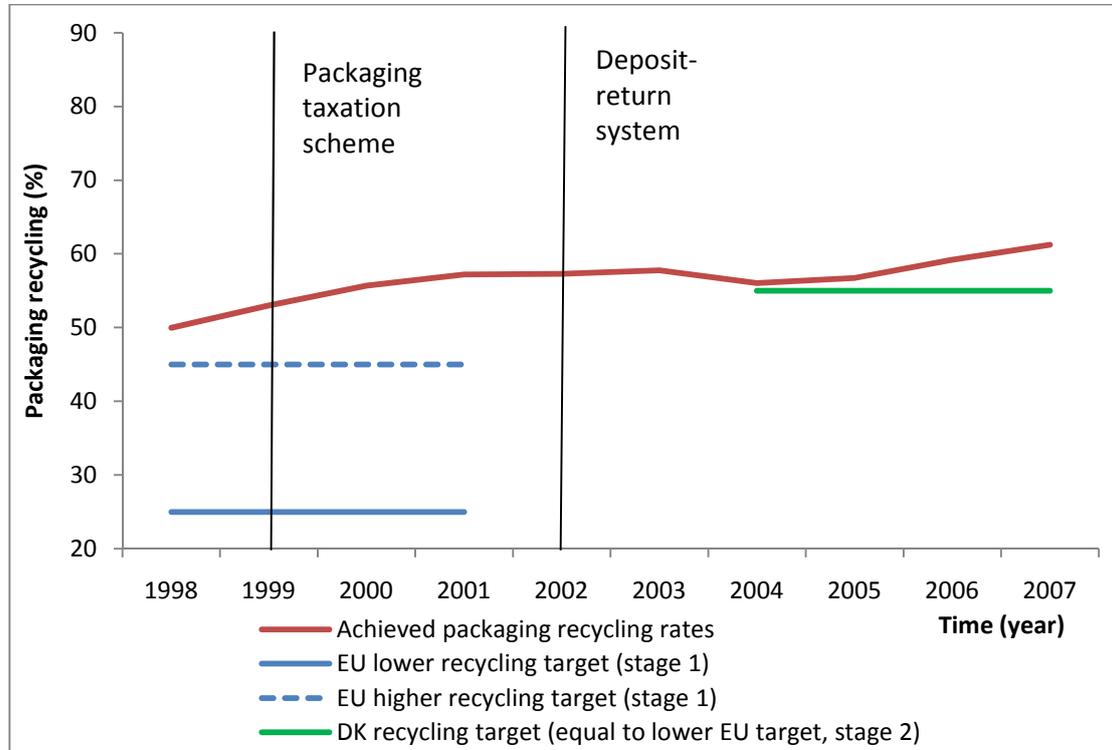


Fig. 9-10: EU and DK packaging recycling targets vs. achieved packaging recycling rates in Denmark, 1998-2007 - EU packaging recovery targets vs. achieved packaging recovery rates in Denmark, 1998-2007

5.2.3. Consumption and recycling per material

5.2.3.1. Paper & board

The following section will demonstrate the developments regarding the paper & board packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

It can be seen that the paper & board packaging consumption in Denmark has been consistently higher than the baseline throughout the decade, ending up at some 70 ktonnes above it (Fig. 11). With the exception of a small period of stability (2002-04), a constant increase is observed; it is worth mentioning in this context that paper & board raised its share in total packaging consumption from about 52% to 61% during the period examined.

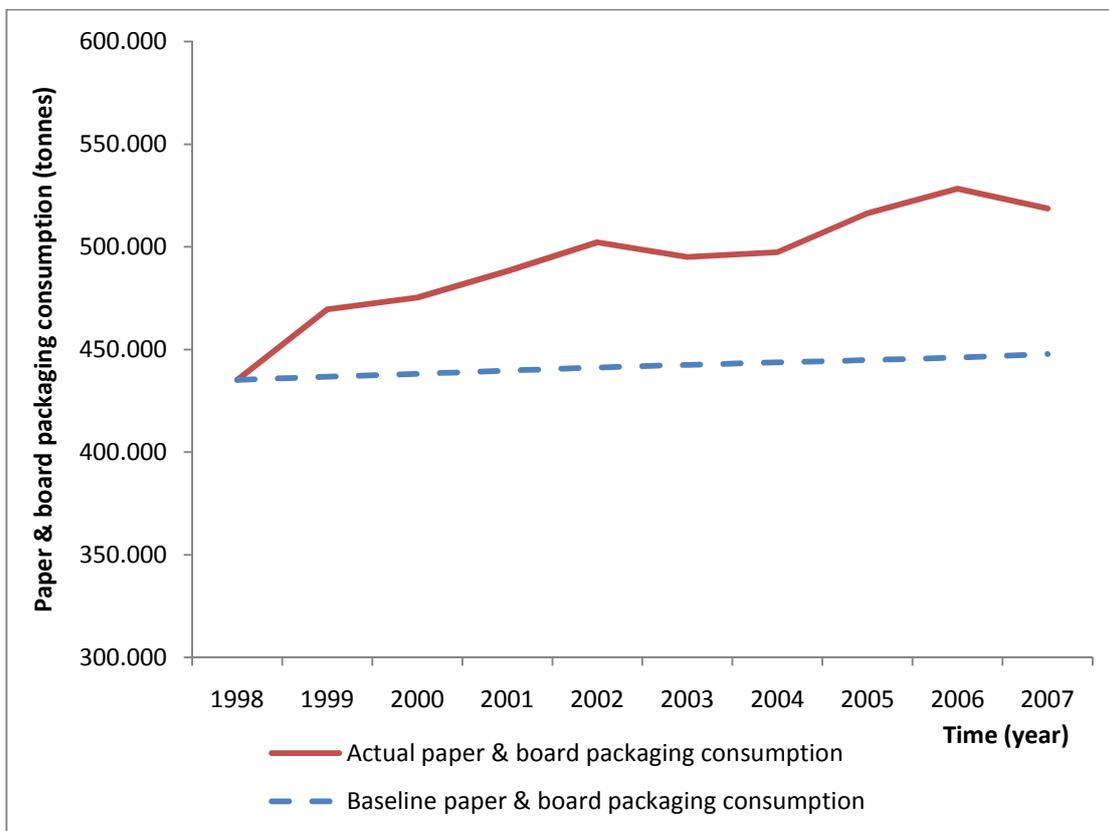


Fig. 11: Actual vs. baseline paper & board packaging consumption in Denmark, 1998-2007

The paper & board packaging intensity of use (Fig. 13) remained rather constant when the decade as a whole is examined. This development, which is unusual considering the general trend of IU reductions, reflects the increasing consumption and importance of paper & board packaging in Denmark. Since the peaks that appear in the graph do not correspond to similar peaks in consumption, they are probably caused by financial factors, such as the structure of the Danish GDP during these particular years.

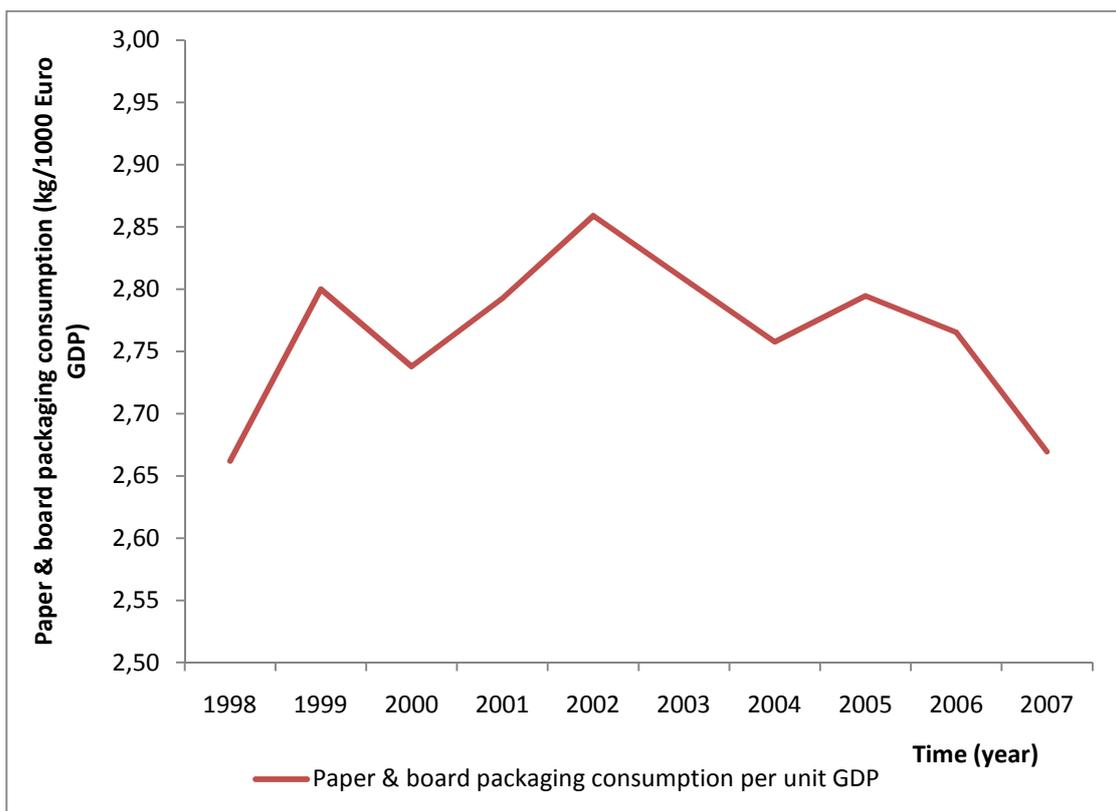
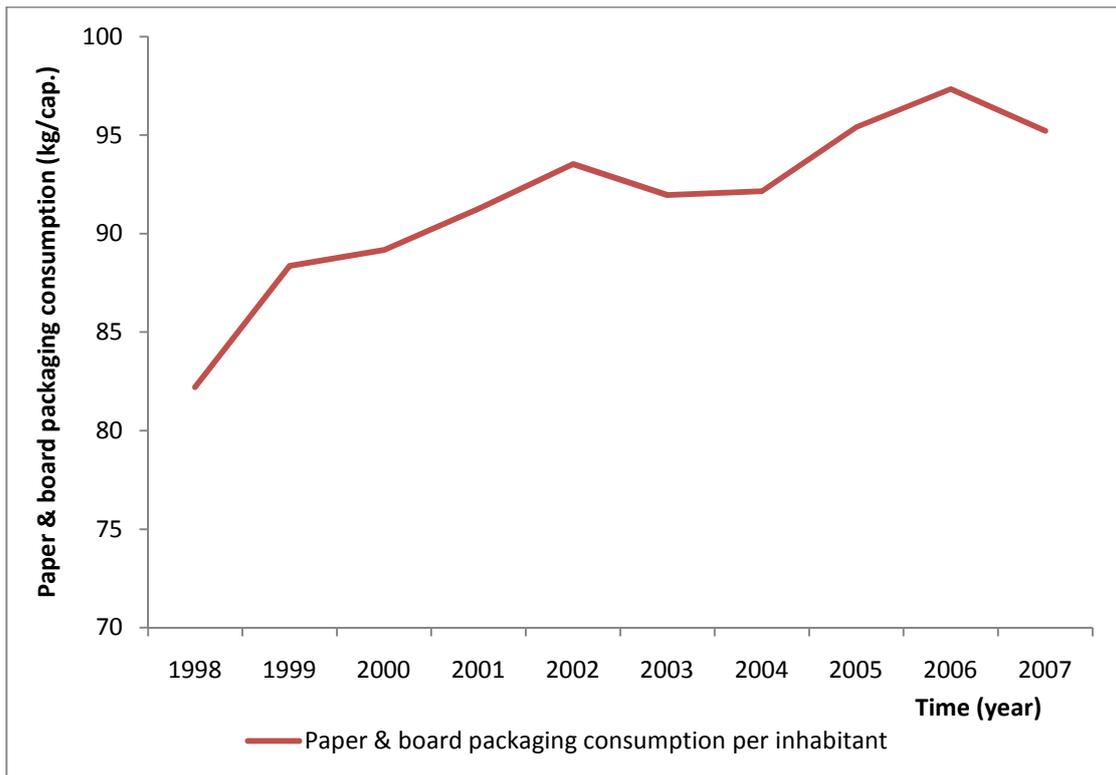


Fig. 12-13: Paper & board packaging consumption per inhabitant in Denmark, 1998-2007 - Paper & board packaging consumption per unit GDP in Denmark, 1998-2007

Paper & board is one of the materials for which Denmark initially chose to introduce a recycling target different than that of the Directive: 55% in 2001 instead

of 15%. During the next Danish policy stage (goals for 2008) the national target was harmonized with the EU one.

The recycling rate in 2007 was only slightly higher than that of 1998, although it fluctuated during the decade; the final rate is, in fact, lower than that achieved in 2001, the first milestone year (Fig. 14). The recycled quantity in absolute terms rose by more than 20% but the accompanying increase in consumption led to the outcome depicted in the graph. When the total recovery rate is considered, however, it appears to have increased from 98.2% in 2001 to 99.6% in 2007. This simultaneous recycling decrease and total recovery increase is interesting and a possible explanation for it will be offered in the discussion section.

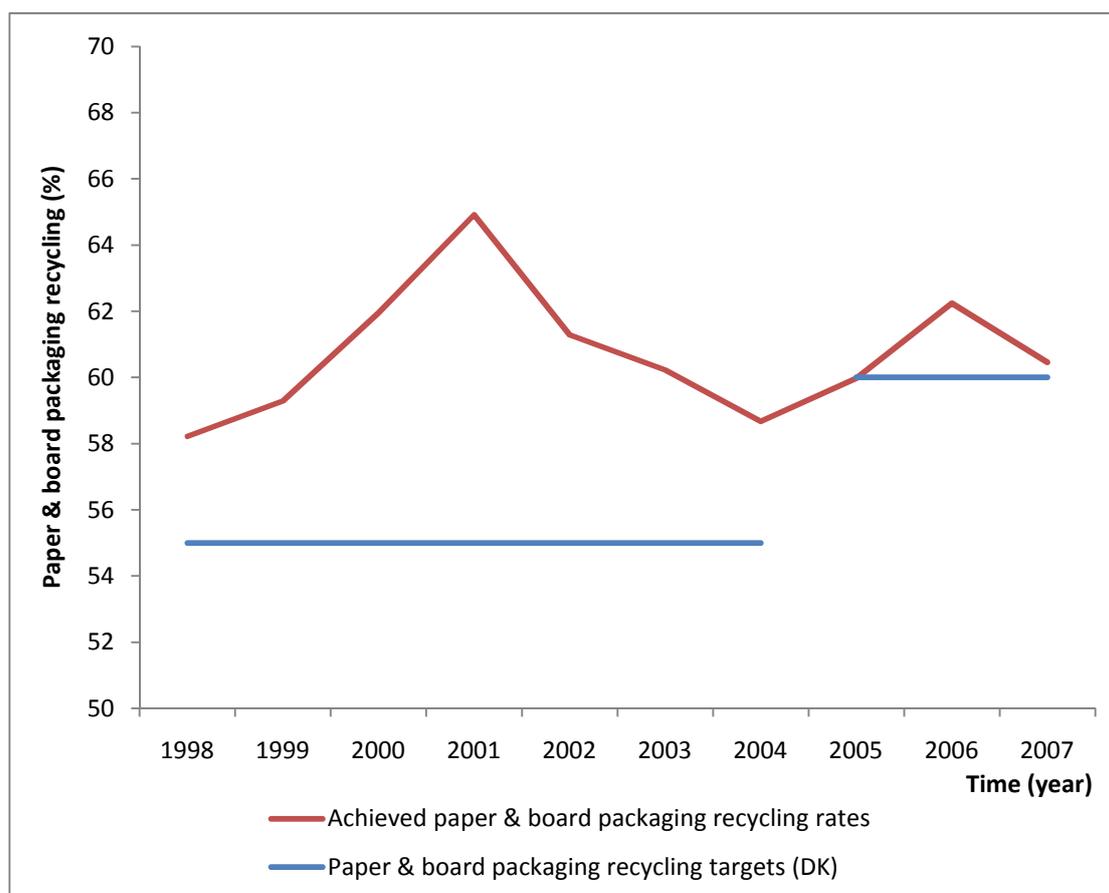


Fig. 14: Paper & board packaging achieved recycling rates vs. national targets in Denmark, 1998-2007

5.2.3.2. Glass

The following section will demonstrate the developments regarding the glass packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

It was mentioned already in Chapter 4 that the glass packaging consumption reduction (about 40% in per capita terms) is one of the most distinct characteristics of the Danish packaging waste developments during the decade examined. The

consumption in 2007 was about 75 ktonnes lower than the baseline, having remained constantly below it since 2002 (Fig. 15). The consumption started to rapidly decrease at the time of the revised mandatory deposit system's introduction and this drop had a great influence upon the overall packaging trends in Denmark; the decline in packaging consumption between 2001 and 2003 that was depicted in Fig. 6 is entirely attributable to the glass packaging developments. The changes in the glass packaging IU (Fig. 17) confirm the trends already described.

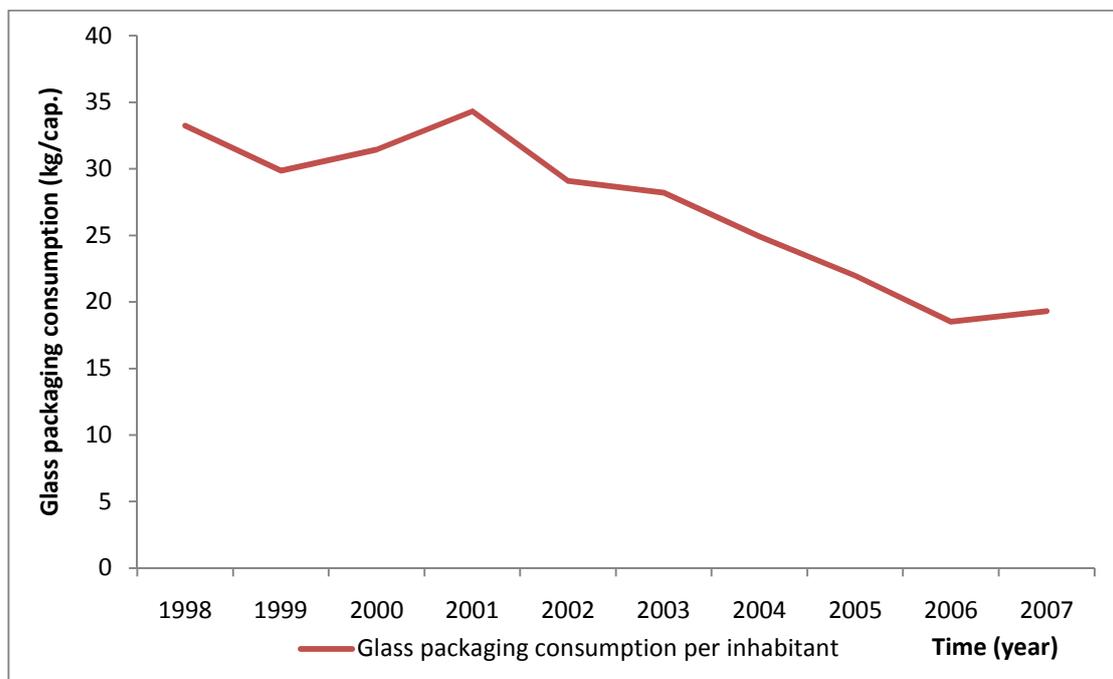
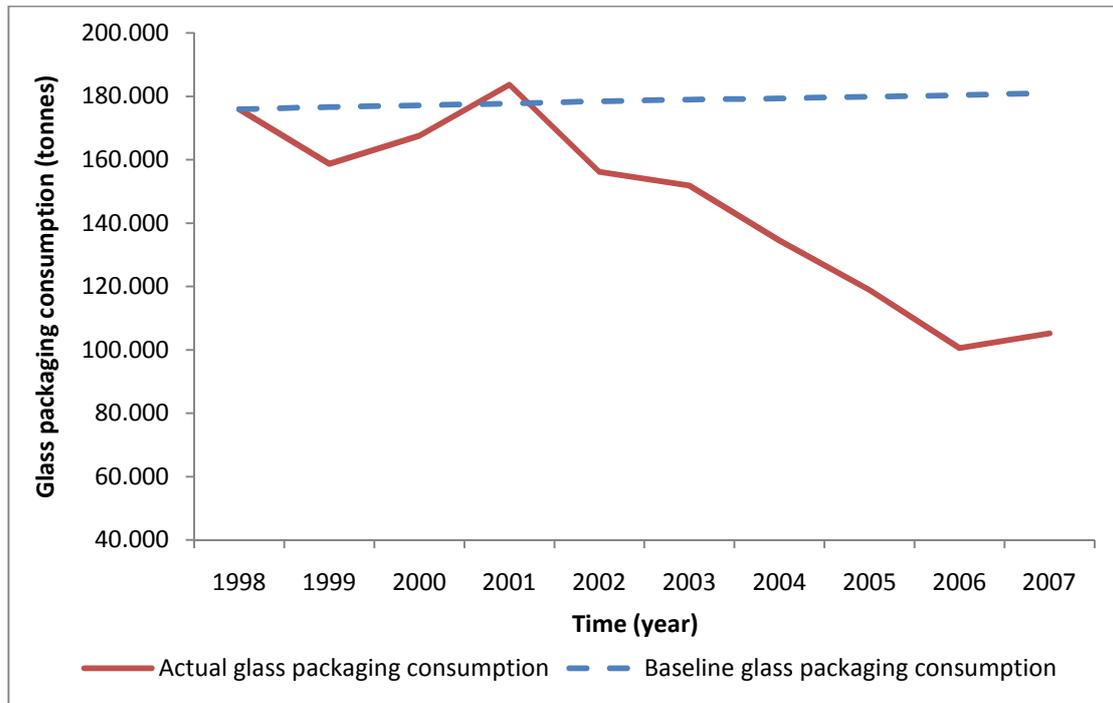


Fig. 15-16: Actual vs. baseline glass packaging consumption in Denmark, 1998-2007 - Glass packaging consumption per inhabitant in Denmark, 1998-2007

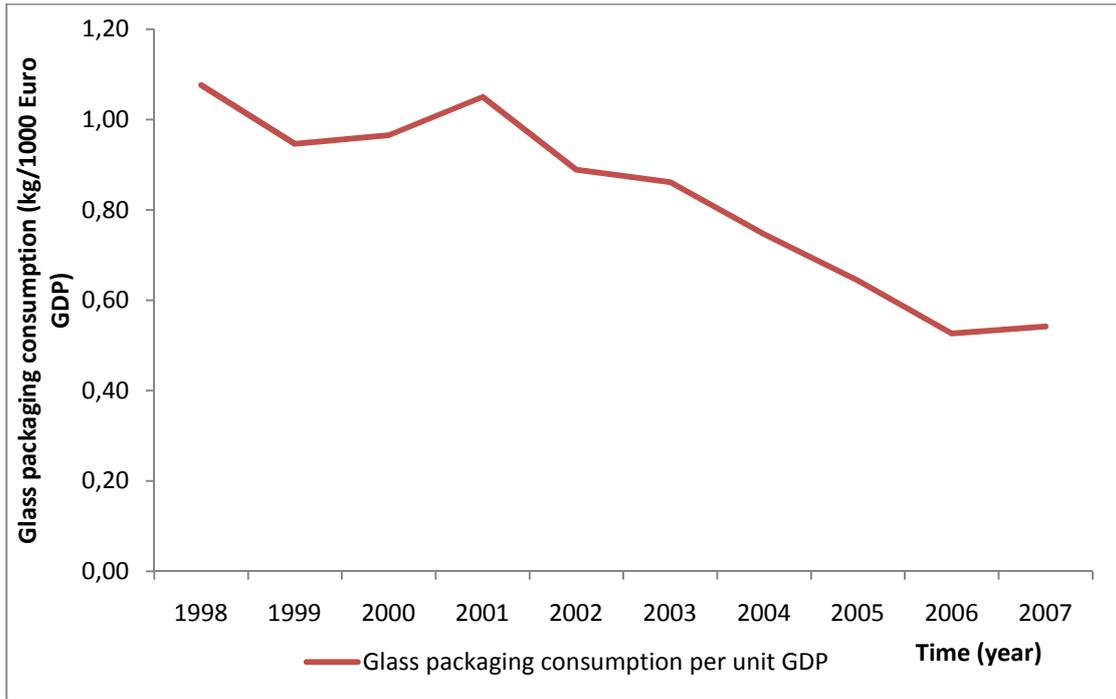


Fig. 17: Glass packaging consumption per unit GDP in Denmark, 1998-2007

Glass is another one of the materials for which Denmark chose to introduce its own –more ambitious- national recycling targets: 65% in 2001 and 80% in 2008 instead of 15% and 60% respectively required by the EU.

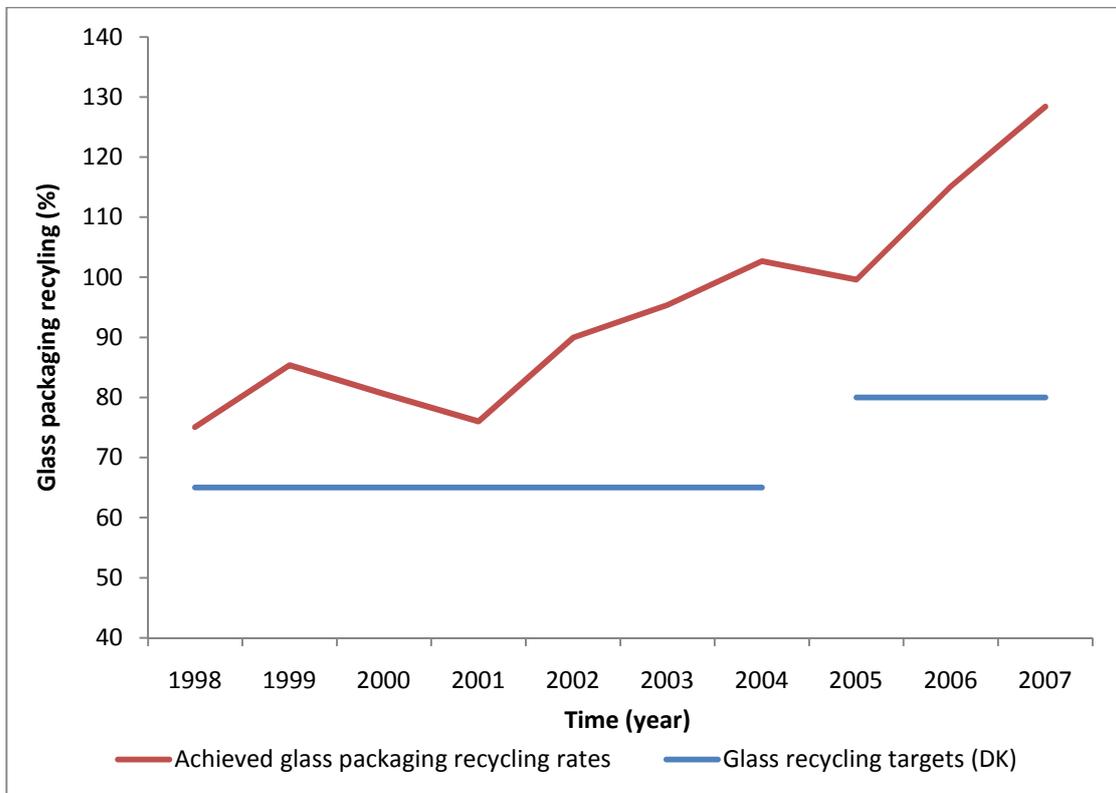


Fig. 18: Glass packaging achieved recycling rates vs. national targets in Denmark, 1998-2007

Fig. 18 depicts the glass packaging recycling rate's development over the specified period. 2002 again stands out as a turning point, marking the start of the rise of the rate by more than fifty percentage points up to 2007. The above 100% recycling rates, which also drive the recovery rate for overall packaging higher than 100%, can be potentially explained by the recycling of end-of-life reusable bottles for beer and beverages that have not been produced in the same year during which they are recycled. Additionally, some statistical uncertainties exist due to private imports of wine and other alcoholic beverages, which are not counted in the amounts marketed but can end up in recycling stations, and, secondarily, due to the fact that glass production statistics involve amounts in terms of units that have to be converted to amounts in terms of mass.

5.2.3.3. Metal

The following section will present the developments regarding the metal packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

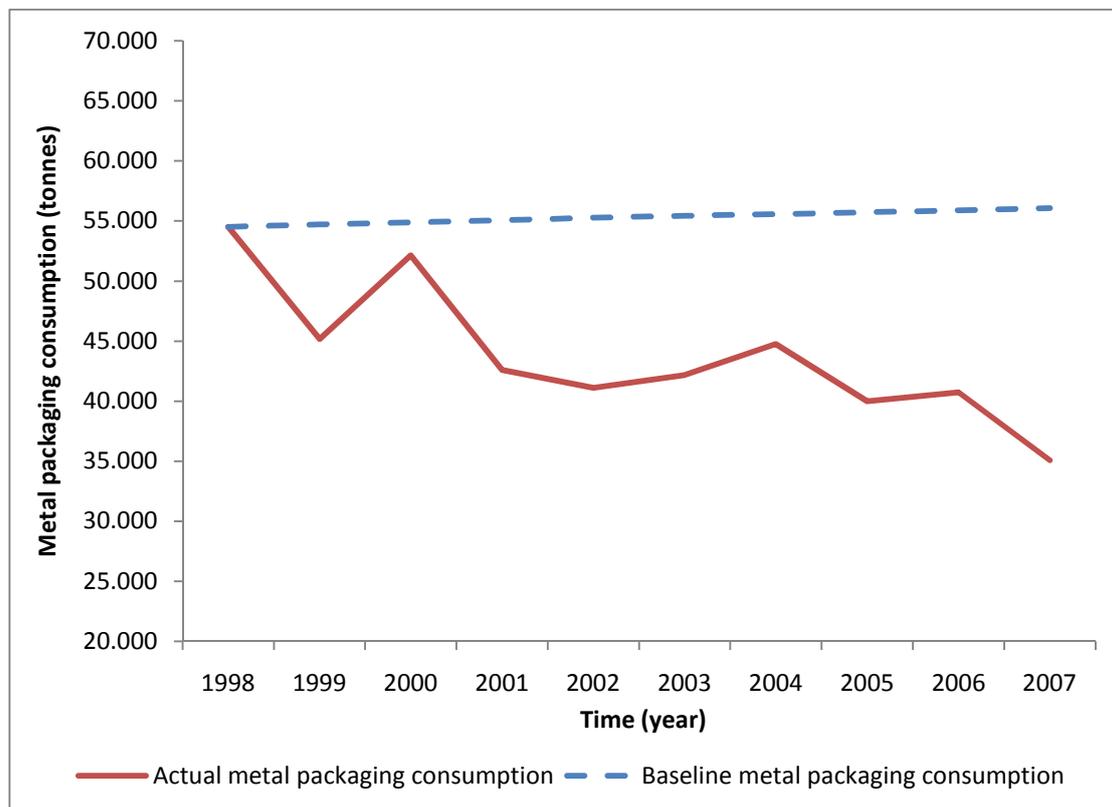


Fig. 19: Actual vs. baseline metal packaging consumption in Denmark, 1998-2007

Denmark managed to significantly reduce the metal packaging consumption during the decade, with the actual amount being about 20 ktonnes lower than the baseline in 2007. Despite the lift of the ban on cans for carbonated beverages in 2001, there was no actual increase in metal packaging consumption at the time. The metal packaging IU development draws the same picture about the situation.

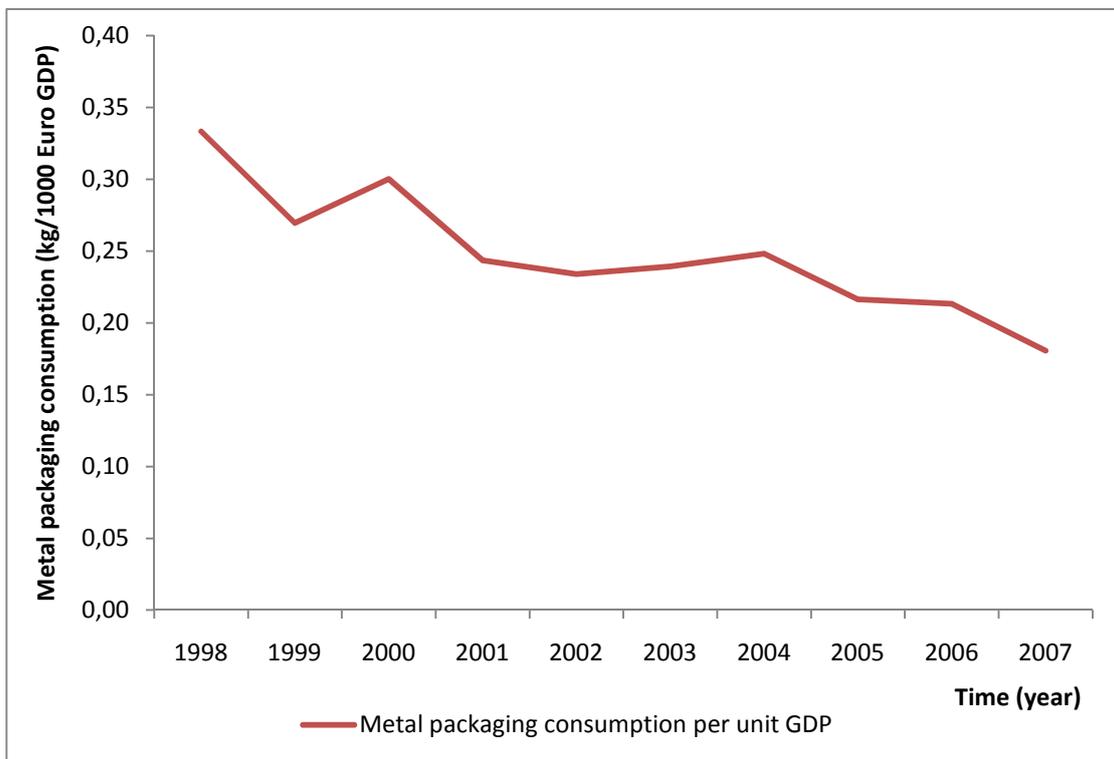
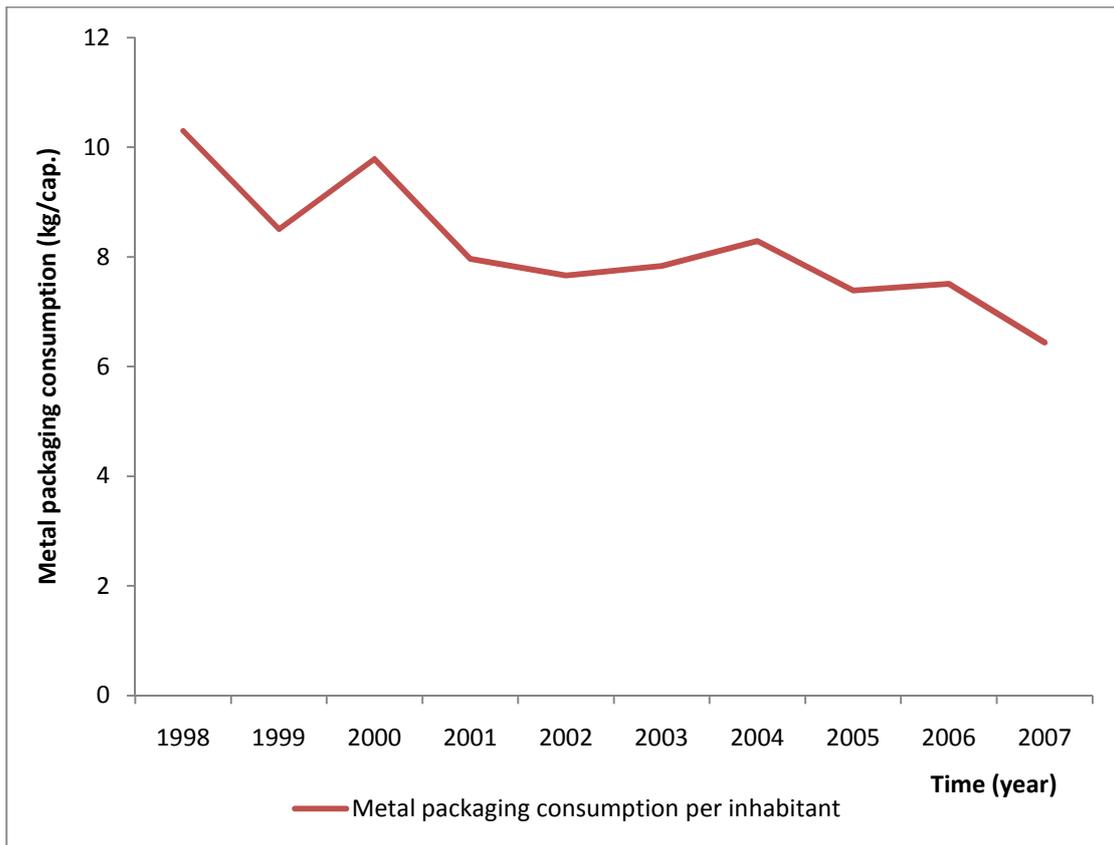


Fig. 20-21: Metal packaging consumption per inhabitant in Denmark, 1998-2007 - Metal packaging consumption per unit GDP in Denmark, 1998-2007

Fig. 22 presents the progress of metal packaging recycling in Denmark from 1998 to 2007. The Danish rate remained practically constant up to 2004, surpassing the

target level by about twenty-five percentage points. A rapid increase of the rate is being observed after that year, leading to a doubling of the metal packaging recycled and to an early and easy attainment of the 2008 target.

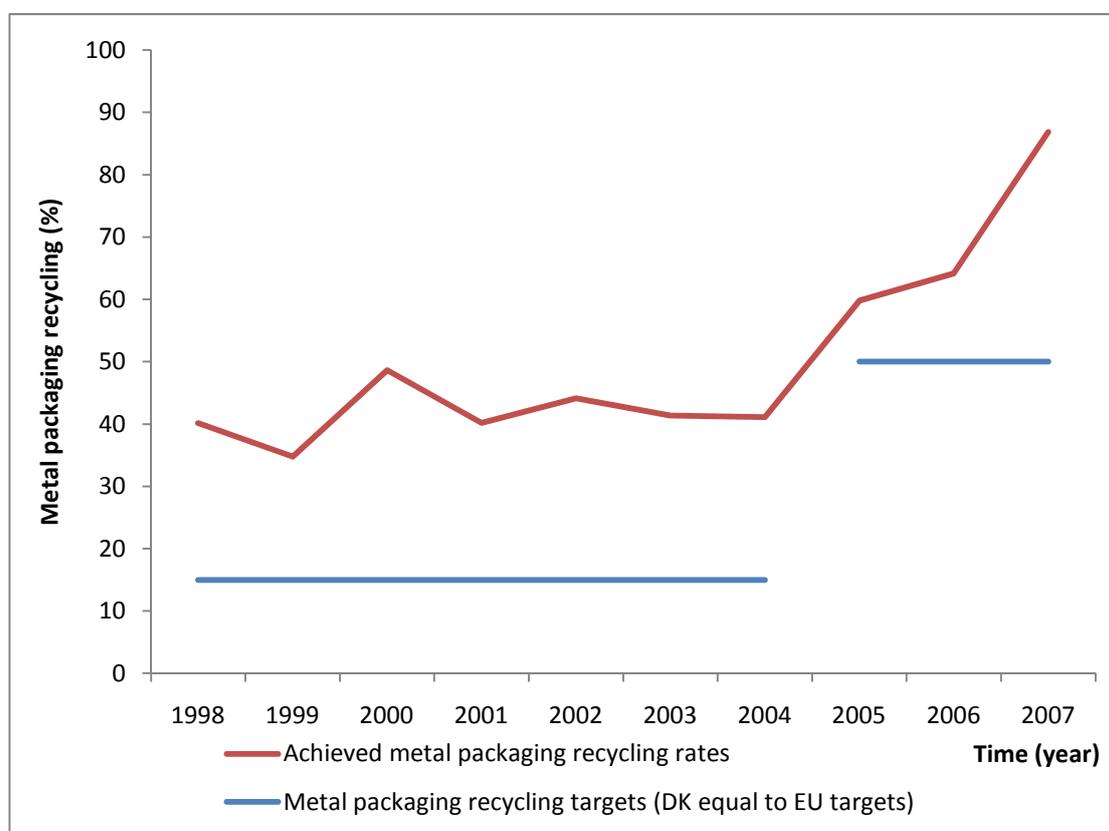


Fig. 22: Metal packaging achieved recycling rates vs. national targets in Denmark, 1998-2007

5.2.3.4. Plastic

The following section will present the developments regarding the plastic packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

The plastic packaging consumption in Denmark became higher than the baseline levels for the first time only after 2004. In fact, the actual levels were reduced below the baseline in 2000 and remained rather stable for the next four years. Even after 2004, the consumption increase appears to have been moderate and signs of stabilization are shown towards the end of the decade; in 2007 the baseline was exceeded by less than 10% (Fig. 23). The material's IU demonstrates a strong decrease between 1999 and 2001, but it had recovered again to its previous levels by 2006 (Fig. 25). The final result for the whole decade is a reduction of about 6%, quite lower than the respective performances of other Nordic countries.

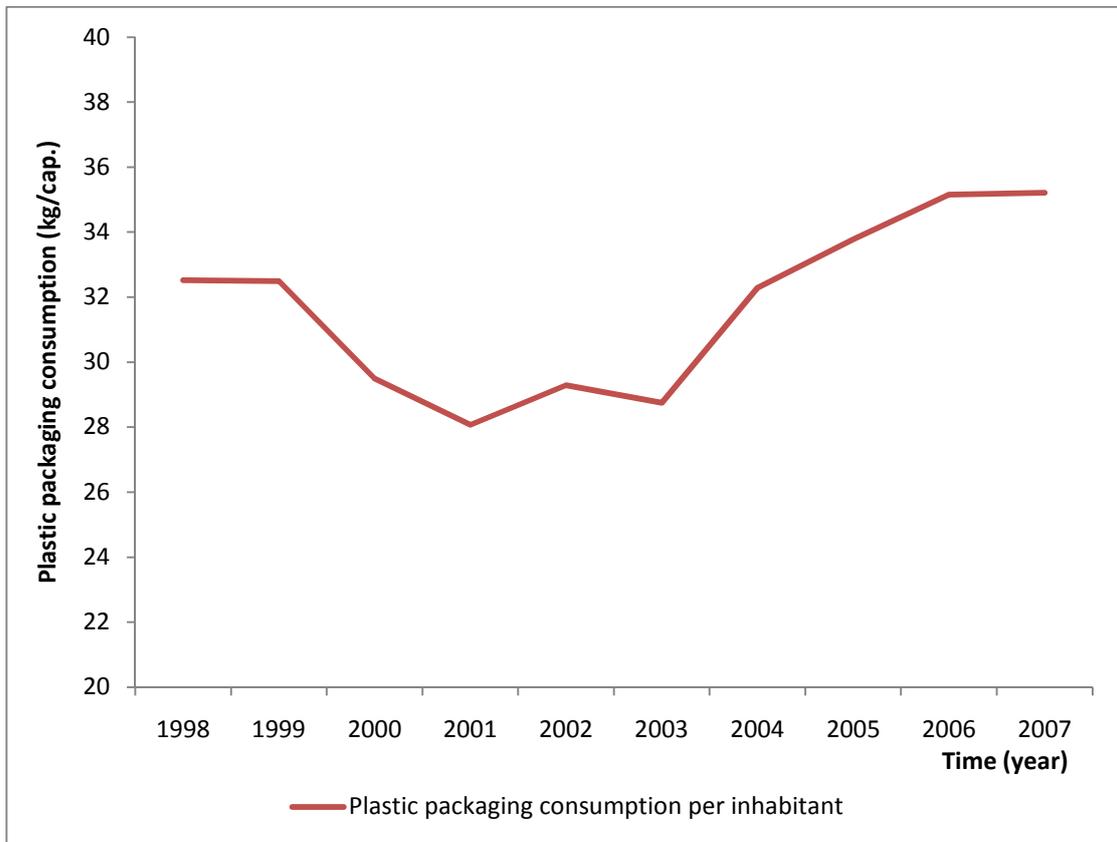
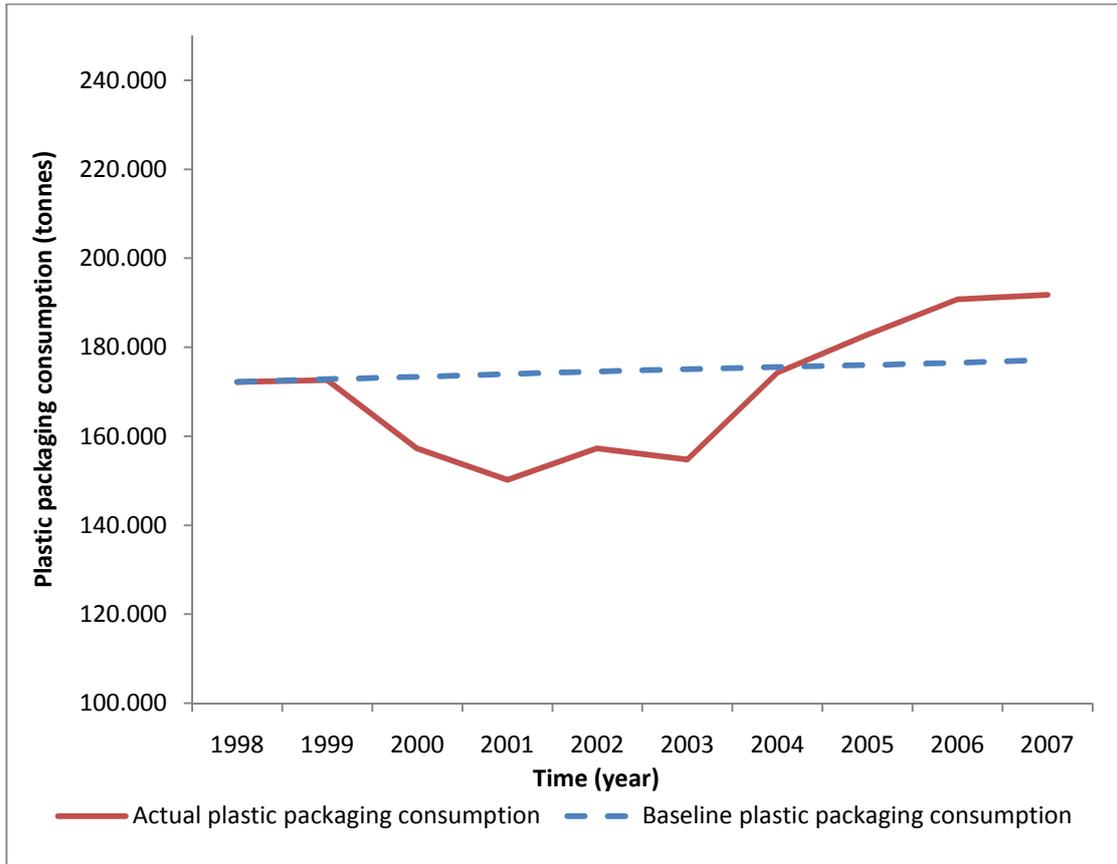


Fig. 23-24: Actual vs. baseline plastic packaging consumption in Denmark, 1998-2007 – Plastic packaging consumption per inhabitant in Denmark, 1998-2007

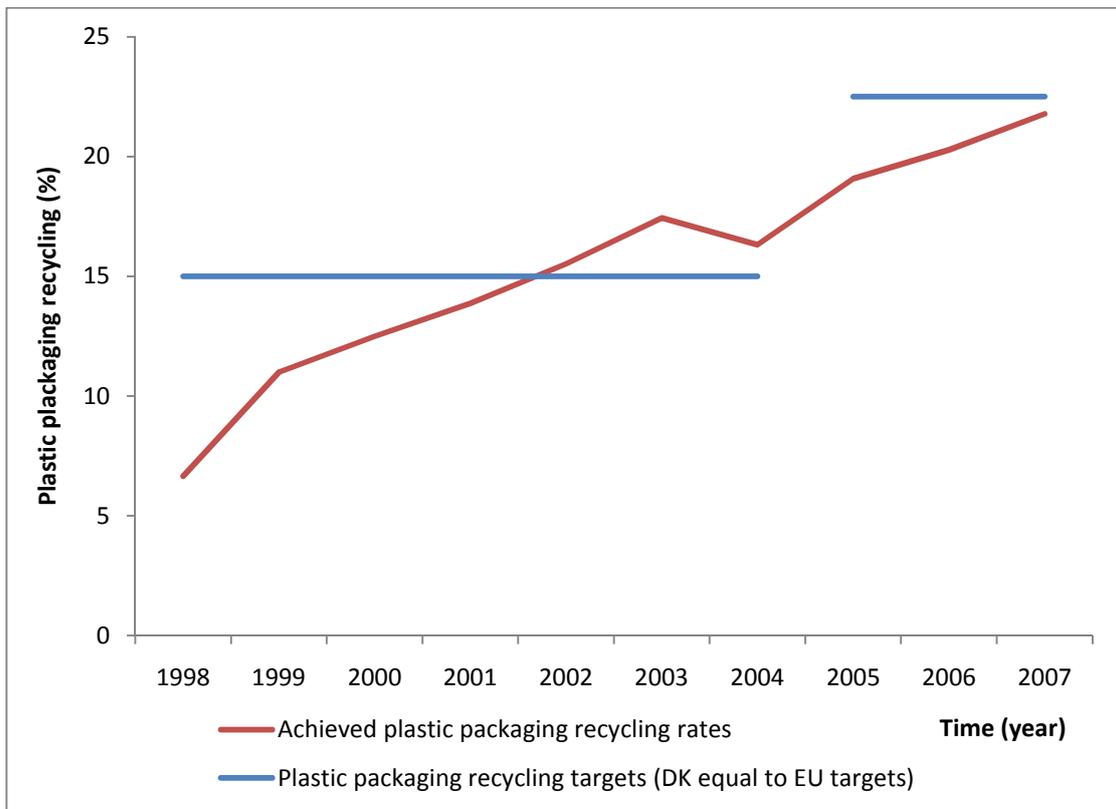
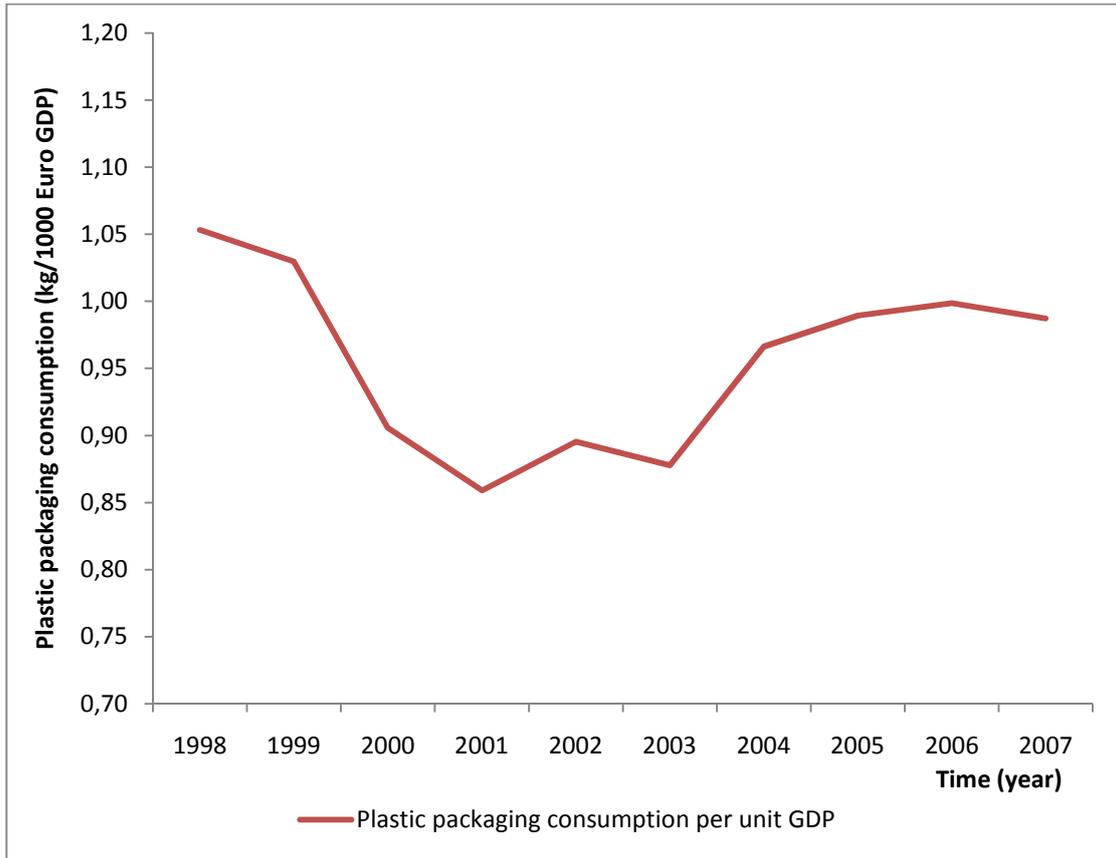


Fig. 25-26: Plastic packaging consumption per unit GDP in Denmark, 1998-2007 - Plastic packaging achieved recycling rates vs. national targets in Denmark, 1998-2007

When considering the development of plastic packaging recycling, a noteworthy observation is that plastic is the only material for which the recycling targets have been consistently higher than the rates achieved at the time of their introduction. Plastic packaging recycling has been constantly on the rise throughout the decade, with its levels having doubled during this period. The 2008 target was not yet attained by the end of 2007, but the difference was smaller than one percentage point.

5.2.4. Discussion

The fact that the overall packaging consumption in Denmark at the end of the decade was below the baseline is a result of the high reductions in glass and metal packaging consumption, which more than compensated for the rises in the other categories (paper & board and plastic). These developments can be attributed to the combined influence of various factors; the packaging taxation system that aims at a reduced material use and the extensive efforts for the promotion of reusability in the beverage containers market (separate taxation and mandatory deposit system) appear to be initiatives towards the right direction. This statement gains in validity when the fact is considered that both the revision of the packaging tax (in order to better reflect the environmental impact of the materials) and the introduction of the new beverage containers deposit scheme took place in 2001-02, corresponding exactly with the beginning of the packaging consumption decrease (Fig. 6).

Considering the overall packaging recycling rates, the pre-Directive measures –the waste tax of 1987 and the 1994 voluntary agreement on transport packaging- appear to have been quite effective judging by the high 1998 recycling rate (Fig. 9). This already good performance, however, in combination with the not very ambitious targets, probably offered little incentive to promote new initiatives aiming at improvements of the situation (e.g. an expansion of packaging recycling schemes covering households). As a result, a less than satisfactory increase of the packaging recycling rate is demonstrated; Denmark recorded the worst overall packaging recycling rate among the Nordic countries in 2007, despite its good position at the beginning of the decade.

On the other hand, the performance of Denmark in the total packaging waste recovery field is excellent; this can be considered a result of the extensive waste-to-energy facilities network –whose existence preceded the introduction of the Directive- and of the 1997 ban on combustible waste landfilling. Moreover, even prior to the introduction of the ban, the waste tax was promoting incineration over final disposal, in a country that much values the recovery of energy from waste.

Proceeding to the examination of each packaging material separately, paper & board packaging is characterized by rising consumption levels, a trend which is underlined by the marginal increase of the IU (Fig. 13) and its progressively larger share in the packaging market. The fact that the packaging taxation scheme attaches the lowest charge to this material could be –at least partially- responsible for this development. One theory that could explain the aforementioned simultaneous

occurrence of stable (or decreasing) paper & board packaging recycling rates and rising total recovery rates can be proposed based on the focus of the Danish policy makers on packaging waste from the industry. A possible rise in the share of sales paper & board packaging relative to transport packaging of the same material would lead to a drop of the overall recycling rate for the material, since sales packaging is largely considered not suitable for recycling and it is not collected separately; increased amounts would be directed towards the waste-to-energy facilities instead in such a scenario. The lack, however, of the detailed data required for the verification of this theory does not allow it to be considered a concrete position.

The systematic and strong efforts to promote reusability in the beverage containers market through the enforcement of separate beverage packaging taxation and the establishment of a mandatory deposit system have been described in detail above; the higher than 40% reduction of the glass packaging per capita consumption indicates that these measures have been successful. The introduction of the revised deposit system can be considered beneficial also in the case of glass packaging recycling. Dansk Retursystem handles, as already stated, recyclable packaging in its machines and the mandatory nature of the scheme ensures that both that and the end-of-life reusable packaging very rarely leave the system and almost always end up recycled. The municipal “bring” systems for households, along with the collection of glass packaging from the retail sector, are also supporting the achievement of the results demonstrated in Fig. 18.

A close to 40% reduction in per capita consumption since 1998 has been recorded also in the case of metal packaging (Fig. 20). This result can be attributed to the financial instruments used by the Danish government: the taxation scheme for beverage containers makes metal cans costly compared to refillable containers, while the packaging tax imposes the highest charge by far on aluminum for other uses and makes also steel and tinsplate quite expensive (Table 13).

The low recycling target up to 2004, which was easily attained, did not seem to provide any incentives for an extra effort to improve the metal packaging recycling rate, leading to a relative stability throughout this period. The rate immediately responded when the target became more ambitious, thus indicating that there was potential for improvement. Therefore, the driving force behind the doubling of the metal packaging recycling rate since 2004 (Fig. 22) appears to have been the introduction of a new goal. One more parameter could have –hypothetically– played a role in this recycling growth: Danish consumers are privately importing about 400 million drinks cans annually from Germany (mainly beer) [PETrecycling CZ, 2008]; if an increased share of these cans began at some point being directed towards the municipal schemes for metal waste collection, the metal packaging recycling rates would be undoubtedly increased. This, however, remains merely a hypothesis in need of additional research if it is to be confirmed. Finally, it has been mentioned in the section discussing material flows that there is a fair share of hypotheses and scaling

up involved in the calculation of the amounts collected and recycled; such methods could be creating some data uncertainties.

The decrease of the plastic packaging consumption to levels below the baseline (Fig. 23) corresponds with the introduction of the new packaging taxation system in 1999. Plastics are both available in large quantities and have a significant impact on the environment; these are the exact characteristics that invoke higher charges as mentioned in the taxation scheme's description. The packaging tax, therefore, shows signs of an effective policy intervention with regard to plastic packaging use, an impact that appears more clearly during the period 1999-2003. The "ambitiousness" of the recycling targets for this material appears to have been quite beneficial and it can be considered as the factor that brought about the recycling doubling between 1998 and 2007. It should be reminded that the primary means for achieving the plastics recycling targets in Denmark is the voluntary agreement covering transport packaging, while it is mandatory for the industry to source-separate plastic transport packaging since 1998 in order to facilitate recycling. The establishment of the mandatory deposit system for beverage containers, along with the reduced charges imposed on secondary plastic packaging materials, have probably also had a positive influence on the recycling rates after 2002.

Fig. 27 demonstrates the development of the share of each packaging material in the overall packaging consumption between 1998 and 2007.

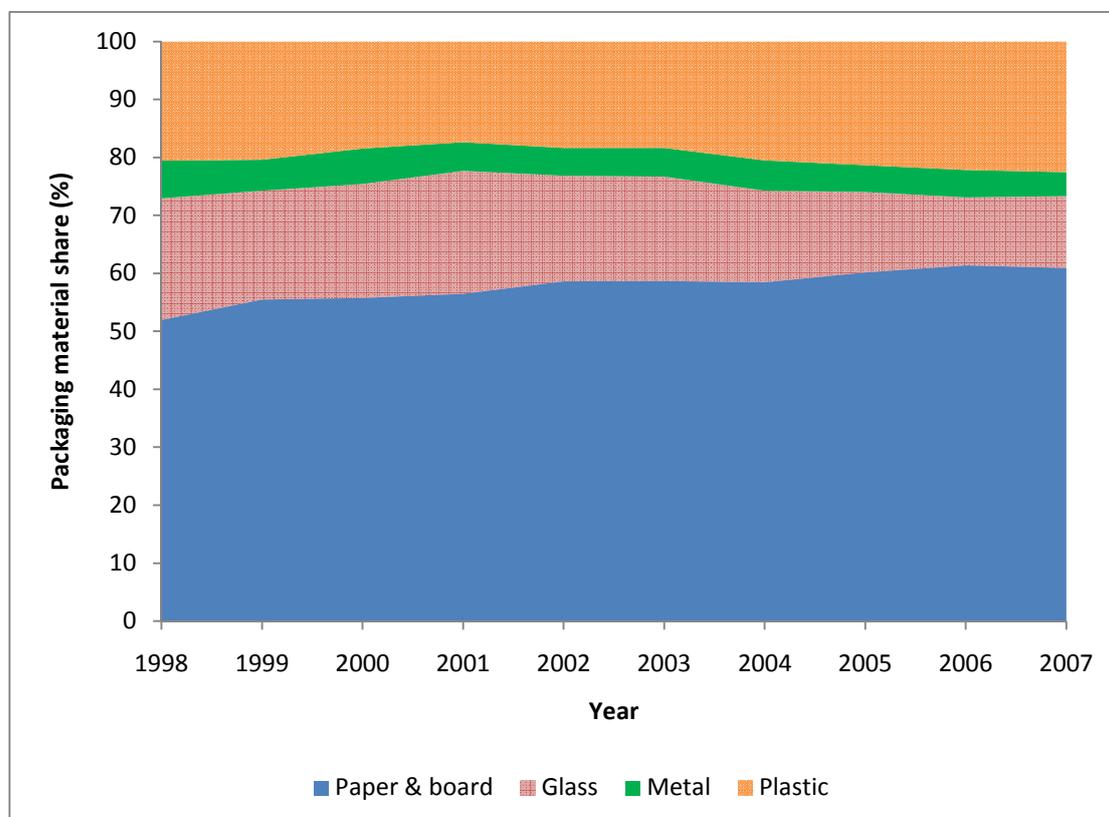


Fig. 27: The development of the share of each packaging material in the overall packaging per capita consumption in Denmark, 1998-2007

It can be seen that the share of paper & board is on the rise throughout the decade, while a -smaller- increase of the plastic packaging's share is also observed; glass packaging is, on the other hand, significantly reduced, while the change in metal packaging is not substantial. A substitution of glass with paper & board and plastic can be said that is taking place during the period at hand; its role in the development of the Danish packaging consumption and the possible effect of the packaging taxation scheme to its realization require further investigation, preferably in a project focused entirely on the case of Denmark. Considering both the consumption levels and the intensity of use for each material as presented above, it is observed that a very weak materialization process took place for paper & board between 1998 and 2007, accompanied by strong dematerialization in the cases of metal and glass and weak dematerialization in the case of plastic.

5.3. Concluding remarks

Packaging policies in Denmark bear two distinctive characteristics: i) packaging management is a part of the general waste management system, and ii) the state reserves the main role within the system. A key aspect of the effort towards complying with the prescriptions of the Packaging Directive is the focus on transport packaging, the cornerstone of which is considered to be the voluntary agreement with the industry. Schemes covering sales packaging do exist (e.g. municipal "bring" systems) but their role is largely secondary, since they are also covering other types of waste. An exception to this is the highly organized deposit system for beverage containers, which handles both reusable and one-way packaging.

Apart from the voluntary agreement on transport packaging, economic instruments are mostly preferred, with various taxation schemes currently in effect. Administrative instruments are represented by the landfilling ban imposed on combustible waste, while a small number of informative instruments are added in the policy mix.

Regarding the focus of the most prominent policy measures on the various stages of the packaging chain, it can be said that its entire length is covered:

- the packaging taxation aspires to bring about waste minimization through improved packaging design (packaging making),
- the beverage containers tax -combined with the deposit system- is focusing on the promotion of reusability (packaging making and consumption), with the deposit system promoting also increased recycling rates (waste collection),
- the voluntary agreement aims at increased recycling (waste collection), and finally,
- the landfilling ban and the waste tax are measures towards the elimination of the final disposal (waste management).

Concerning the goals attainment, Denmark has been successful in most occasions, both in terms of the EU targets and of the higher national ones that replace the former in some cases. The only exception has been plastic packaging recycling in 2001

(13.9% instead of 15%), while for the same material the 2008 target was not yet attained in 2007 (although the gap was very narrow). Furthermore, paper & board recycling was barely above the target in 2007. It should be noted that in most cases the targets set were lower than the results achieved by Denmark when they came in effect. The only exception –plastic packaging- provided indications that ambitious goals have in fact a positive effect and can lead to constant improvements.

The high overall packaging consumption in Denmark is considered to be partly caused by factors that are not expected to change in the near future, such as the structure and activities of the industry. The reduction in per capita consumption, however, attributed partly to the packaging taxation schemes, is a very important development that makes a more in-depth examination of the Danish case necessary. Such an examination should also focus on the relevance of the material substitution observed and its influence on the results achieved.

6. Policy evaluation: Finland

The first part of the chapter will offer an overview of the Finnish policy background and will describe all aspects of packaging use and packaging waste management in the country. The second part focuses on the results achieved by Finland and the developments regarding packaging consumption, intensity of use, recycling and total recovery; the results will be compared with the targets set and, wherever possible, the effect of specific policies upon them will be defined.

6.1. Policy background

1993	Introduction of producer responsibility scheme for packaging
1994	Taxation scheme for beverage containers
1996	Landfilling waste tax – Introduction of deposit system for beverage containers

Table 15: Policy measures currently in effect in Finland (non packaging-specific measures that are relevant for packaging waste management are also included)

6.1.1. Packaging waste management

The defining characteristic of packaging waste management in Finland is the full application of the EPR principle; the state has transferred the responsibility for the recovery of packaging materials to the business sector and limits itself in a regulatory and supervising role. The outline of this system was described in the Waste Act of 1993. Its provisions included the following:

- packaging producers must have as little recourse to virgin materials as possible and seek to replace them with secondary raw materials,
- producers and importers must ensure that their products are durable, repairable, reusable or recyclable and as free of toxicity for the environment as possible when they become waste,
- waste producers have to organize the collection of waste and waste holders have to participate in the recovery and elimination of waste [Simon, 2000].

It should be mentioned that packaging waste is not the only field covered by the EPR principle, since similar schemes exist also for electronic and electrical appliances, batteries and accumulators, tires from motor vehicles, cars and paper products (newspapers, magazines, copy paper, etc.).

After having noticed the multitude of tasks of the Danish local authorities, the responsibilities of their Finnish counterparts appear to be minimal; municipalities can designate collection sites for waste delivery, they are responsible for the collection of household packaging waste and they must handle waste in their possession in ways that enable meeting with the government targets on packaging waste recovery [EDG, 2001].

The major aspect of the business sector's involvement is the obligation of producers and importers to prevent the generation of packaging waste and to see to

the reuse and recovery of packaging and packaging waste, carrying the costs in proportion with the amount and types of packaging they place on the market. Businesses have the option of either joining a compliance scheme or arranging individual take-back and recovery operations. Additionally, the Council of State decisions 962/1997 and 1025/2000 state that packers or economic operators with an annual turnover above a specified threshold shall annually provide SYKE (Suomen Ympäristökeskus, the Finnish Environment Institute) with packaging data regarding the previous year [Kaysen & Jakobsen, 2003]. Finally, the companies involved in municipal or contractual waste transport schemes that recover more than a specified amount of packaging waste annually, must state the amount and type of waste recovered.

The main actor in the Finnish packaging policy field is PYR (Pakkausalan Ympäristörekisteri, the Environmental Register of Packaging). Established in 1995, it is owned by representatives of the business and packaging sectors and helps individual firms, which sign a contract with it, to transfer their responsibilities for the recovery of packaging materials to relevant producer responsibility organizations, since the firms seldom seek to undertake these responsibilities without help. PYR takes care of administrative procedures: it establishes contacts with the packers and importers of packed products on behalf of the PROs, runs a register on companies that put packed products on the Finnish market -including those that import/export packed products-, charges membership and recovery fees, collects data from packers/fillers, prepares statistics, disseminates information and submits data on packaging to the authorities on behalf of its members [Kaysen & Jakobsen, 2003]. As mentioned above, packers and importers of packed products with taxable sales or products' value exceeding a specified annual threshold are required by law to submit their annual packaging statistics to SYKE but they can be relieved of this obligation by registering with PYR, which takes care of data collection with the use of questionnaires sent to the firms. PYR's data collection covers more than 95% of the packaging market in terms of total turnover and more than 90% in terms of packaging weight.

There are nine PROs currently established in Finland:

- Suomen Aaltopahviiyhdistys (corrugated cardboard packaging)
- Suomen Teollisuuskuitu (industrial fibers)
- Suomen Kuluttajakuitu (carton packaging)
- Suomen NP-kierrätys (liquids carton packaging)
- Suomen Uusiomuovi (plastic packaging)
- Suomen Keräyslasiyhdistys (glass packaging)
- Mepak-Kierrätys (metal packaging)
- Suomen Palautuspakkaus (beverage packaging with a deposit)
- Puupakkausten Kierrätys (wooden packaging).

These organizations are established in order to meet the requirements of the law and ensure that packaging will be recovered in accordance with the targets set by the government for their respective materials. They are non-profit companies with founders and shareholders from the entire packaging chain (from packaging raw materials' manufacturers to recovery firms) and they are coordinated by PYR. It is worth mentioning that Suomen Palautuspakkaus (PALPA) is not the only company responsible for the deposit system but rather the coordinating actor in this field; it is by itself responsible for non-refillable aluminum and plastic beverage containers and simultaneously cooperates with three more companies: Ekopulloyhdistys (refillable beer and soft drinks bottles), A-Pullo (refillable glass bottles for alcoholic beverages) and Alko (non-refillable glass bottles), which is also the state-owned retail monopoly for alcoholic beverages [PETrecycling CZ, 2008b].

PTR (Pakkaustutkimus, the Association of Packaging Technology and Research) is active in the field of data collection; it gathers information from producers of packaging and importers/exporters of empty packaging, data on the recovery of packaging from the producers' organizations and data from waste collectors and recycling/recovery facilities [Kaysen & Jakobsen, 2003]. Also a non-profit organization, it coordinates packaging research in Finland –holding an independent advisor status- with its members being private companies, packaging affiliated associations and research institutes; its income is derived from membership fees and research contracts [Simon, 2000]. Another relevant entity is SPY (Suomen Pakkausyhdistys, the Finnish Packaging Association), which studies technological and financial trends in the industry, relevant legislation and general attitudes and passes this information on to its members. One of its primary roles is communication, achieved through the publication of a trade journal and the organizing of major events concerning packaging [Simon, 2000].

Finally, SYKE deals in two areas: the regulation of the packaging ordinance and data collection and processing. Its information sources are PYR, the individual firms that are under the obligation to report their packaging data but do not participate in PYR, the municipalities and the waste transporters who recover packaging waste in quantities greater than a specified amount. SYKE compiles all received data, prepares the official statistics and submits them to the EU.

Packaging waste management financing

The packaging waste management system is financed by the membership and annual fees charged by PYR to its members. Recovery fees are collected from packers and importers of packed products.

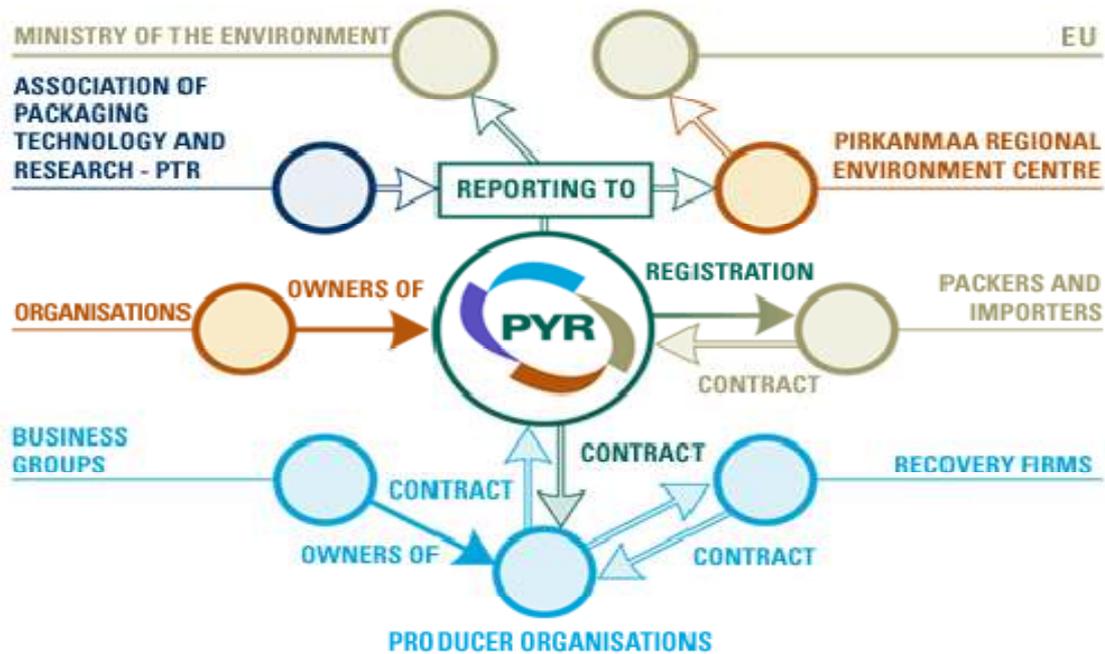


Fig. 28: The Finnish packaging waste management system [PYR, 2009]

6.1.1.1 Policy measures implemented

The pre-Directive era

There were policies implemented in Finland on the packaging and packaging waste field already before the introduction of the Packaging Directive. Recycling initiatives covering paper and cardboard have existed for a long time, while reuse systems for beverage containers were introduced in the 1970s. Finnish breweries had introduced reusable packaging for alcoholic beverages as early as 1916.

The current situation

The most prominent instrument in the current Finnish packaging policy mix is the allocation of the responsibility for packaging recovery to the producers through the mechanism described above. However, there is also another important policy implemented in Finland: the tax on beverage containers (introduced in 1994), which is combined with a mandatory deposit scheme (operational since 1996). The system covers carbonated soft drinks, alcoholic beverages, bottled water and certain other drinks packages and aims at the promotion of reuse. In order to accomplish this, the system distinguishes between three packaging categories: reusable packaging (tax exemption), and two categories of one-way packaging (included in a recycling scheme or not). A set of requirements has to be met in order for a product to gain the tax reduction or exemption [Golding, 1999]. Generally, refilling is comparatively advantageous in Finland for two reasons: the first is that the national capacity for glass recycling is limited, there is an unstable recovered glass market, while no facilities for the conversion of recovered PET and other plastics into feedstock exist;

the second reason is the low population density of Finland and the relatively low packaging consumption, which do not justify the investments needed for the establishment of recycling systems whose success generally depends greatly on achieving economies of scale through the collection of sufficient amounts of waste [Platt & Rowe, 2002]. As a result, refillable packaging units for beer, soft drinks and water constituted 87% of the market in 1995 and 84% in 1999; the only one-way packaging available is cans that participate in the deposit system with a 95% return rate [ECOLAS-PIRA, 2005].

The taxation system described above is the one applied during the period examined for the purposes of this project. It should be noted, although not of importance for this research, that since 1/1/2008 the system was restructured. The tax on recyclable one-way packaging was abolished and two new taxation categories replaced the old ones: packaging participating in the deposit system and packaging that does not. The motive behind this change was ensuring an open competition and free entry in the market by leveling the playing field for returnable one-way and refillable beverage packaging [Scandinavian Brewers' Review, 2008]. This initiative was accompanied by the expansion of the returnable bottles range through the inclusion of recyclable plastic bottles in the deposit system.

A national tax on the landfilling of waste in municipal landfills was imposed in 1996, covering waste left at public landfill sites. It has been aimed at encouraging the spread of alternative waste disposal options and its effectiveness assessment by the Ministry of the Environment in 2005 indicated that it has helped reduce the amount of waste ending up in public landfills despite the increased consumption.

It should be noted that, similar to the case of Denmark, the Finnish policy makers are primarily focused on the packaging waste from trade, the industry and various institutions. The owner of the waste is responsible for the collection and transportation to a recycling or recovery facility and, in practice, there is an agreement in place with a private collector or a public waste treatment plant, according to which the owner of the waste pays for the collection; the producers' organizations are responsible only for the recycling or recovery of the packaging waste and not for their collection [Kaysen & Jakobsen, 2003]. Apart from the aforementioned provisions for beverage packaging, the only other measure aiming at sales packaging is the establishment of municipal systems for the collection of glass containers that are not returned through the deposit system.

6.2. Achieved results and analysis

The developments in Finland with regard to packaging consumption, intensity of use, recycling and total recovery will be presented and discussed in the following paragraphs.

Finland has introduced in some cases its own national targets for packaging waste recycling and total recovery, which range from slightly to significantly more

ambitious than those prescribed by the EU Packaging Directive; additionally, quantitative targets have been introduced for packaging waste minimization and for the total recovery of some individual materials, although these are not required by the Commission. The Finnish national targets for packaging waste are presented in the following table.

	<i>Recycling in 2001 (%)</i>	<i>Total recovery in 2001 (%)</i>	<i>Recycling in 2008 (%)</i>	<i>Total recovery in 2008 (%)</i>
Paper & board	53	75	60	75
Glass	48	-	60	-
Metal	25	-	50	-
Plastic	15	45	22.5	-
Overall packaging waste	42	61	55	61
Packaging waste minimization	At least 6% reduction of packaging weight relative to the volume of packed products consumed in Finland compared to 1995		5% reduction of packaging waste in relation to the GDP compared to 2001	

Table 16: Finnish national targets for packaging waste

6.2.1. Overall packaging consumption

The following section presents the development of the overall packaging consumption in absolute and per capita terms between the years 1998 and 2007, along with the overall packaging intensity of use during the same period.

As it was already mentioned in Chapter 4, Finland is the only country in the group that demonstrated an overall packaging consumption below 100 kg/cap. annually. This can be attributed to the influence of two factors. The first is the non-inclusion of wooden packaging in the statistics; its use is very widespread in Finland, and, if considered, it would raise the 2007 consumption from about 91 kg/cap. to about 132 kg/cap. (+45%). In order to stress its importance, it should be noted that wooden packaging inclusion in the case of Denmark would result to a rise from 156 kg/cap. to only 176 kg/cap. annually (+13%). The second factor is the extensive reuse of packaging (73% in 2007, according to PYR), which allows Finland to use vast amounts of packaging, while maintaining at the same time a comparably minimal rate of packaging waste generation.

Looking into the development of packaging consumption within this decade, it is obvious that Finland was unable not only to minimize the generation of packaging waste, but even to keep it relatively stable. In 2007, the absolute packaging consumption was more than 45 ktonnes above the baseline level (Fig. 29) and the per capita consumption had increased by more than 10% compared to 1998 (Fig. 30). It is interesting that these developments came about despite the introduction of packaging minimization targets in both policy periods. It was not possible to verify the attainment of the goal for 2001, but the result required for 2008 was already achieved

in 2007; packaging waste in relation to the GDP was reduced by 12.2% compared to 2001 as opposed to a 5% target. The per capita packaging consumption, on the other hand, increased by about 3.2% during the same period (2001-07). Finally, it is noteworthy that the packaging consumption rise was actually moderated by the simultaneous increase of the reuse rate by seven percentage points between 1998 and 2007 [PYR, 2010].

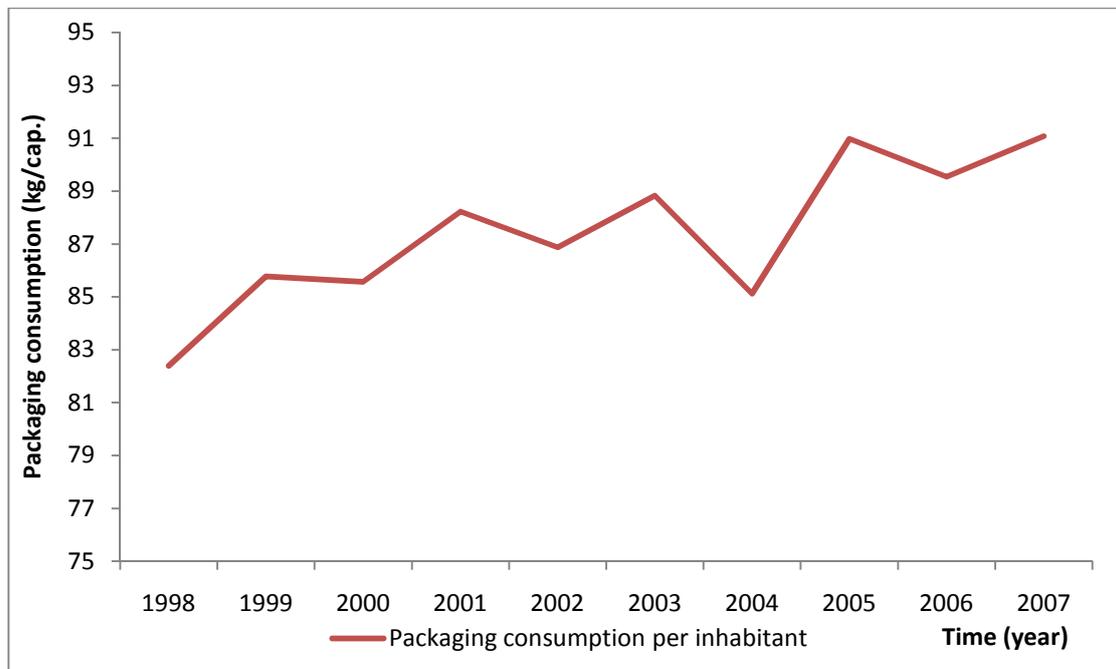
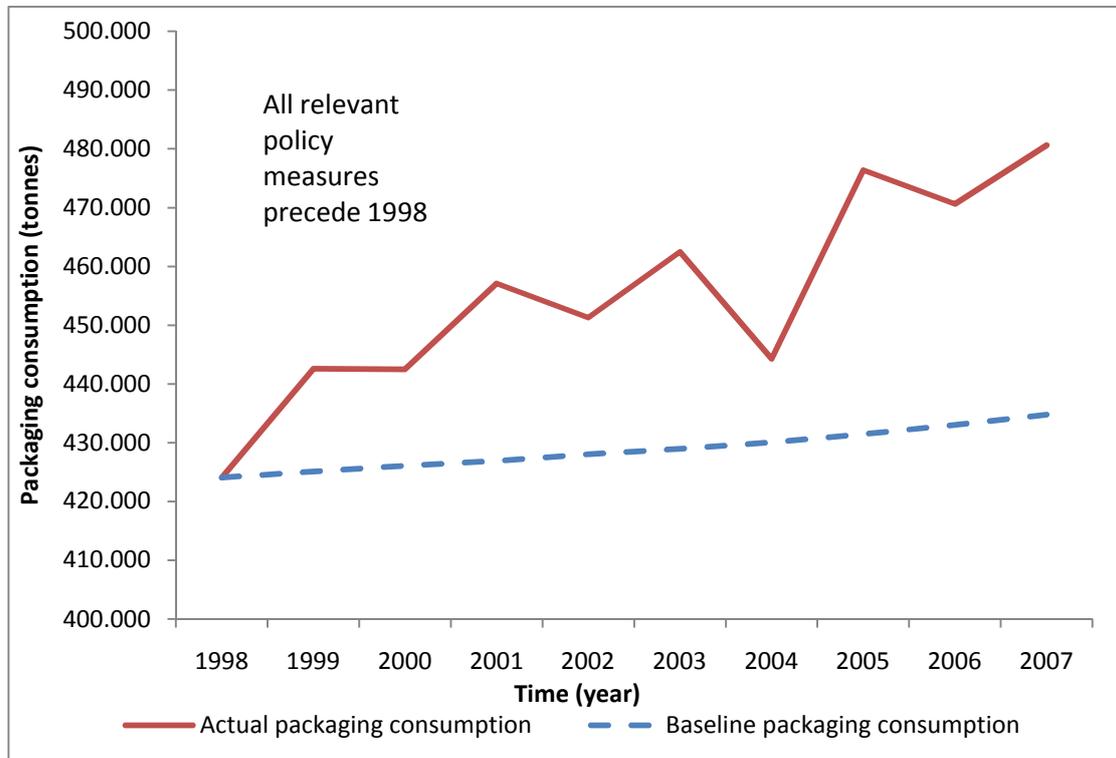


Fig. 29-30: Actual vs. baseline packaging consumption in Finland, 1998-2007 - Packaging consumption per inhabitant in Finland, 1998-2007

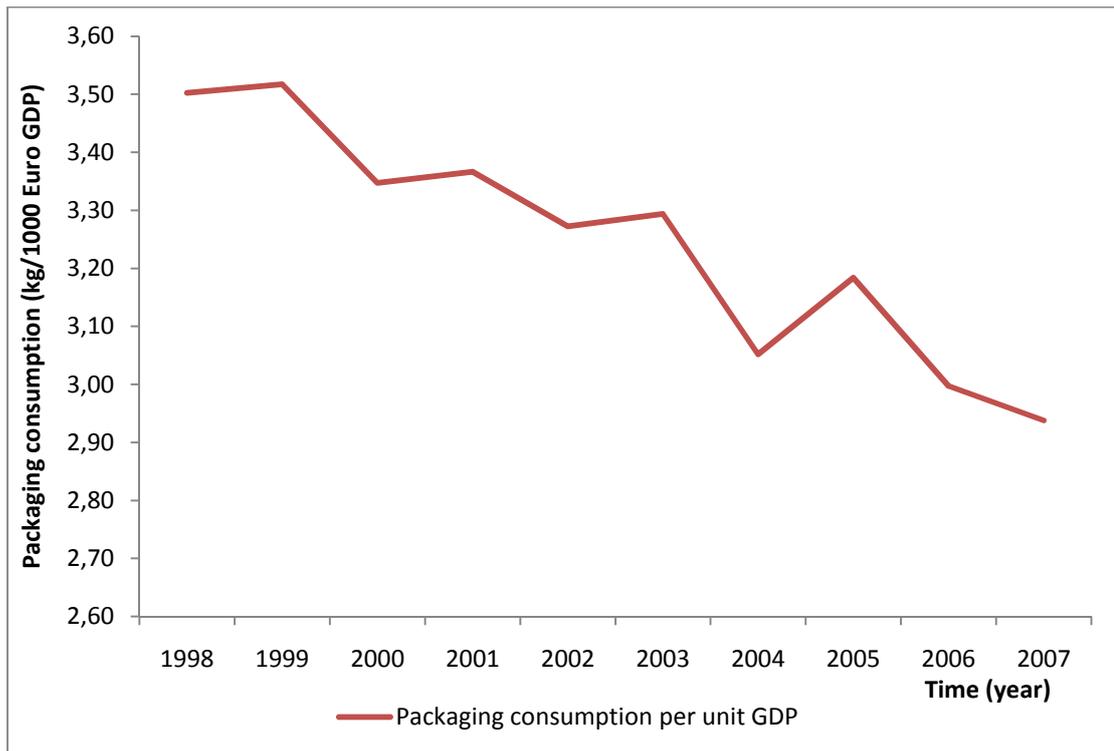


Fig. 31: Packaging consumption per unit GDP in Finland, 1998-2007

The situation described above seems to be completely reversed when the overall packaging intensity of use development is considered (Fig. 31). Finland has reduced its packaging IU by 16% between 1998 and 2007, claiming the second best result among the group members. Although the packaging intensity of use is expected to decline in all developed economies, as is the Finnish, some factors that led to more significant reductions appear to exist in Finland. The transfer of manufacturing activities abroad and the rise of sectors such as electronics and R&D would belong in this category. Shipbuilding and high value-added metal processing are also important aspects of the Finnish economy with a low packaging intensity, while the rise of biotechnology is one more step in the same direction.

6.2.2. Overall packaging recycling and total recovery

The following section will illustrate the development of the recycling and total recovery rates achieved by Finland against the targets set during the 1998-2007 period.

The recycling target for the first milestone year (2001) had been already attained in 1998 and the period that followed up to that year can be characterized as one of stability (Fig. 32). Since 2001, however, the overall packaging recycling rate rose by more than twenty percentage points. This increase resulted in Finland occupying the second place in this field among the group members, which is a considerable accomplishment when the fact that its performance was the worst in 2001 is taken into account.

It was chosen to include a depiction of the recycling rate's development when the wooden packaging data are included (after 2003, when they became available) in Fig. 32. Although wooden packaging is not a part of this analysis, the effect it has on the Finnish results cannot be, as already mentioned, disregarded. Therefore, it is not surprising that the inclusion of wood changes drastically the situation in this case also; the courses of the two recycling rates (with and without wood) are parallel after 2003, indicating that wooden packaging was also increasingly recycled, but the difference between the rates in 2007 amounted to more than eighteen percentage points and it is enough to prevent Finland from attaining the 2008 recycling target already at that point.

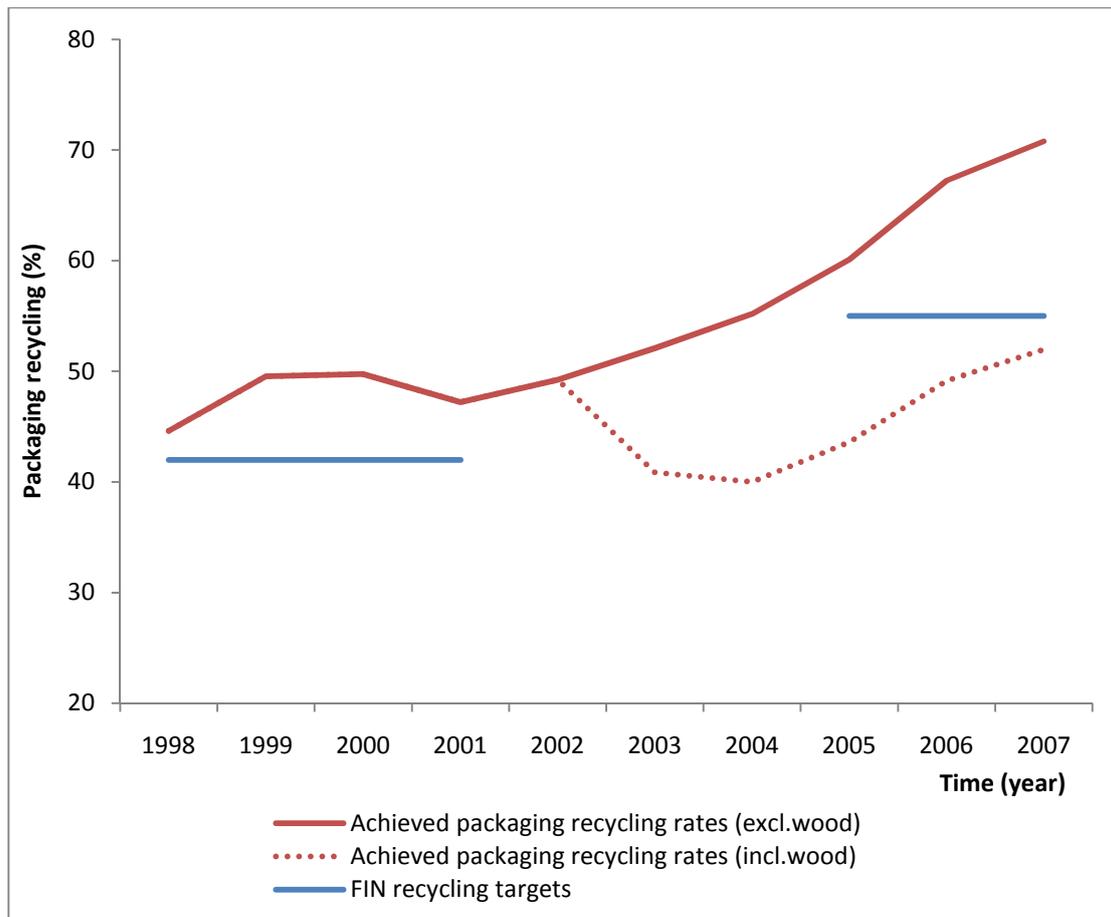


Fig. 32: FIN packaging recycling targets vs. achieved packaging recycling rates in Finland, 1998-2007

The total recovery target for overall packaging remained the same throughout the decade, despite having been attained already in 2001. From that year on and up to 2005 an only limited increase of about three percentage points was recorded, but the last two years of the decade saw an additional rise of more than fifteen points. It should be noted that wooden packaging inclusion in the case of total recovery has the exactly opposite effect of that depicted with regard to recycling; the recovery rates are consistently higher when wood is included, although not by much (from five and a half points in 2003 to a little less than three percentage points in 2007).

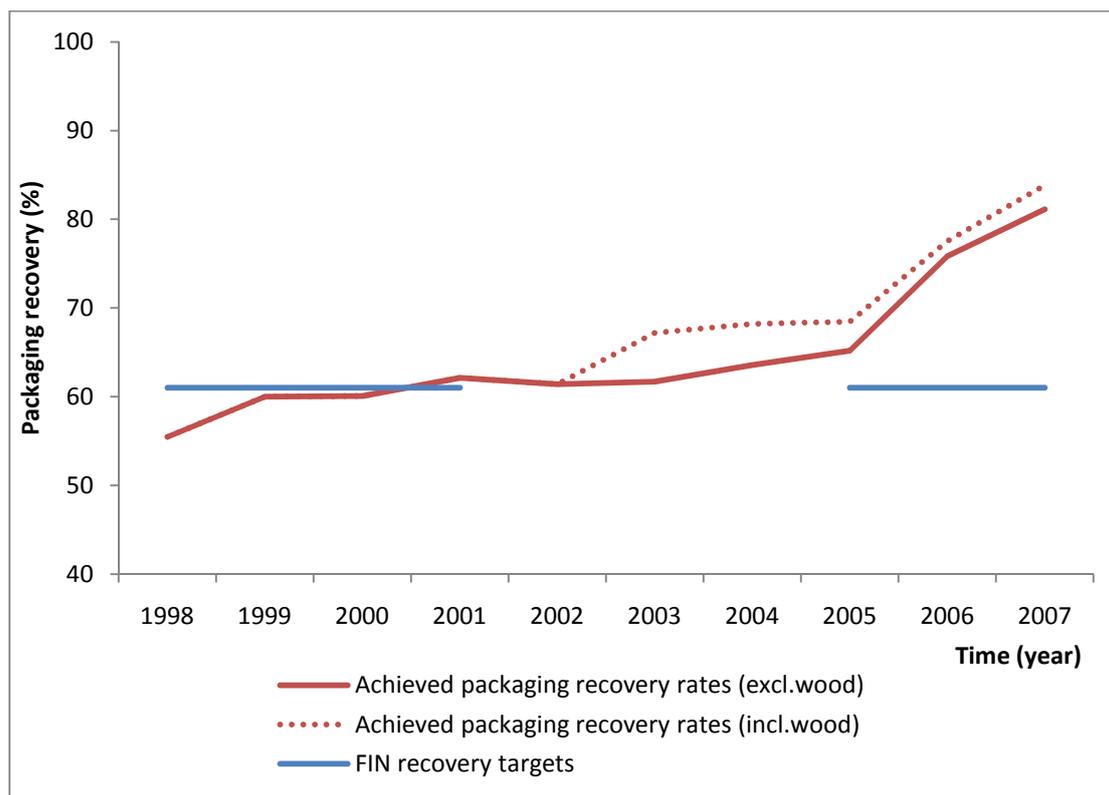


Fig. 33: FIN packaging recovery targets vs. achieved packaging recovery rates in Finland, 1998-2007

6.2.3. Consumption, recycling and total recovery per material

6.2.3.1. Paper & board

The following section will demonstrate the developments regarding the paper & board packaging consumption (absolute and per capita), intensity of use, recycling and total recovery against the targets set during the period 1998-2007.

The paper & board consumption decline in 2004 (about 25 ktonnes, Fig. 34) is singlehandedly responsible for the overall packaging consumption drop during the same year (about 18 ktonnes, Fig. 29). There is no clear indication of the cause of this fluctuation and no policy developments during that period able to justify it. What is, however, beyond any doubt, is that the paper & board packaging consumption remained above the baseline for almost the whole decade, with the only exceptions being 2004 and 2005, and that it demonstrated a pattern of overall increase. The actual paper & board packaging consumption in 2007 exceeded the baseline by about 13 ktonnes, having increased by almost 8% since 1998. A similar picture is drawn by Fig. 35, which accentuates the fluctuations during the decade and the moderate overall increase in per capita consumption (about 5%). Finally, the trend for the paper & board packaging IU, as demonstrated in Fig. 36, is that of a gradual and almost uninterrupted decline, which results in the 2007 IU being about 20% lower than that of 1998.

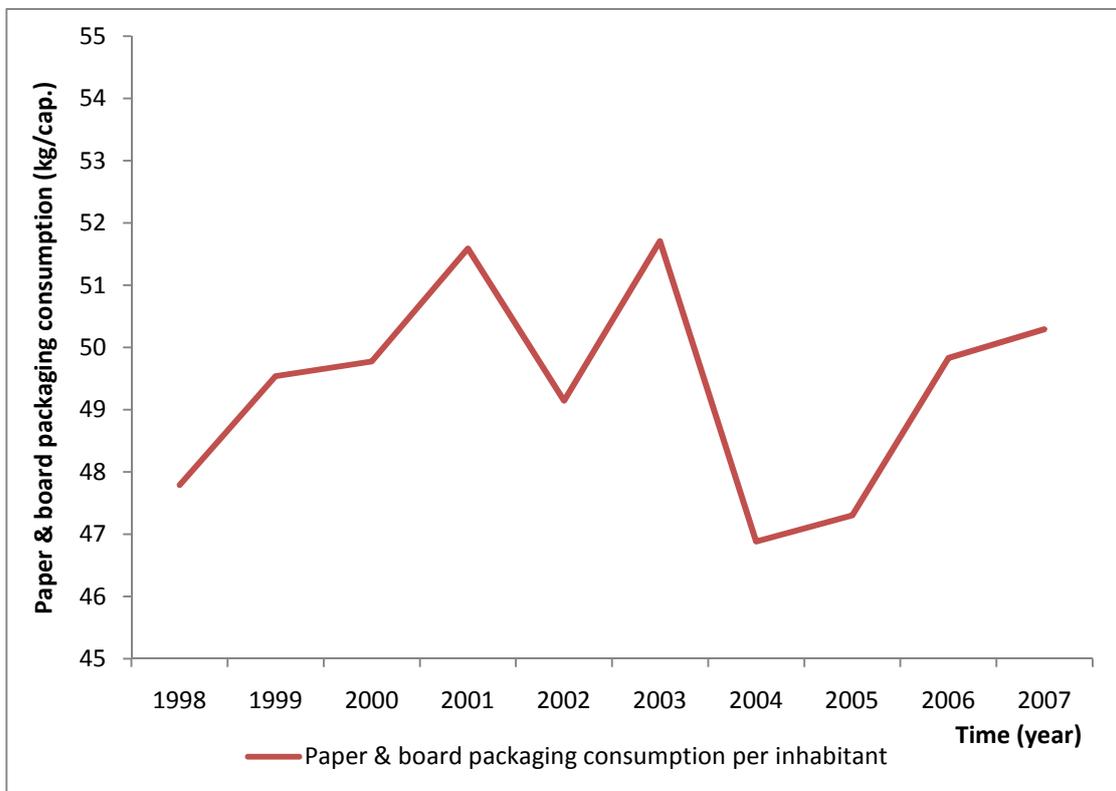
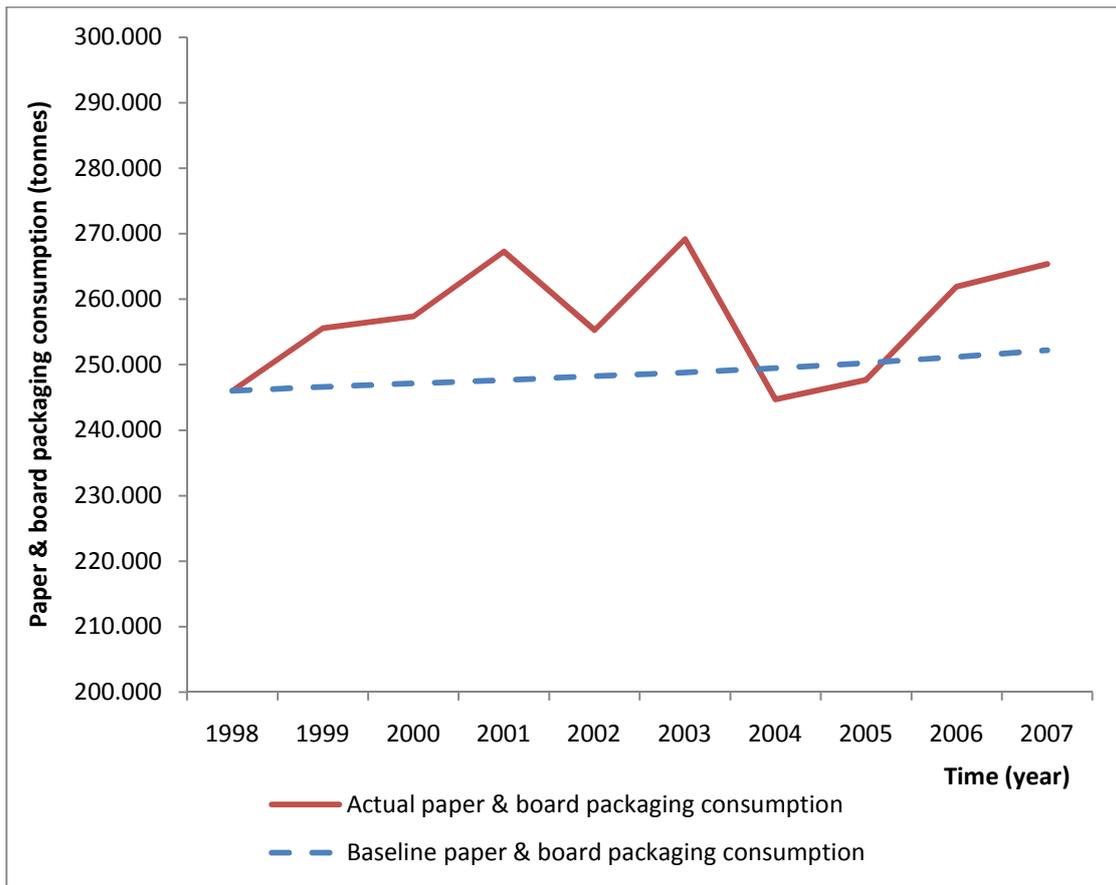


Fig. 34-35: Actual vs. baseline paper & board packaging consumption in Finland, 1998-2007 - Paper & board packaging consumption per inhabitant in Finland, 1998-2007

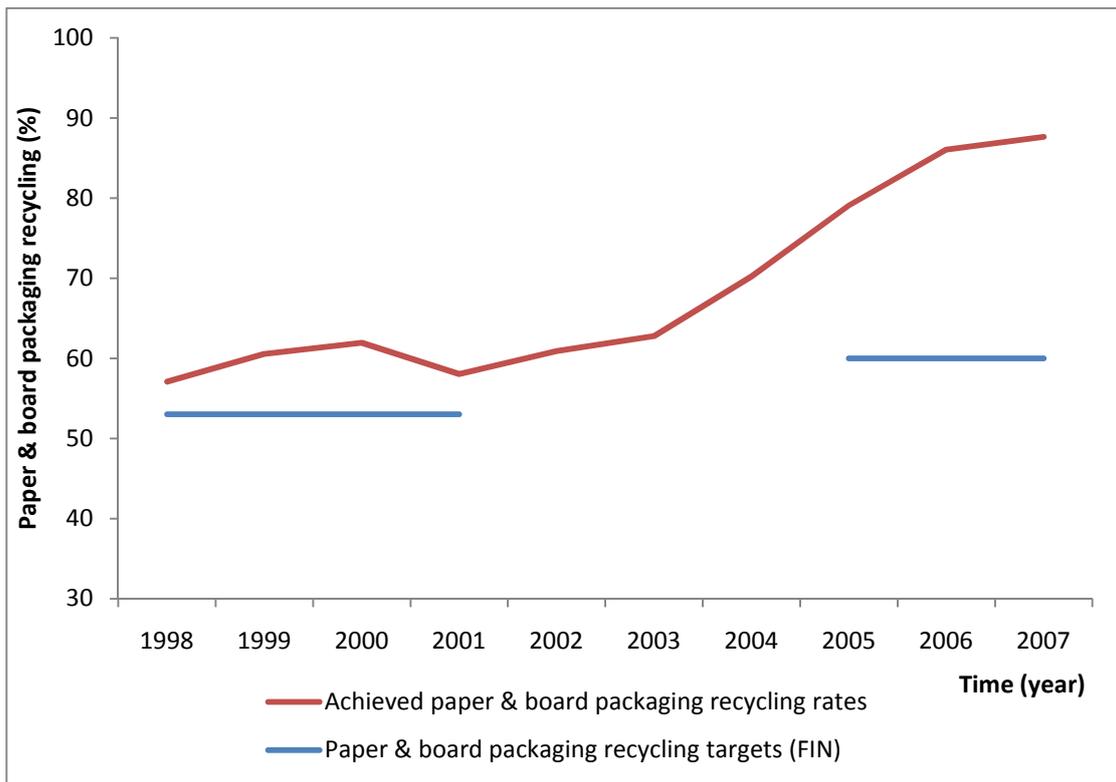
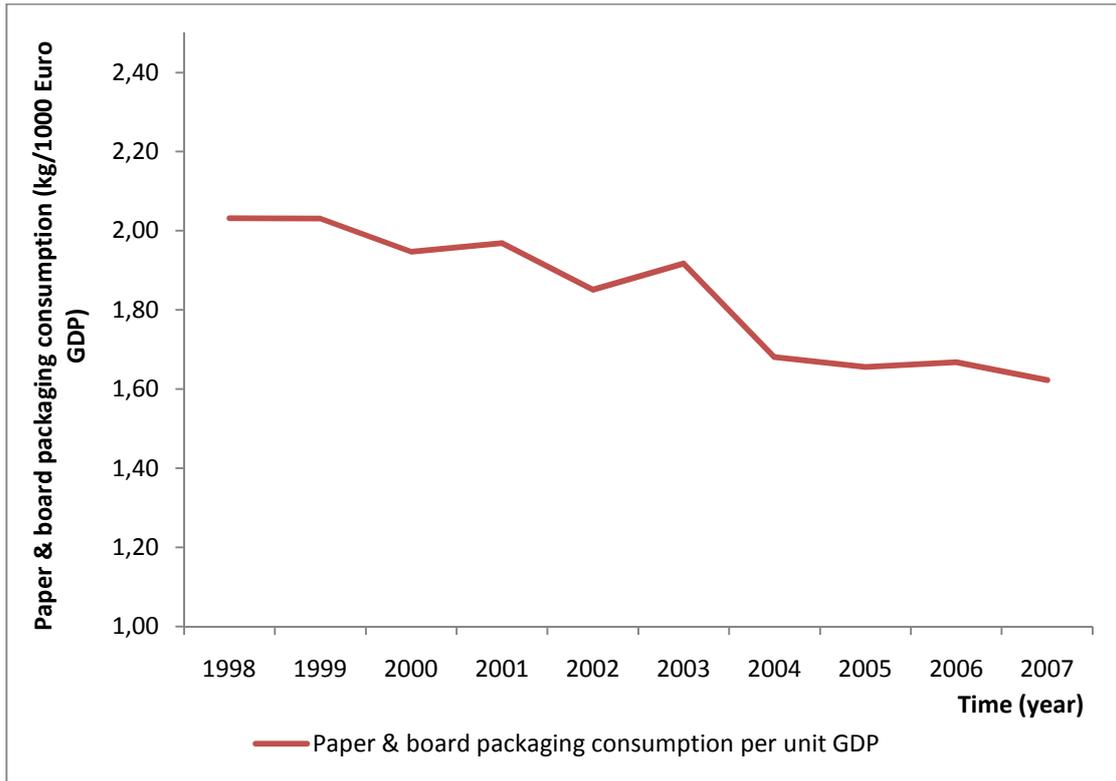


Fig. 36-37: Paper & board packaging consumption per unit GDP in Finland, 1998-2007 - Paper & board packaging achieved recycling rates vs. national targets in Finland, 1998-2007

The image drawn by Fig. 37 and 38 regarding the paper & board recycling and total recovery rates is quite similar to that of the respective rates for overall

packaging. The recycling rate was above the 2001 target already in 1998 and a significant increase began being recorded after 2003, leading to a 2007 rate which was higher than the one for 1998 by more than thirty percentage points and, additionally, the highest among the group members. It is worth mentioning that the overall increase in packaging recycling (Fig. 32) can be attributed -to a large extent- to the increase in paper & board packaging recycling. The total recovery rate remained practically constant between 1998 and 2003, failing to attain the 2001 target by a small margin, while after 2003 it rose by more than twenty percentage points and became the second best in the group, falling behind only Denmark.

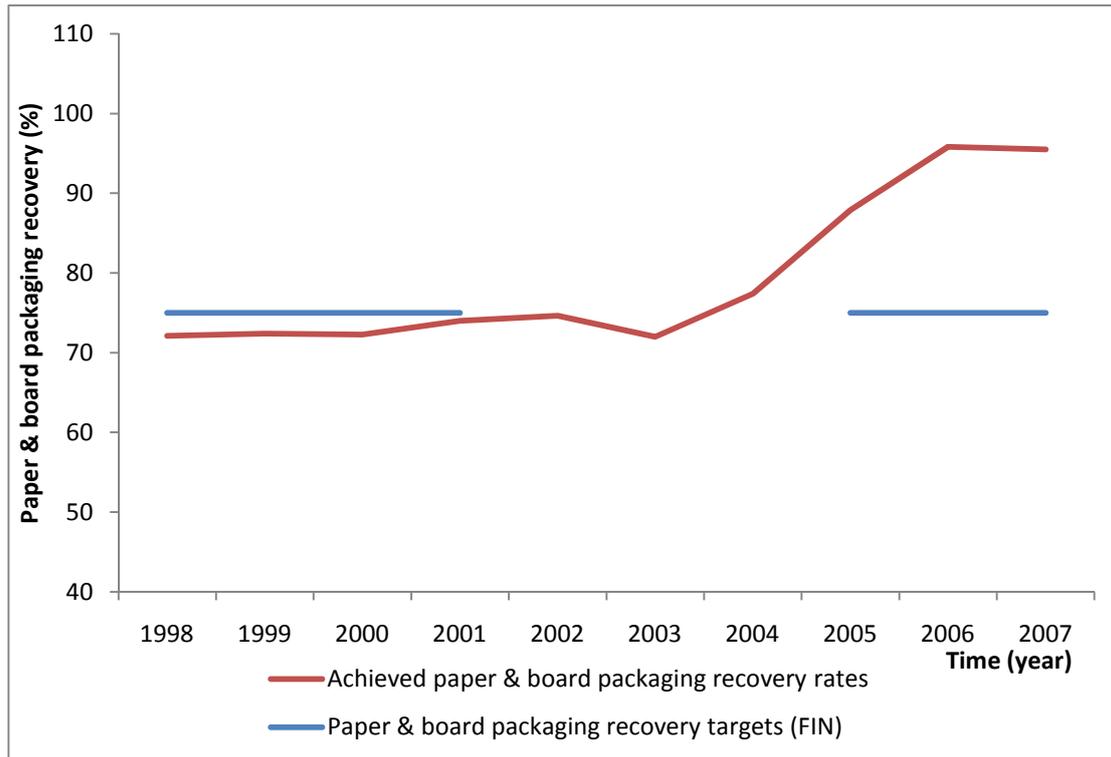


Fig. 38: Paper & board packaging achieved recovery rates vs. national targets in Finland, 1998-2007

6.2.3.2. Glass

The following section will present the developments regarding the glass packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

The glass packaging consumption in Finland has remained consistently above the baseline throughout the entire decade at hand (Fig. 39). An increase of almost 15 ktonnes was recorded by 2007, with the actual consumption being 13 ktonnes above the baseline during that year. The same image is supported by Fig. 40 and 41; the increase of the per capita glass packaging consumption by more than 20%, which is the highest in the group, and the low decrease of the glass packaging IU between 1998 and 2007 are clear indications of the validity of the trend described above.

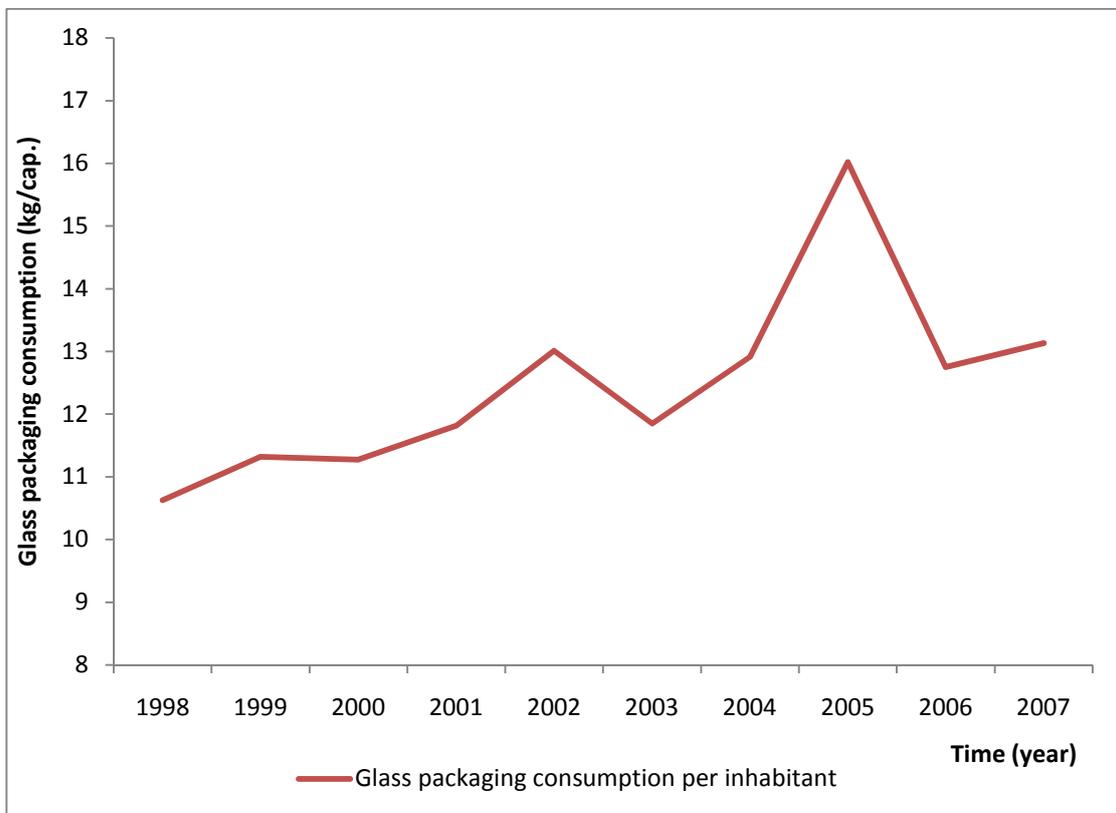
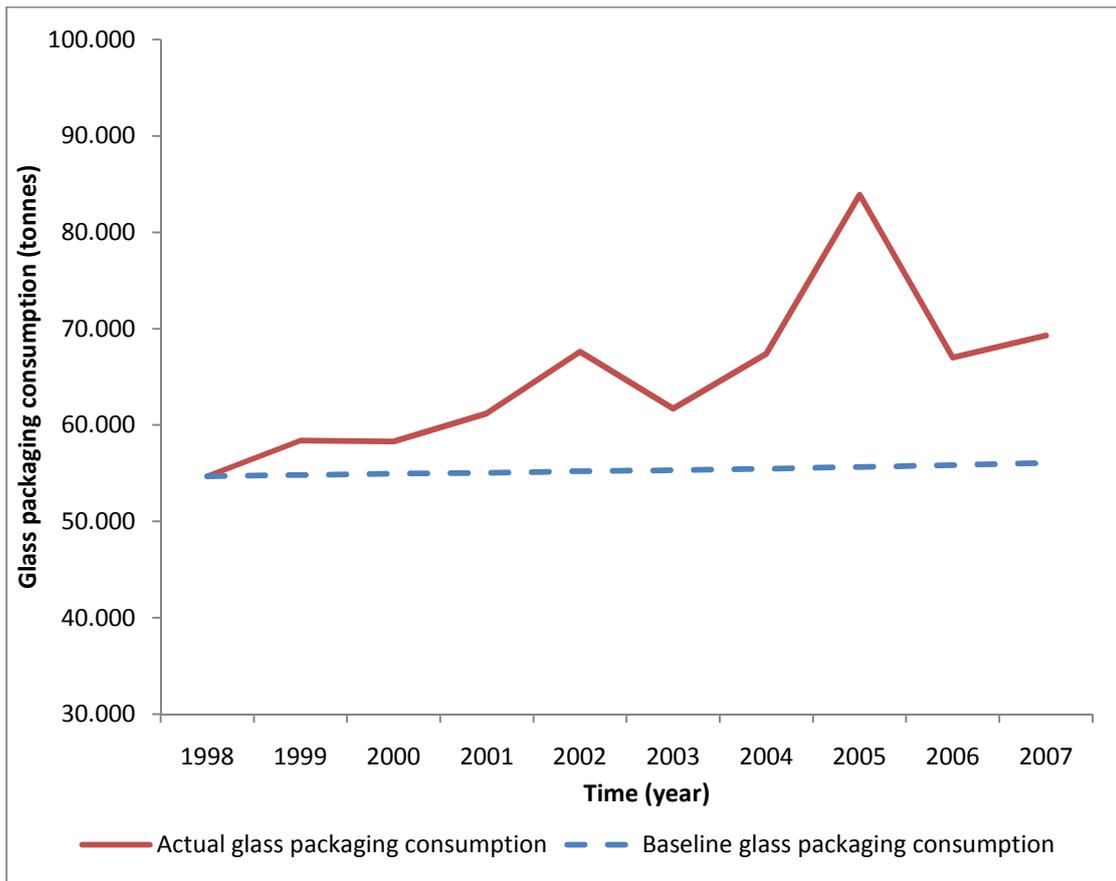


Fig. 39-40: Actual vs. baseline glass packaging consumption in Finland, 1998-2007 - Glass packaging consumption per inhabitant in Finland, 1998-2007

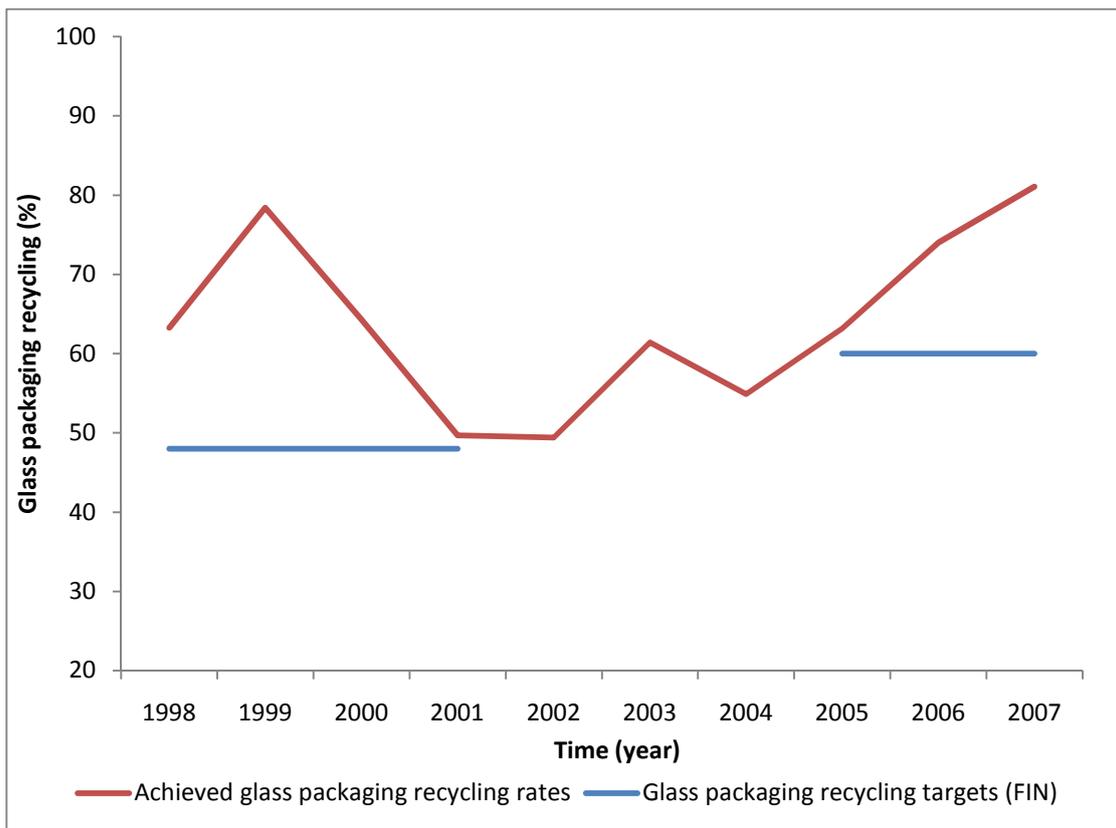
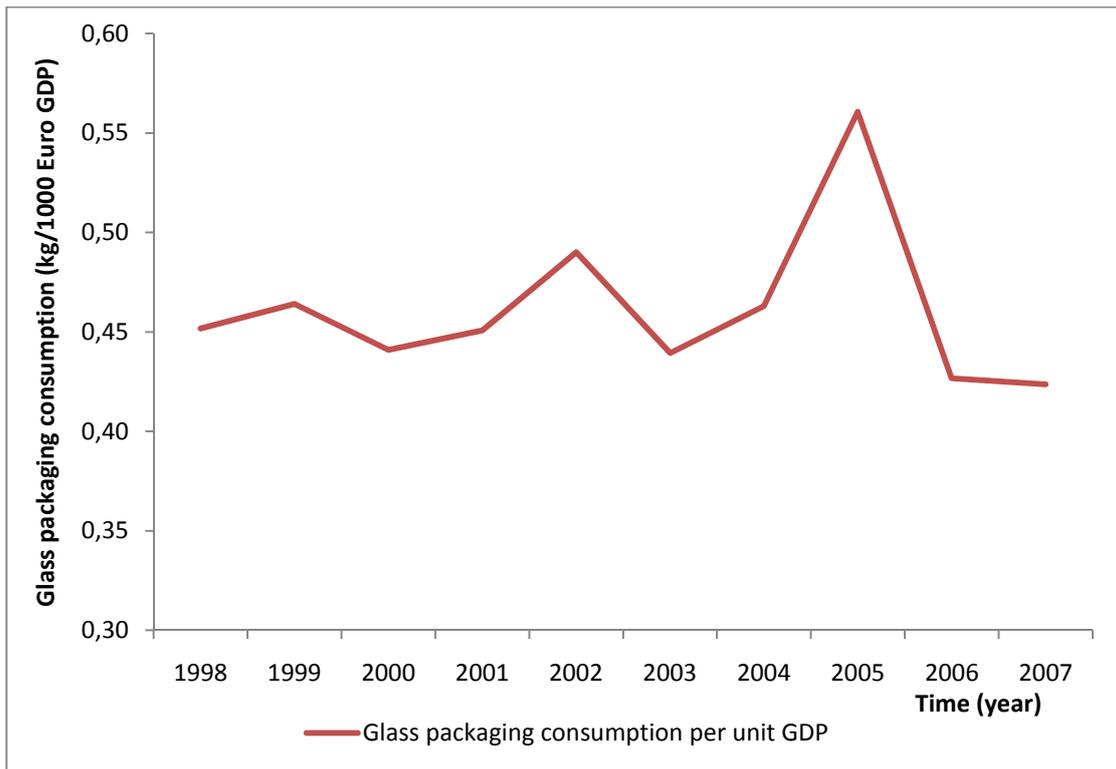


Fig. 41-42: Glass packaging consumption per unit GDP in Finland, 1998-2007 - Glass packaging achieved recycling rates vs. national targets in Finland, 1998-2007

Glass packaging recycling had reached levels quite higher than the target set for 2001 during the first years of the decade but a steep drop of almost thirty percentage

points was recorded after 1999, leading to an only marginal attainment of the first policy period goal. A gradual increase of the rate began again after 2002, the 2008 target was attained at the year of its introduction (2005), and the 1999 rate was reached again (and eventually exceeded) in 2006-07. Despite that progress, however, the Finnish glass packaging recycling rate was –by far- the lowest among the group members in 2007.

6.2.3.3. Metal

The following section will present the developments regarding the metal packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

The development of the metal packaging consumption in Finland is described best by the following figures: although the baseline consumption predicted a rise by about 800 tonnes between 1998 and 2007, the actual increase amounted to more than 14,000 tonnes (Fig. 43). Generally, two periods of increasing consumption can be distinguished (1998-2001 and 2005-07), with the mid-decade years demonstrating rather stable metal packaging waste generation. Both Fig. 44 and 45 confirm the trend already visible in Fig. 43. Finland has shown the highest increase in per capita metal packaging consumption among the countries of the group and, even more remarkably, its IU is one of only three examples of increased intensity when all materials in all Nordic countries besides Norway are considered.

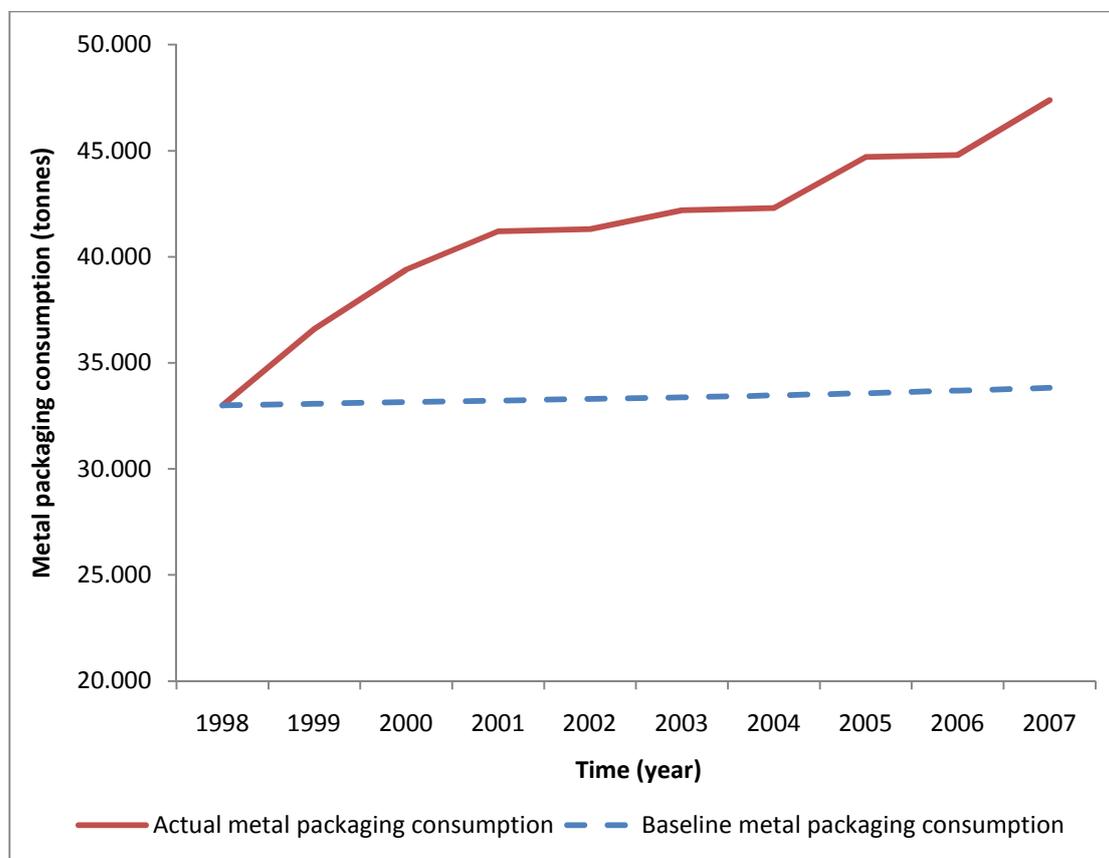


Fig. 43: Actual vs. baseline metal packaging consumption in Finland, 1998-2007

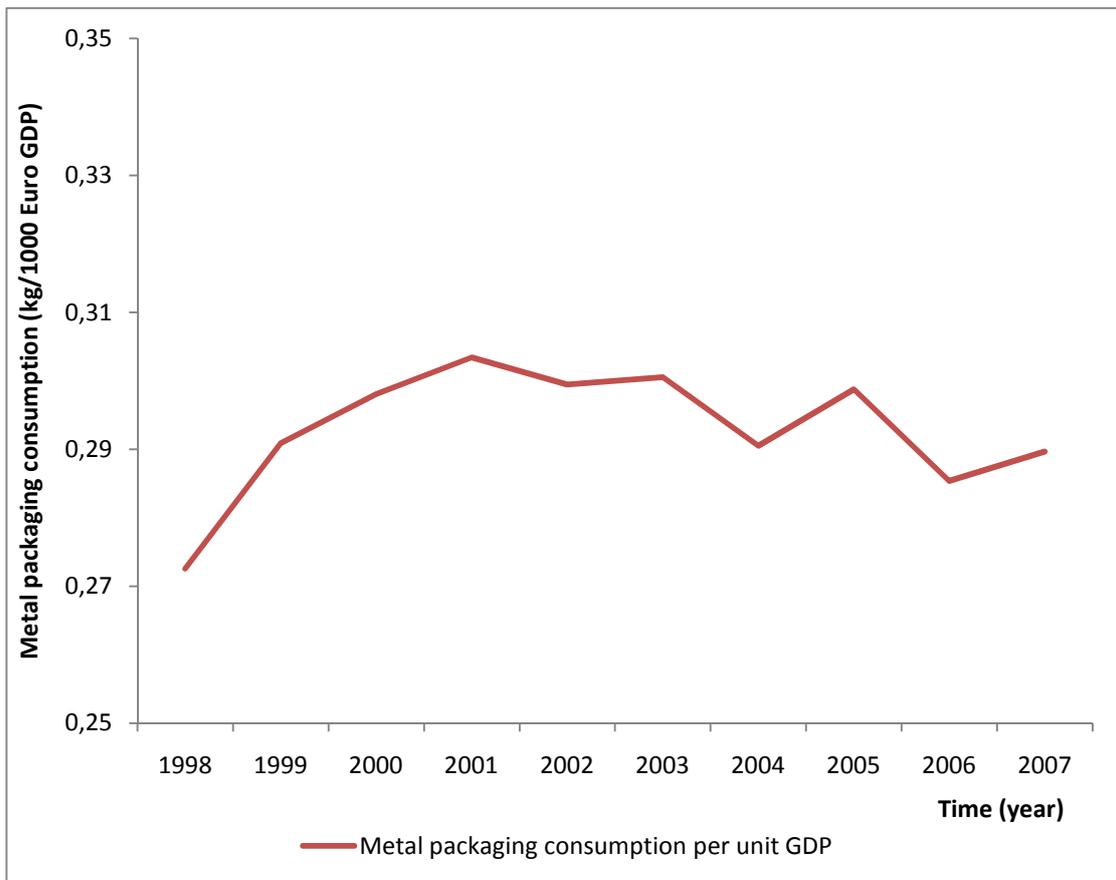
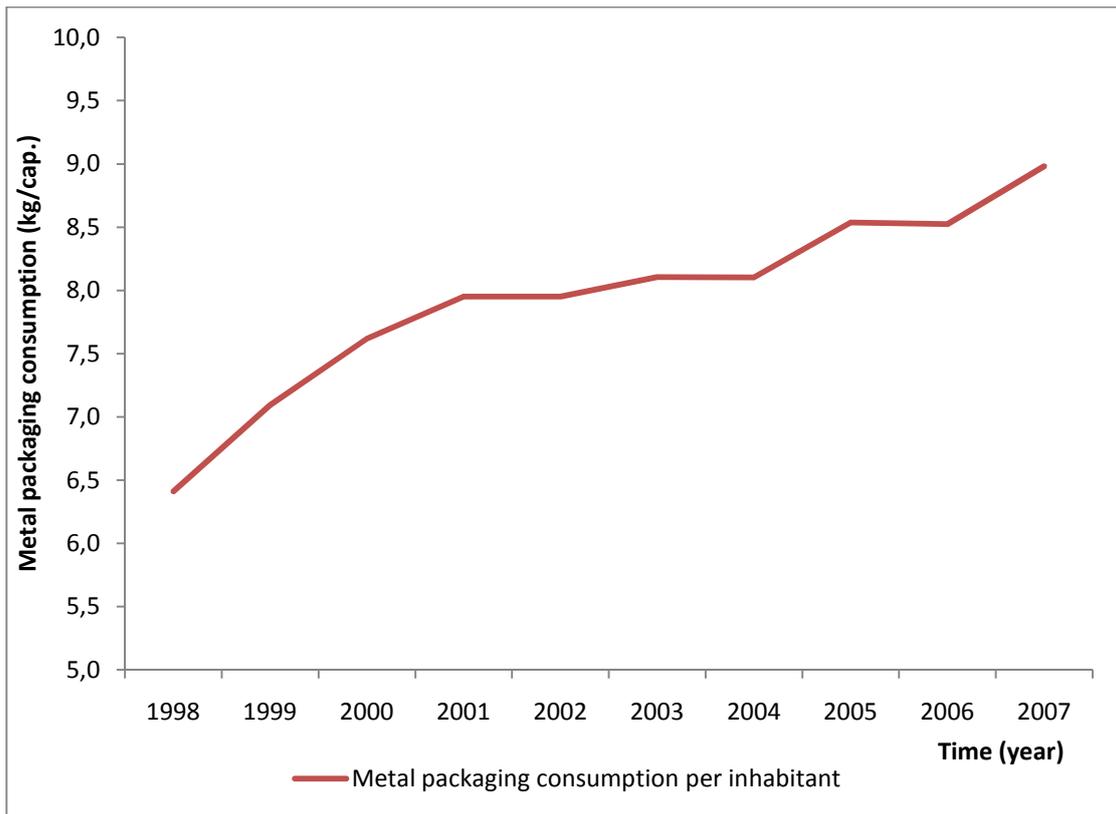


Fig. 44-45: Metal packaging consumption per inhabitant in Finland, 1998-2007 - Metal packaging consumption per unit GDP in Finland, 1998-2007

Metal packaging recycling in Finland has also demonstrated a continuous rise of the rate between 1998 and 2007. Once again, an initial period of increase between 1998 and 2002 is followed by stability and a return in rising rates is observed after 2005. The targets for both policy periods were attained easily and earlier than required and the overall increase of the rate during the decade amounted to fifty-five percentage points, thus giving Finland the second place among its Nordic counterparts.

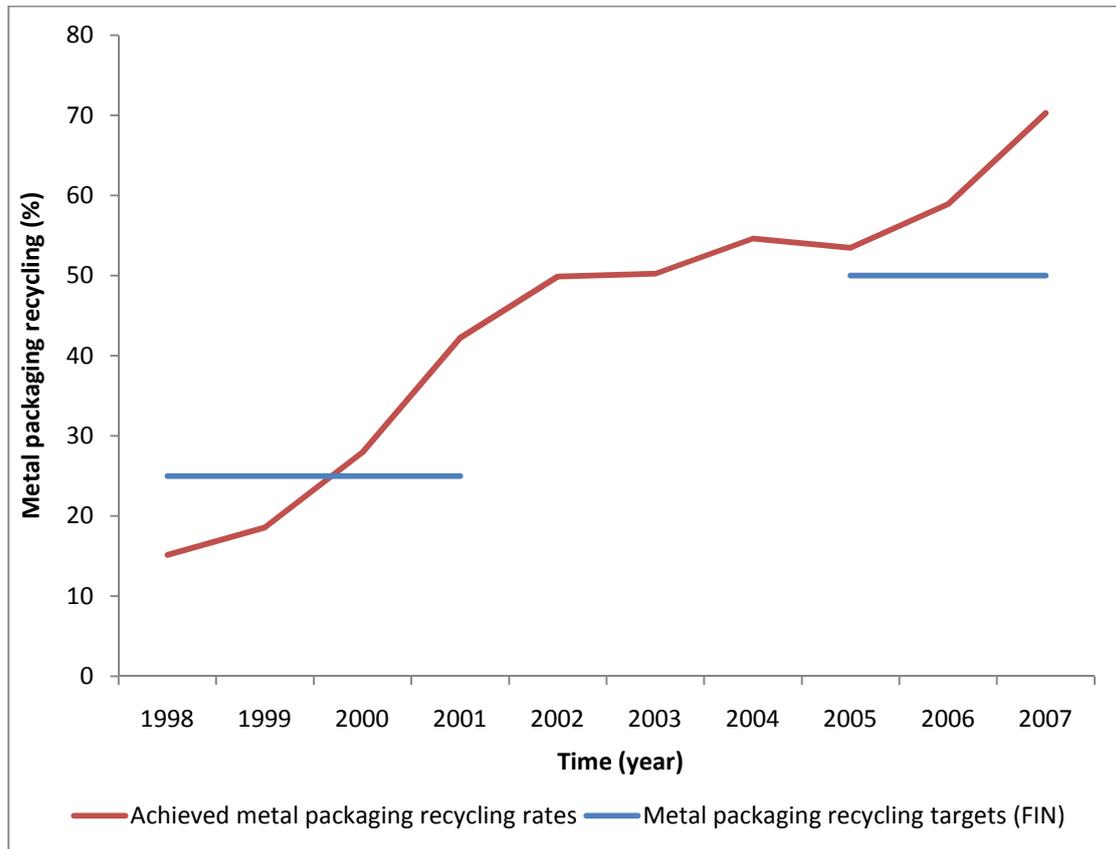


Fig. 46: Metal packaging achieved recycling rates vs. national targets in Finland, 1998-2007

6.2.3.4. Plastic

The following section will present the developments regarding the plastic packaging consumption (absolute and per capita), intensity of use, recycling and total recovery against the targets set during the period 1998-2007.

Finland managed to maintain the plastic packaging consumption levels below the baseline between 2000 and 2004, but at the end of the decade the increase was about fourfold the one predicted by the baseline (8 ktonnes instead of 2). Despite that latest rise, the per capita plastic packaging consumption change between 1998 and 2007 amounted to a moderate 6% rise (Fig. 48), while the plastic packaging intensity of use recorded the highest reduction among the group members, declining by more than 19% between 1998 and 2007 (Fig. 49).

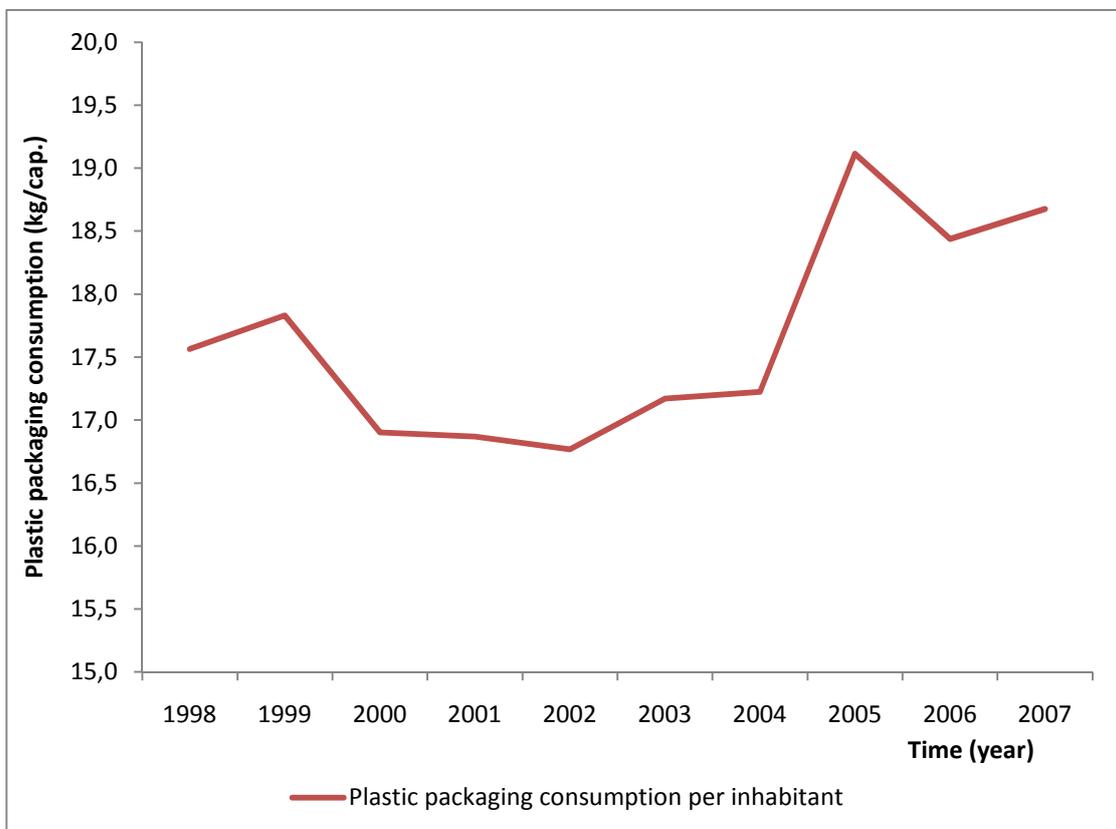
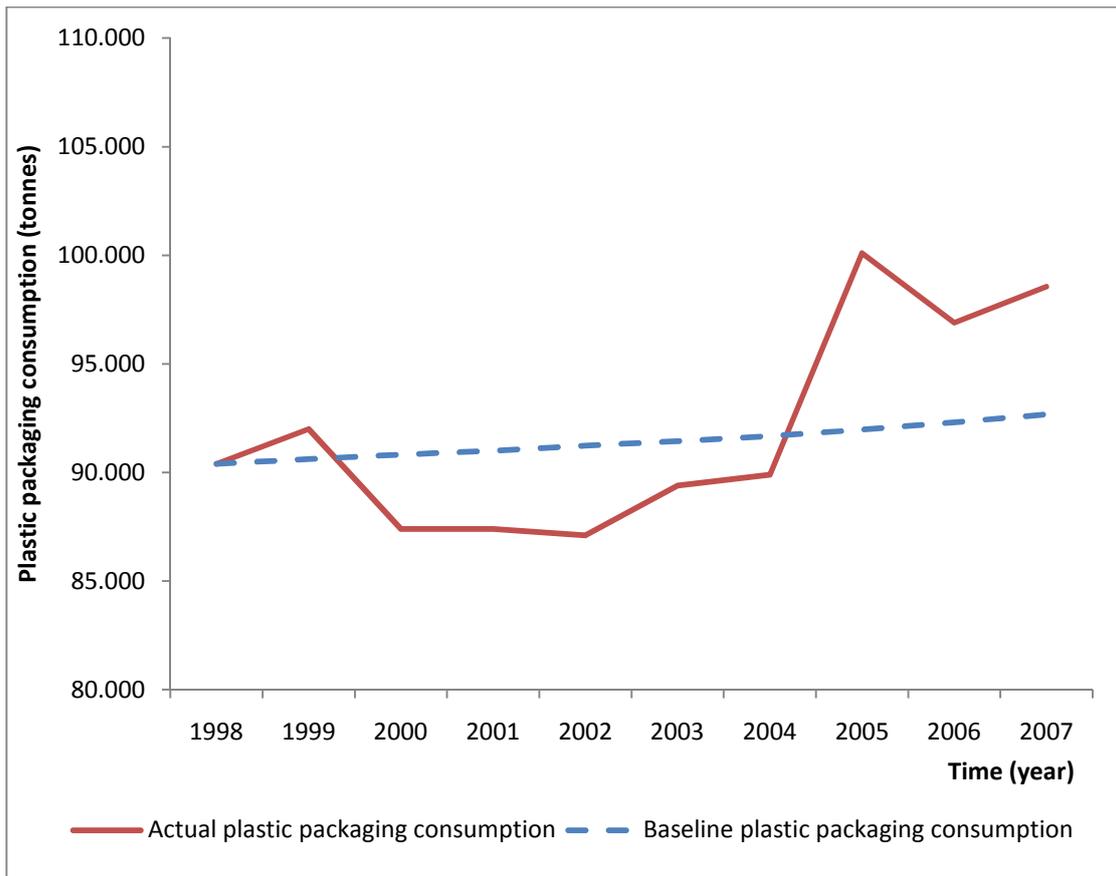


Fig. 47-48: Actual vs. baseline plastic packaging consumption in Finland, 1998-2007 - Plastic packaging consumption per inhabitant in Finland, 1998-2007

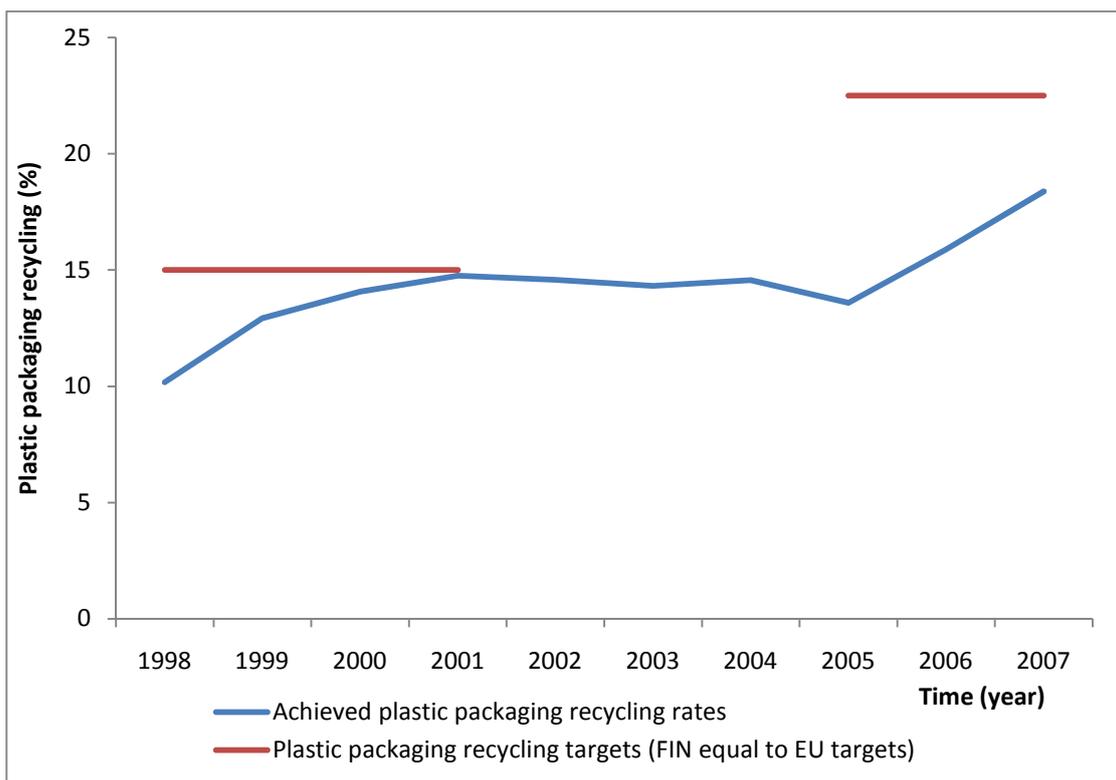
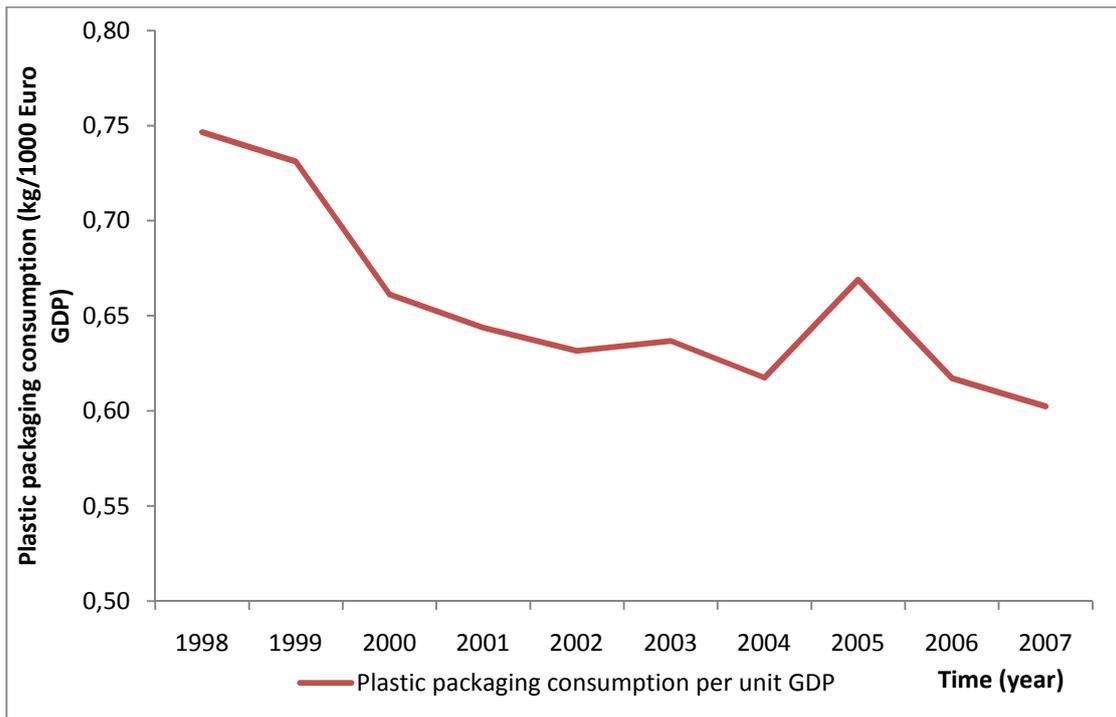


Fig. 49-50: Plastic packaging consumption per unit GDP in Finland, 1998-2007 - Plastic packaging achieved recycling rates vs. national targets in Finland, 1998-2007

Plastic packaging recycling in Finland demonstrated a substantial growth between 1998 and 2007, with the rate nearly doubling during that period. An initial rise took place between 1998 and 2001, with the first policy stage target being unattained by a minimal margin (0.2%), and a 4-year stability period followed. The next rise began

materializing after the introduction of the second policy period target and it has been ongoing since then. This increase, however, has been quite lower than those of the other Nordic countries and the Finnish plastic packaging recycling rate is the worst of the group in 2007.

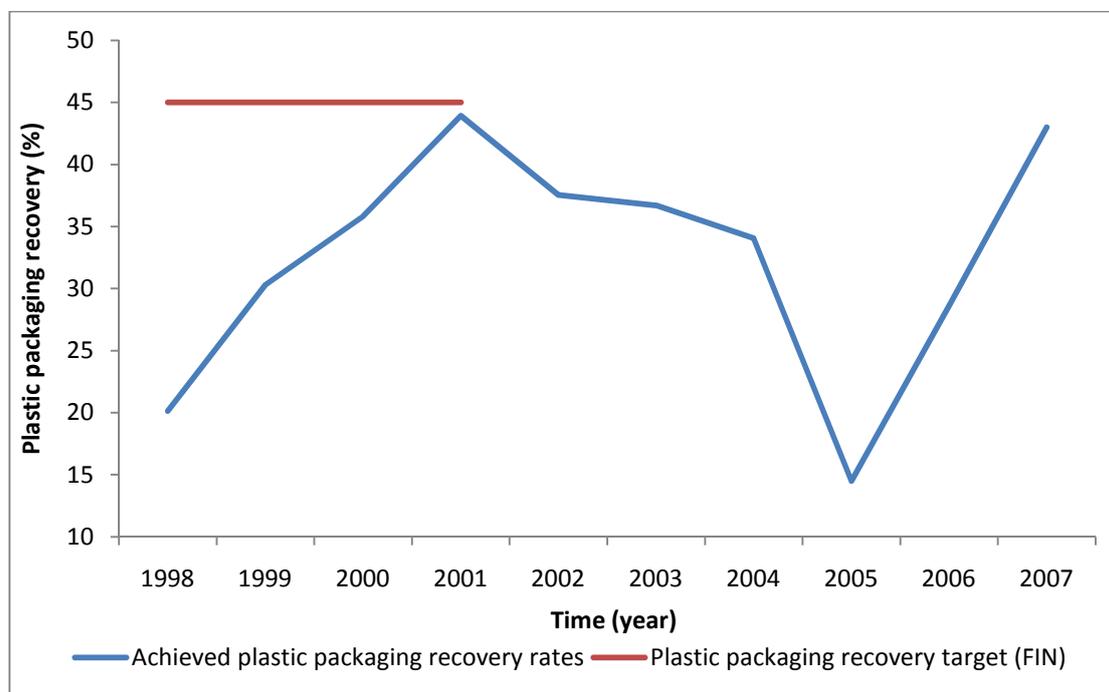


Fig. 51: Plastic packaging achieved recovery rates vs. national targets in Finland, 1998-2007

Finland also introduced a total recovery target for plastic packaging for the year 2001. A very substantial increase was achieved (the total recovery more than doubled, Fig. 51), although the target was not actually attained. However, it was not followed by a new goal and after 2001 the total recovery plummeted to levels lower than those of 1998. In fact, the data suggest that the recovered plastic packaging in 2005 was almost exclusively recycled, with the difference between the recycling and the total recovery rates falling below 1%. The total recovery rates are rising again since then and the 2001 levels have been reached once more, but the performance is by far the worst among the Nordic countries.

6.2.4. Discussion

A point that can be made by looking into the development of the overall packaging waste generation in Finland (Fig. 29) is that the choice to relate the packaging minimization target to the GDP has probably resulted in it being ineffective. This is not the first time that this has been suggested: a similar conclusion about GDP-related minimization goals was reached by Rouw [2009] in her study of the Dutch packaging policy and its targets attainment.

Moving on to the overall packaging recycling, the post-2001 rising levels (Fig. 32) constitute a development that cannot be attributed to any newly introduced –at that

point- policy initiatives. An assumption that can be made is that the PROs responsible for the various packaging materials, which were relatively “new” entities –having been established only in 1998- were on a course of continuous improvement of their operation methods and made advances in their membership levels. Additionally, it is logical for the packaging sector to have anticipated that the forthcoming targets for the next milestone year would not be as easy to attain as those for the first policy period, thus providing new incentives for stronger efforts towards the rise of the recycling rate. It should be noted that quite similar explanations could be proposed also in the case of the developments in paper & board packaging recycling (Fig. 37). On the other hand, the choice to keep the total recovery target for overall packaging stable (Fig. 33) possibly did not facilitate a renewed effort for higher recovery rates for some time; a substantial increase began being recorded only through the last two years, quite later than the time when the increase in overall packaging recycling got under way.

The key to understanding the glass packaging consumption rise during the decade (Fig. 39) could be partially provided by the developments regarding reusability. High reusability rates for glass packaging are consistently achieved, but -according to PYR data- these rates fell gradually from 84% to 76% between 1998 and 2007 in spite of the existence of the reusability-oriented beverage packaging taxation system. Moreover, a factor that can be seen as further reinforcing the expansion of the glass packaging market is the increasing alcohol consumption in Finland (from 6.9 L/cap. in 1998 to 8.2 L/cap. in 2005) [HCDG, 2008]. When considering the recycling rates for glass packaging (Fig. 42), the level of the target appears to have had a significant influence upon their development. Up to 2001 the goal had been very low compared to the actual performance at the time; this has possibly played a role in the recycling decline between 1998 and 2001. The anticipation of a new target and its subsequent introduction can be held accountable for the rise that followed. The aforementioned decline in reusable glass packaging utilization can also be considered a reason for the increase of the amount of recycled packaging units after 2002.

PYR data suggest that the metal packaging reuse rate increased slightly during the period examined (93% in 2007 instead of 90% in 1998), a fact that makes the rise in metal packaging consumption (Fig. 43) more difficult to comprehend. It seems that one of the few fields where one-way metal packaging can be utilized -since such high reuse rates are recorded- is beverage containers; a possible scenario is that the development presented in the graph is related to the changes in their market share. Considering that these cans are the only form of one-way packaging for beverages available in Finland and that refillable packaging for beer, soft drinks and water has dropped between 1995 and 1999 [ECOLAS-PIRA, 2005], it can be assumed that this scenario has some validity. The aforementioned rise in alcohol consumption, which could mean higher beer can sales, also points towards the same direction. However, it is unlikely that beverage cans could solely account for such a high increase in

consumption; it should be assumed that this material has been increasingly popular for other applications too (e.g. metal drums in the industry).

Metal packaging is the first case where the target set has been considerably higher than the actual recycling rate at the period of introduction (Fig. 46). It appears that this initiative triggered the increase of the recycling rate. Additionally, the beverage packaging taxation system, which offers reduced charges for containers participating in recycling schemes, in combination with the decline of reusable packaging utilization in this sector, can be seen as potentially influential factors. Furthermore, the more effective work of the newly-established relevant PROs could be once more a valid argument for the explanation of the positive developments.

When plastic packaging consumption is considered, the good performance during the mid-decade years (Fig. 47) corresponds with a rise of the reusability rates for plastic packaging achieved roughly during the same period, according to PYR data. The level of the recycling targets -compared to the actual rates at the time- seems to have been the driving force behind the development of the plastic packaging recycling rates (Fig. 50). These improved during the first stage in order to attain the target but remained stable during the period between the two stages. The introduction of the new, more ambitious, goal in 2005 appears to have provided the necessary boost for a further rise of the plastic packaging recycling rate, although whether the new goal would be attained in 2008 was not certain.

Fig. 52 demonstrates the development of the share of each packaging material in the overall packaging consumption between 1998 and 2007.

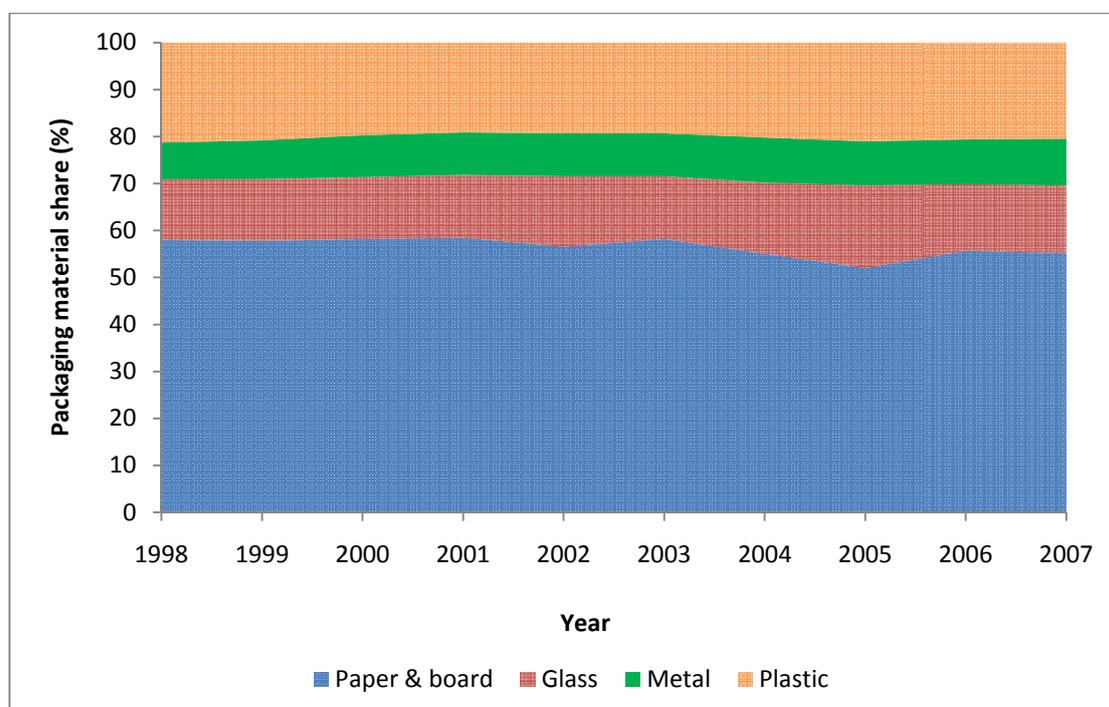


Fig. 52: The development of the share of each packaging material in the overall packaging per capita consumption in Finland, 1998-2007

Generally, no significant changes have been observed in the share of each packaging material throughout the period examined, with the exception of some fluctuations in paper & board that are probably attributable to statistical factors. Considering both the consumption levels and the intensity of use for each material as presented above, it is observed that all packaging materials went through a weak dematerialization process between 1998 and 2007, with the exception of metal packaging for which a materialization process was recorded.

Some concerns about the reliability of the Finnish data are caused by the unusual fluctuations recorded in several cases (e.g. Fig. 34, 39 and 47 for paper & board, glass and plastic packaging respectively). According to the Finnish side's views, data collection methods have remained unchanged during the period examined and cannot thus be considered as responsible for these occurrences¹²; a thorough justification of all the fluctuations, however, was considered to be impossible. Some partial explanations that were offered included the surprisingly high beer consumption in Finland during 2005, which affected the glass packaging consumption, and an increase in the use of PET bottles during the years 2005-06, which in turn affected the plastic packaging waste generation.

6.3. Concluding remarks

The Finnish packaging use and packaging waste management policies are characterized by their focus on packaging reuse and the implementation of the Extended Producer Responsibility principle.

The priority given to reuse is apparent already from the provisions of the 1993 Waste Act and the high reuse rates reached are helping Finland avoid the generation of very large packaging waste quantities. The fact that more than 2,600 ktonnes of packaging (including wood) were used in 2007 but only 700 ktonnes of waste were generated speaks volumes of the Finnish success to make progress in packaging reuse. However, despite the additional introduction of quantitative packaging waste minimization targets, Finland is on a course of increasing packaging consumption, which the reuse rates' improvement can only moderate but not reverse; the fact that the 2008 minimization target was related to the GDP development appears to have been an ineffective choice.

The producer responsibility scheme is based on the existence of one central company that is responsible for the administrative and financial aspects and for the coordination of the various material-specific PROs. Generally, there are indications that -since their establishment in 1998- the PROs are working in most occasions with an increasing effectiveness, bringing about improvements in the recycling rates. Through their work, Finland has managed to become the most improved country -and one of the current forerunners- in terms of overall packaging recycling, owing it primarily to paper & board packaging. There are sectors, nevertheless, where the

¹² Personal communication with Sirje Stén, Senior Adviser, Pirkanmaa Centre for Economic Development, Transport and the Environment

Finnish are far behind their Nordic counterparts and stronger efforts are required from the organizations involved (glass recycling, plastic recycling and total recovery).

Other than the -purely administrative in nature- introduction of producer responsibility and of minimization targets, Finland relies on a financial instrument, namely the beverage packaging taxation scheme. It is difficult to determine whether this system has been effective using only the data available for this project; however, facts such as the declines in reusable glass packaging and in overall reusable beverage packaging or the evolution of metal packaging consumption provide some indications that the system does not offer the incentives required in order to bring about the expected results. Another financial instrument that influences packaging developments, although not aiming directly at packaging, is the waste tax imposed on the amounts heading for landfilling.

The entire length of the packaging chain is covered by the Finnish policies, although the main focus is on packaging reuse (packaging making, consumption). Recycling (waste collection) is promoted through the work of the PROs and the taxation on beverage packaging, while the final disposal issue (waste management) is addressed primarily through the landfilling waste tax.

As far as the goals attainment is concerned, Finland has proved to be quite successful. The most important example of a target not attained is that of waste minimization for 2008. Other than that, the jury is still out on the plastic packaging recycling rate, which by 2007 had not yet reached the levels required for 2008. The targets set were occasionally stricter than those of the EU, or even not required by the Commission, and in several cases appeared to have had a significant influence upon the results achieved; see, for example, the cases of metal and plastic packaging recycling and the negative consequences of low or non-existent targets for plastic packaging recovery and glass recycling.

7. Policy evaluation: Sweden

The first part of the chapter will offer an overview of the Swedish policy background and will describe all aspects of packaging use and packaging waste management in the country. The second part focuses on the results achieved by Sweden and the developments regarding the packaging consumption, intensity of use, recycling and total recovery; the results will be compared with the targets set and, wherever possible, the effect of specific policies upon them will be defined.

7.1. Policy background

1984	Establishment of recovery system for metal beverage containers
1986	Establishment of PRO responsible for glass packaging
1994	Recovery system for metal beverage containers is expanded in order to include also PET bottles
1997	Introduction of the producer responsibility scheme for packaging
2000	Waste tax on landfilling
2002	Ban on the landfilling of sorted combustible waste
2006	Waste incineration tax

Table 17: Policy measures currently in effect in Sweden (non packaging-specific measures that are relevant for packaging waste management are also included)

7.1.1. Packaging waste management

Sweden is one more example of a country where the national packaging waste management policy is based on the Extended Producer Responsibility principle. In general, a substantial part of Sweden's waste policy relies on the EPR principle, which covers newspapers (since 1994), tires (1994), packaging (1997), vehicles (1997) and electric and electronic products (2000) [Ebbesson, 2004]. The framework regarding packaging was presented in the Ordinance on Producers' Responsibility for Packaging (1997:185), which prescribed the following:

- packaging shall be produced in such a way that its volume and weight are limited to the level required in order to maintain a good level of safety and hygiene,
- producers shall arrange systems for the collection of all packaging waste that arise,
- packaging waste shall be taken care of in an environmentally acceptable way,
- the recycling objectives for collected packaging waste shall be met.

The scope of the local authorities' involvement is quite limited: the municipalities have to prepare waste plans that must include separate chapters on packaging waste. On the other hand, the business sector's tasks are much more extended. They initiate at the design level, where producers shall design, produce and sell packaging in ways

allowing its reuse or recycling, while the production process is such that minimizes the outlet of dangerous compounds. As mentioned above, producers shall organize collection systems –in cooperation with the municipalities- for packaging waste from households and others, while the consumers (households and others) shall sort their packaging waste and deliver them to these systems. Producers also have to inform the consumers about the sorting, collection and disposal processes and options available to them. Finally, they must reuse or recycle the collected packaging or ensure that its treatment is environmentally acceptable [EDG, 2001].

The key role within the Swedish packaging waste management system is played by REPA (Registret för producentansvar och återvinningssystem för förpackningar), the administration company that was established by the various PROs. REPA is responsible for the registration of firms; they have to report to it and pay fees according to the amount and types of packaging they put on the market. REPA is also responsible for the distribution of these fees to the PROs based on the total weight of each material and the price set for it (Table 18). The only exception is the material company for glass packaging, which does not participate in REPA and collects fees individually. The producers that pay fees to REPA (or the glass packaging PRO) are fulfilling their producer responsibility tasks, while those who do not do so are obliged to establish their own systems for the collection of packaging waste; one such case is the McDonald's fast-food restaurants with the exception of their corrugated cardboard packaging [Kaysen & Jakobsen, 2003].

<i>Material category</i>	<i>Packaging fee (SEK/kg)</i>
Paper/cardboard, beverage carton	0.75
Paper/cardboard, other	0.52
Paper/cardboard, certain industrial packaging	0.02
Corrugated board	0.12/0.29/1.22 ¹³
Corrugated board, service packaging	0.52
Metal, cans > 16 cm in diameter	0.66
Metal, other aluminum	2.52
Metal, steel plate	2.52
Metal, drums	0.06
Metal, steel band and wire	0.42
Plastic, commercial packaging	0.10
Plastic, other	1.37
Plastic, service packaging	1.24

Table 18: Packaging fees charged by REPA per type of material (1 SEK = 0.10 €) [REPA, 2010b]

Theoretically, local authorities are responsible for dealing with free-riders, but in practice REPA assumes the responsibility also for such problems. It should be noted that since 2007 REPA has become a subsidiary of FTI (Förpacknings- och

¹³ Depending on the company's operating sector

Tidningsinsamlingen, Packaging and Newspaper Collection), which was also established by the material PROs for the coordination of the collection operations. More than 10,000 firms are currently affiliated with REPA, which states that it covers most of the packaging placed on the Swedish market [REPA, 2010]. Firms whose annual turnover is lower than a specified threshold are not obliged to join the producer responsibility scheme and they do not pay fees for their packaging materials [Hage, 2007]. In addition to this, small companies or companies using small amounts of packaging can pay a general fee for the collection and recycling and do not need to report the packaging amounts marketed. These quantities are not included in the statistics; such companies account for approximately 5% of the total packaging quantity in Sweden [Kaysen & Jakobsen, 2003].

There were six PROs established in Sweden up to 2006:

- Returwell (corrugated cardboard packaging)
- Svensk KartongÅtervinning (cardboard and paper packaging)
- Svensk GlasÅtervinning (glass packaging)
- MetallKretsen (metal packaging)
- PlastKretsen (plastic packaging)
- Svensk Returträ (wooden packaging).

In 2006, Returwell and Svensk KartongÅtervinning merged in order to create Returkartong.

These organizations were established and are owned by enterprises and trade organizations in order to administrate the collection and management of packaging waste. Each one of them prepares statistics concerning the amounts of packaging marketed and the amounts collected and recycled. The two companies that they have jointly established in order to deal with the administrative and organizational aspects of producer responsibility (FTI and REPA) have now merged their operations, as mentioned above.

Naturvårdsverket (the Swedish Environmental Protection Agency) is responsible for regulating the implementation of Ordinance 1997:185. It also sends annual questionnaires to the material PROs and the data it receives are handled by the national statistics agency SCB (Statistiska centralbyrån). Naturvårdsverket prepares the final annual report and submits it to the European Commission.

The collection of household waste is -in general- a municipal responsibility in Sweden. The collection of packaging waste, however, is organized by FTI, within the context of the producers' obligation to establish collection systems for their packaging materials; private or municipal operators are usually contracted in every municipality in order to undertake the actual collection tasks. "Bring" systems with centrally placed collection bins and recycling stations are established; waste are separately collected there and households have to bring their packaging waste to these points. The collected amounts are transported to contracted recycling facilities. Collection

spots can also exist in apartment blocks, while curbside collection can take place in housing estates [Kaysen & Jakobsen, 2003]. On the other hand, packaging waste from the industry are collected separately. It should be noted that the focus is entirely on the business sector for corrugated cardboard, since it is not part of any “bring” system.

There is an ongoing dialogue in Sweden concerning the effectiveness of the collection systems aiming at households and the possible ways to improve it. It is mandatory for households to sort packaging waste, clean them of product residues, make use of the collection options that the producers provide and dispose of the different packaging materials in the assigned recycling bins; however, the participation is rarely controlled or enforced and free-riding is relatively easy [Hage et al., 2009]. Although about 6,000 collection points exist, the low population density is responsible for the fact that several households are still located far from the nearest station. In order to compensate for this, local authorities are offering financial incentives (e.g. differentiated municipal fees) so as to strengthen participation, while they also implement infrastructural measures (e.g. curbside collection); additionally, many multi-family dwellings buy services from recycling companies (property-close collection) [Hage et al., 2009]. Municipalities find it necessary to be involved in the efforts for the establishment of better-functioning collection systems because of the landfilling taxation; fractions of producer responsibility materials that end up in the general waste -instead of the collection points- are raising the municipal costs for landfilling [Mattsson et al., 2003]. This has led several municipalities to the establishment of their own additional collection systems with source separation.

Packaging waste management financing

As mentioned above, the packaging waste management system is financed by REPA through the distribution of the licensing and recovery fees paid by its members to the material companies in relation to the respective quantities and the prices set for each material.

7.1.1.1. Policy measures implemented

The pre-Directive era

Svensk GlasÅtervinning -the only PRO independent from REPA -, which is responsible for glass packaging, was established in 1986 by the glass packaging and beverage producers and the trade sector, thus marking the beginning of the collection system. The cans manufacturers, working together with the association of breweries and the supermarkets, had organized recovery systems for their packaging (1984), while the system was expanded in order to cover also PET beverage containers in 1994.

The current situation

The defining characteristic of the Swedish packaging waste management system is undoubtedly the introduction of the producer responsibility scheme, which was

described in detail above. An array of other policies, however, is implemented alongside this system. A waste tax on landfilling was imposed in 2000, followed by a prohibition of the sorted combustible waste landfilling in 2002 and a similar prohibition concerning organic waste in 2005. Although none of these initiatives is focused specifically on packaging waste, they definitely have an influence in this field also; the municipal efforts to reduce the amounts of producer responsibility materials that end up in the general waste stream so as to decrease their landfilling taxes are an example of such an influence.

A waste incineration tax was introduced in 2006. It is comprised of two parts: an energy tax and a CO₂ tax; heat-only boilers are levied full tax while CHP plants pay tax only on the proportion of energy for heating. CHP plants are also rewarded with a reduced tax level due to their electrical efficiency [Sahlin et al., 2007]. Studies suggest, however, that this initiative will possibly have a limited impact upon the Swedish waste flows; its primary target –the stimulation of recycling– would have better chances of attainment with measures such as the reduction of the time needed for source separation at the households (through the introduction of central sorting systems) or that of the time spent by consumers in waste transportation to collection points (through curbside collection). Additionally, the increase of the information provided regarding the benefits of material recycling and the existing recycling systems is also believed to have been more beneficial [Sahlin et al., 2007].

As mentioned above, there are some financial incentives offered by the municipalities in order to encourage source separation and recycling. Moreover, coordinated information campaigns are run by the municipalities and the producers, combined with other informative initiatives such as the environmentally sustainable packaging labeling and labeling that provides information about the materials contained in the package [EDG, 2001].

The pre-Directive system for cans and PET bottles is still in place. The retake and recycling of aluminum beverage cans is compulsory in Sweden, with the target levels being based on LCAs; in addition to this, a duty is paid for aluminum cans imports, with the exception of members of the deposit system. It is argued that the introduction of high recycling targets within the producer responsibility scheme supports the market position of reusable packaging, since it is directly competitive to one-way packaging [Golding, 1999]. It should be noted that MetallKretsen is not responsible for the deposit system; a separate company (Returpak) has been established by the brewery industry, the beverage packaging industry and the retail sector and this company has to report data on the marketed and collected amounts to Naturvårdsverket. As for PET bottles, they are covered by deposit systems. In this case also, the responsibility for data collection and reporting on the marketed and returned amounts lies with Returpak. The plastic beverage containers deposit system is focused only on PET since it was the only available option when the system was being developed [The Swedish Ministry of Environment, 2003].

7.2. Achieved results and analysis

The developments in Sweden with regard to the packaging consumption, intensity of use, recycling and total recovery will be presented and discussed in the following paragraphs.

Sweden has introduced mainly its own national targets for packaging waste recycling and total recovery, which differ considerably from those prescribed by the Packaging Directive. A distinctive characteristic of these targets is that they do not necessarily follow the packaging categorization into four materials; instead, they can be much more specific as demonstrated in Tables 19 and 20. Some targets set for the total recovery of individual packaging materials are also not required by the Commission, thus constituting a strictly national initiative.

	Recycling in 2001 (%)	Total recovery in 2001 (%)
Paper, cardboard, carton	40	70
Corrugated cardboard	65	-
Glass	70	-
Sheet metal, steel	70	-
Aluminum (excl. beverage containers)	70	-
Aluminum (in beverage containers)	90	-
Plastic (excl. PET)	30	70
PET bottles	90	-

Table 19: Swedish national targets for packaging waste during the 1st policy period

	Recycling in 2008 (%)	Total recovery in 2008 (%)
Cardboard, paper, carton, corrugated cardboard	65	-
Glass	70	-
Metal (excl. beverage packaging)	70	-
Metal beverage packaging	90	-
Plastic (excl. beverage packaging)	30	70
Polymer beverage packaging	90	-
Overall packaging waste ¹⁴	55	60

Table 20: Swedish national targets for packaging waste during the 2nd policy period

¹⁴ These targets shall be attained by 2009

7.2.1. Overall packaging consumption

The following section presents the development of the overall packaging consumption in absolute and per capita terms between the years 1998 and 2007, along with the overall packaging intensity of use during the same period.

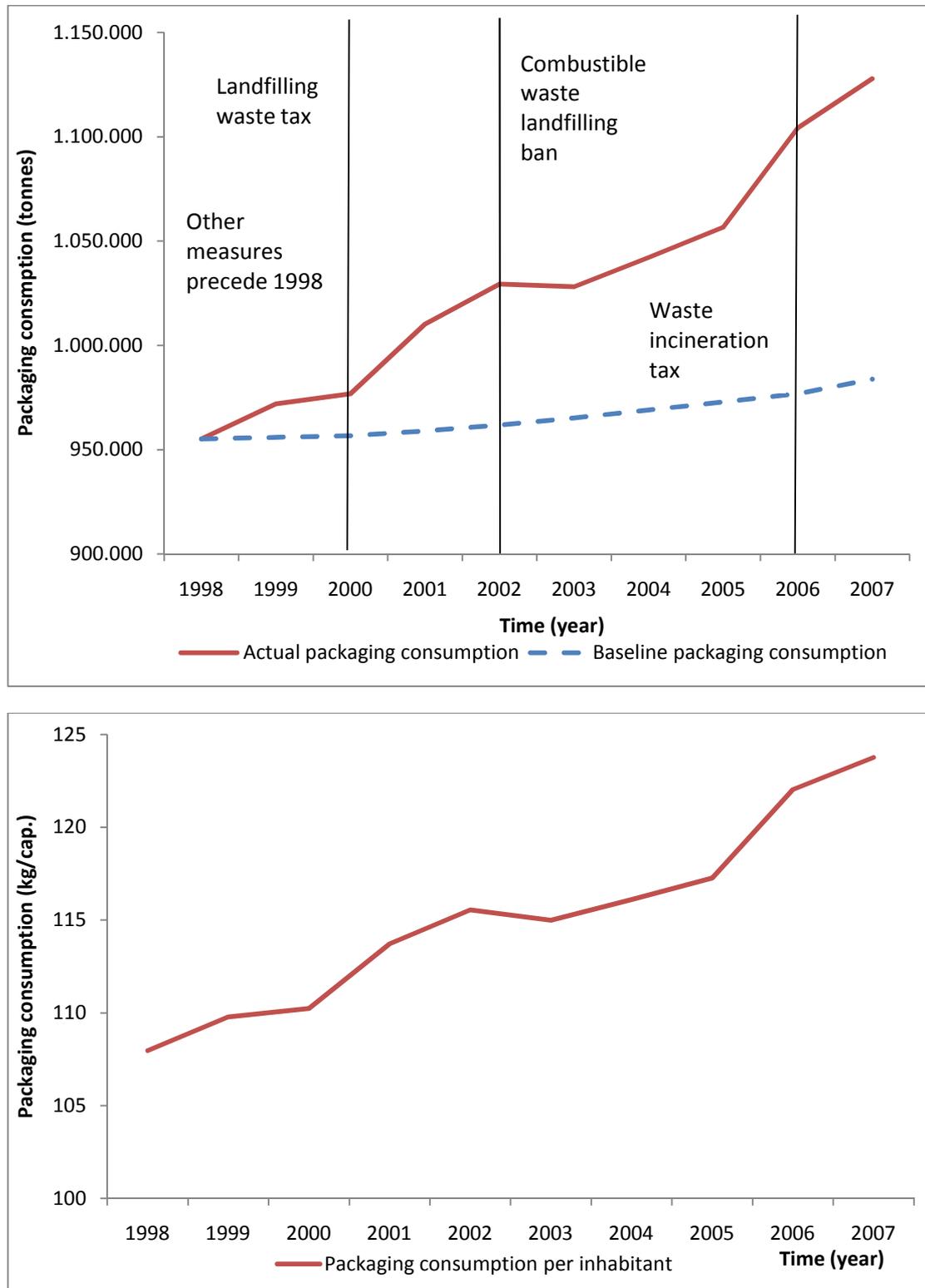


Fig. 53-54: Actual vs. baseline packaging consumption in Sweden, 1998-2007 - Packaging consumption per inhabitant in Sweden, 1998-2007

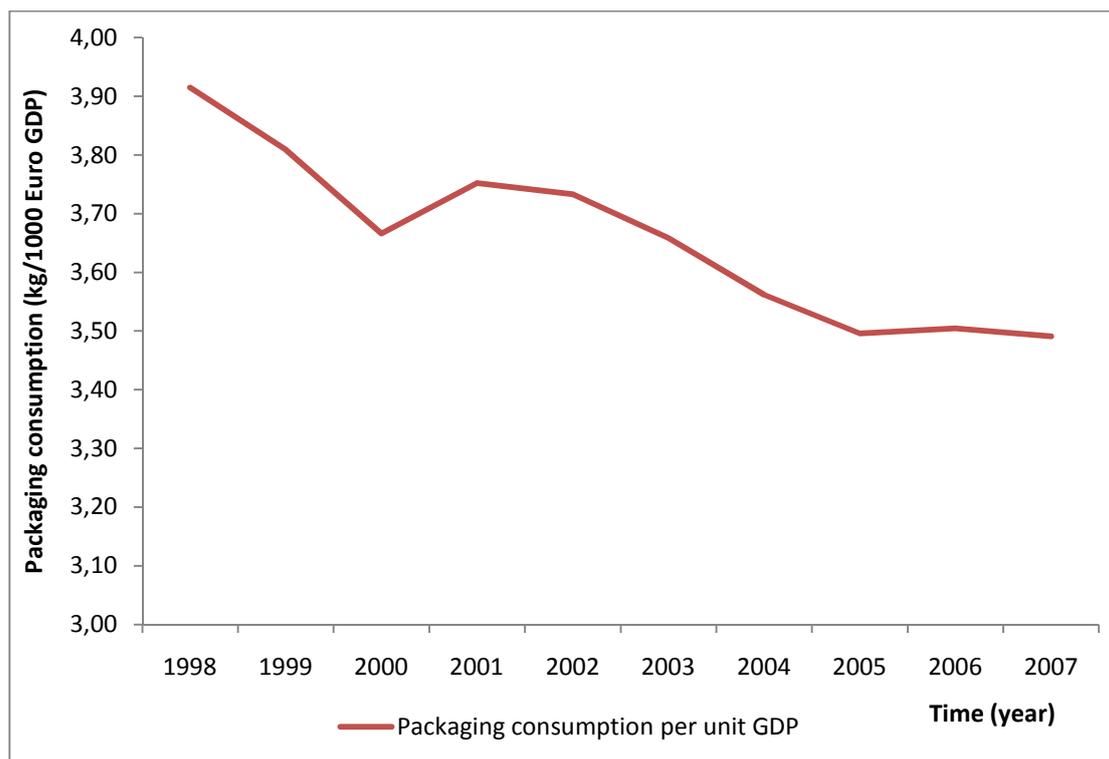


Fig. 55: Packaging consumption per unit GDP in Sweden, 1998-2007

Instead of the baseline consumption rise of almost 30 ktonnes between 1998 and 2007, the actual increase during that period exceeded 170 ktonnes. At the same time, the increase of the per capita packaging consumption measured at more than 14%, thus being the second highest figure among the Nordic countries. The reduction in the overall packaging intensity of use does not change this picture, since it is expected in a developed economy anyway –as explained already-, while at the same time it is the lowest among the group members (excluding Norway) at less than 11%.

7.2.2. Overall packaging recycling and total recovery

The following section will illustrate the development of the recycling and total recovery rates achieved by Sweden against the targets set during the 1998-2007 period.

The overall packaging recycling rate in Sweden was very high at the beginning of the period examined: about thirty percentage points above the maximum required by the Commission (Fig. 56). A large reduction of more than fifteen percentage points was recorded, however, up to 2000; despite this decline, Sweden was still the country with the highest overall packaging recycling rate in the group in 2001, thus demonstrating the high level of its original performance. Close to the end of the first policy stage (2001) the recycling rate began to rise again and has continued increasing ever since. The levels of the beginning of the decade had not been reached again up to 2007, but the national target for 2009 had been easily attained. It should be noted that the Swedish recycling rate in 2007 was slightly higher than that of Finland, thus maintaining the first place among the countries compared here.

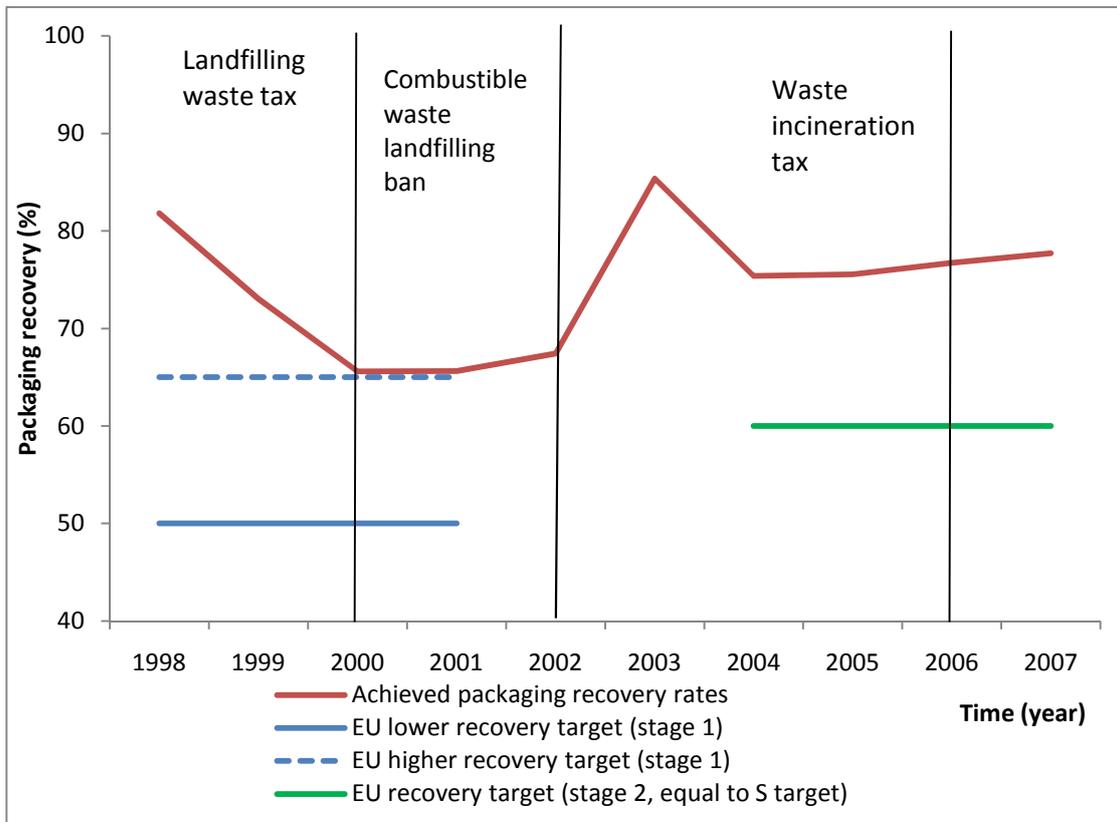
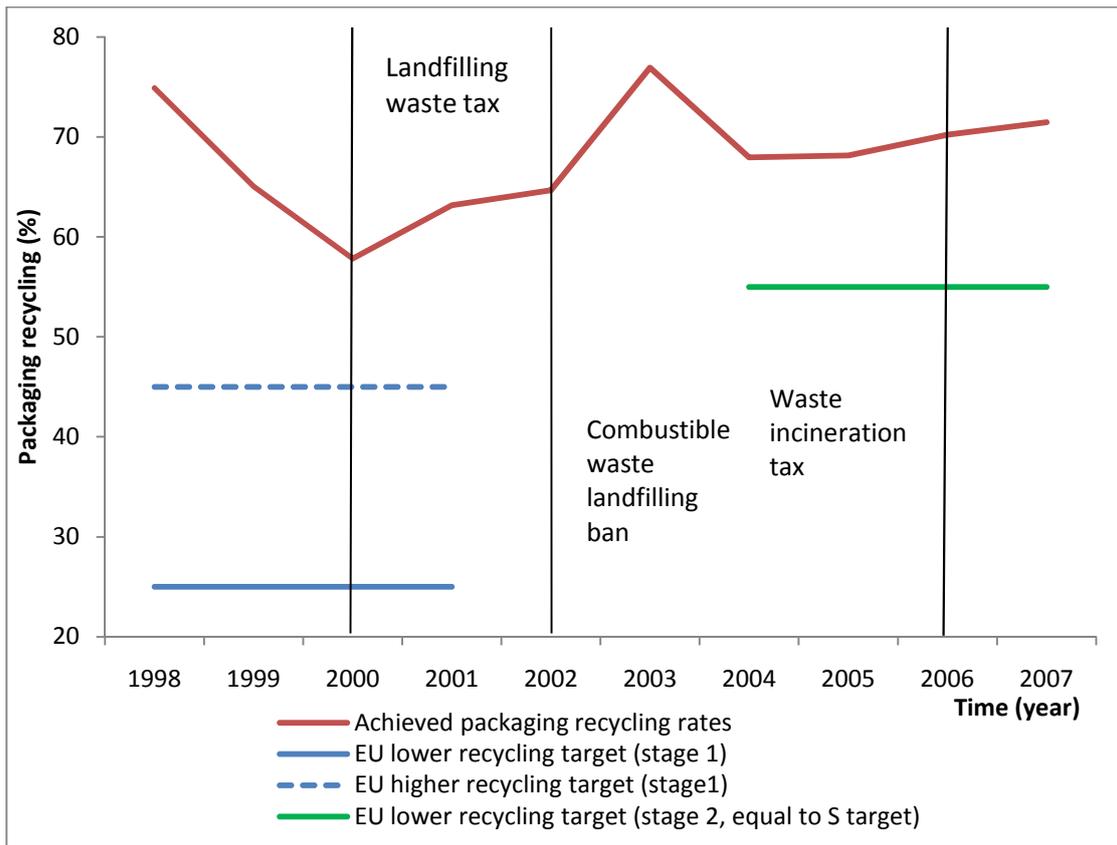


Fig. 56-57: EU and S packaging recycling targets vs. achieved packaging recycling rates in Sweden, 1998-2007 - EU and S packaging recovery targets vs. achieved packaging recovery rates in Sweden, 1998-2007

A similar pattern can be observed concerning the overall packaging total recovery rate (Fig. 57).

7.2.3. Consumption and recycling per material

7.2.3.1. Paper & board

The following section will demonstrate the developments regarding the paper & board packaging consumption (absolute and per capita), intensity of use and recycling. The Swedish policy makers had subdivided paper & board into two separate categories during the first policy stage (Table 19), but the reporting to the Commission did not include separate data regarding each one of these. Therefore, the attainment of the Swedish targets for that period cannot be verified and we will be limited to a comparison of the overall paper & board packaging recycling rates achieved with the paper & board packaging recycling target set by the EU for that period. For the second policy stage, Sweden set one target for the whole paper & board material category and, therefore, no similar limitations exist.

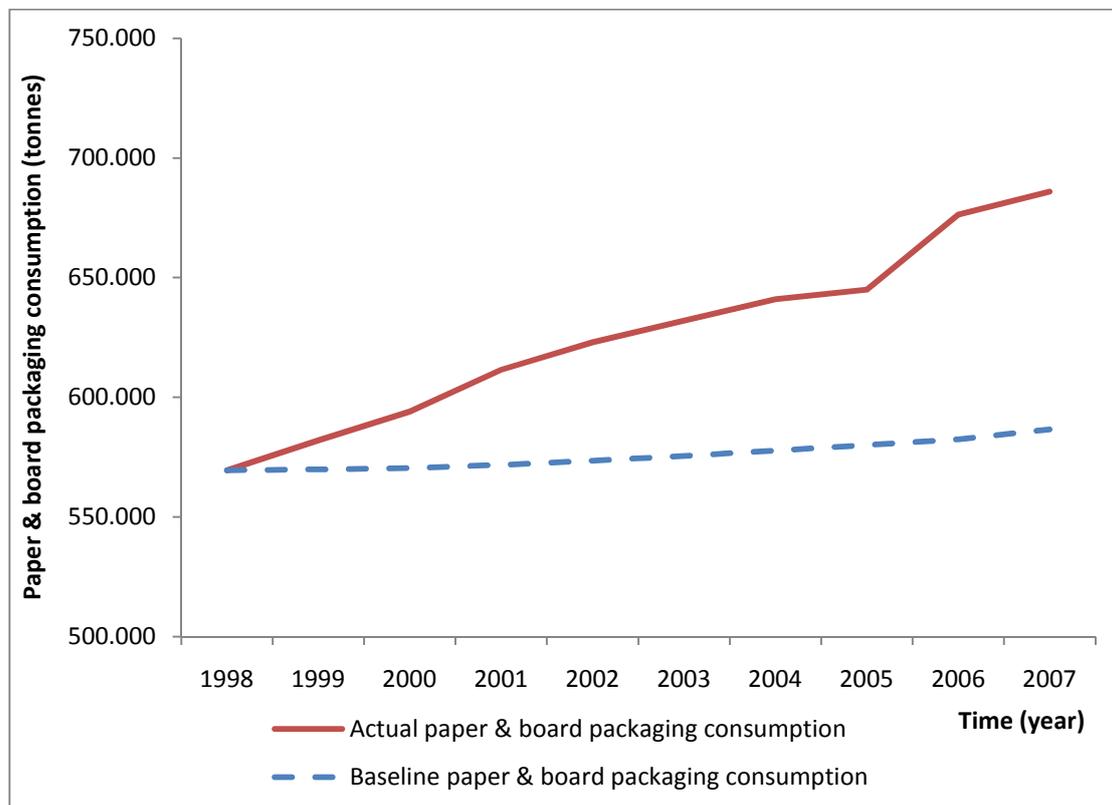


Fig. 58: Actual vs. baseline paper & board packaging consumption in Sweden, 1998-2007

Sweden's failure to achieve any packaging minimization or -at least- a limited growth of packaging waste generation is apparent also in the case of paper & board. Instead of the 17 additional ktonnes of paper & board packaging consumption that would be expected due to the population change between 1998 and 2007, the actual increase amounted to more than 115 ktonnes. The increase reached almost 17% in per

capita consumption terms, being the highest among the Nordic countries. At the same time, the paper & board packaging intensity of use was reduced by 9%; even this cannot be considered as a particularly good performance, however, since Finland, for example, achieved a reduction of the IU for the same material that was more than double of the Swedish one.

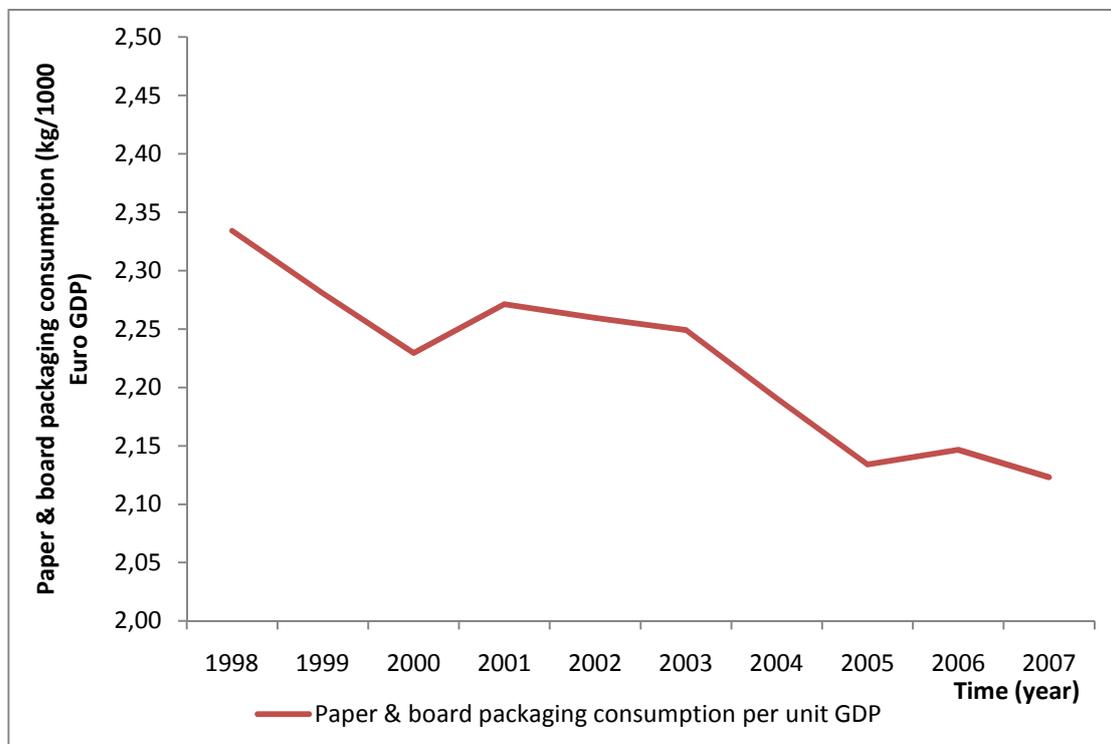
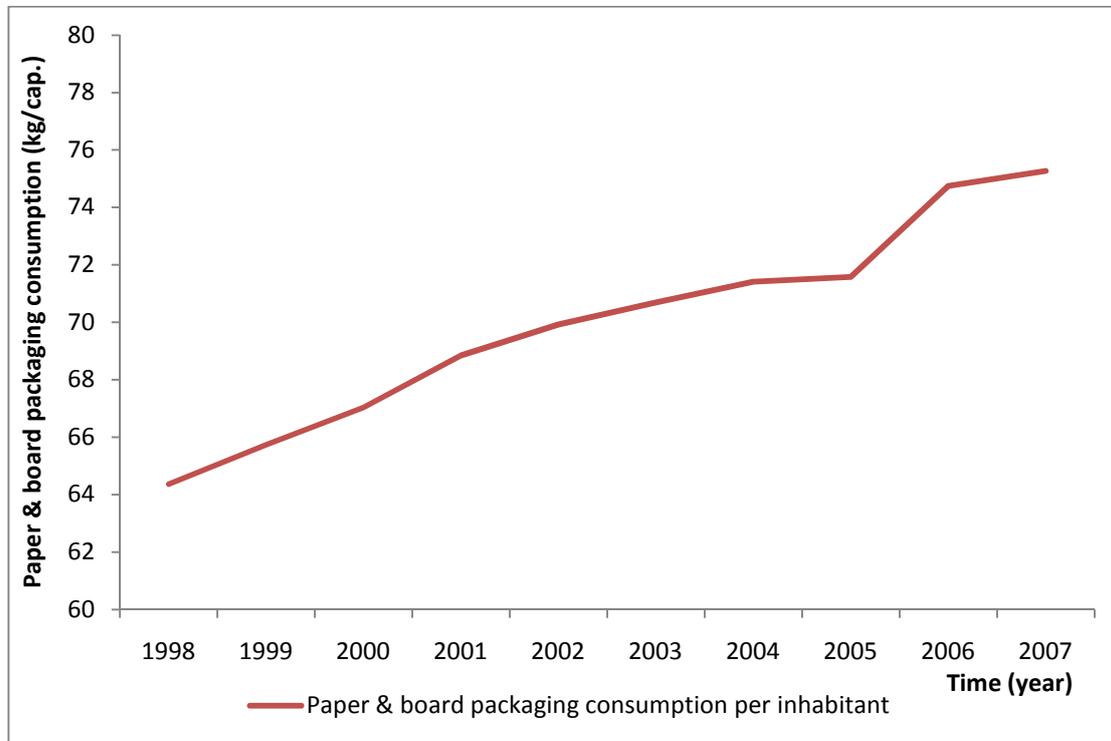


Fig. 59-60: Paper & board packaging consumption per inhabitant in Sweden, 1998-2007 - Paper & board packaging consumption per unit GDP in Sweden, 1998-2007

Looking into the recycling rates for paper & board packaging (Fig. 61), the first remark that can be made is that an initial decline is observed in this case also; Sweden recorded a decrease of more than twenty percentage points during the first two years. Once again, the turning point is the year 2001 and a steady increase has been maintained ever since, without reaching, however, the 1998 levels. The 2003 spike in overall packaging recycling (Fig. 56) appears to have been caused by the paper & board recycling rate for that year; the fact that this was a single-year occurrence, after which the previous levels were reached again, leaves room for the assumption that statistical factors could be responsible for it. The high recycling rates at the beginning of the decade had given Sweden the first place among the group members in 2001, but by 2007 it had fallen behind the forerunners by at least ten percentage points.

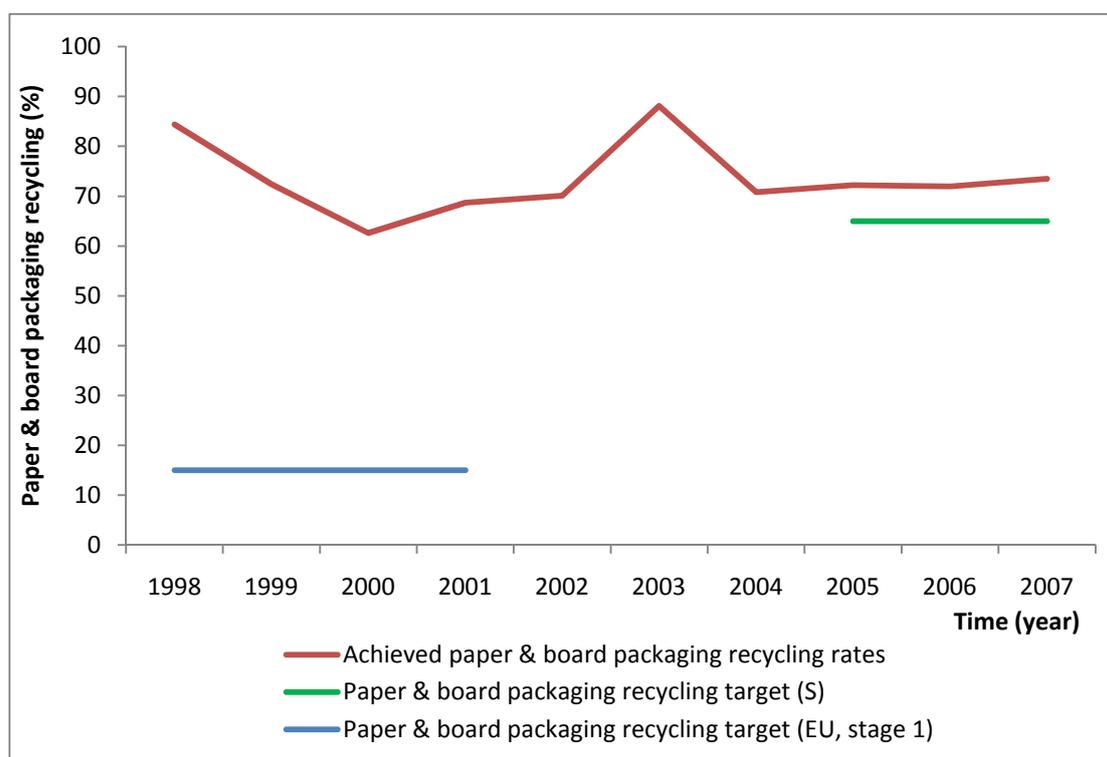


Fig. 61: Paper & board packaging achieved recycling rates vs. EU and national targets in Sweden, 1998-2007

7.2.3.2. Glass

The following section will present the developments regarding the glass packaging consumption (absolute and per capita), intensity of use and recycling against the targets set by Sweden during the period 1998-2007.

In order to comprehend these developments, the functioning of the alcohol market should first be explained. There is a government monopoly in Sweden on the sale of any beverage with an alcohol content above 3.5% by volume. A state-owned chain of retail stores (Systembolaget, the Swedish Alcohol Retail Monopoly) is the only legally licensed vendor of such beverages. Moreover, heavy taxation has been imposed on beer (reduced in 2008), wine and other alcoholic beverages, leading to

vast amounts of such products being privately imported from neighboring countries (Estonia, Germany). By some accounts, if these quantities of glass packaging were to be included in the national statistics, they would raise the material's consumption in Sweden by about 20% [Kaysen & Jakobsen, 2003].

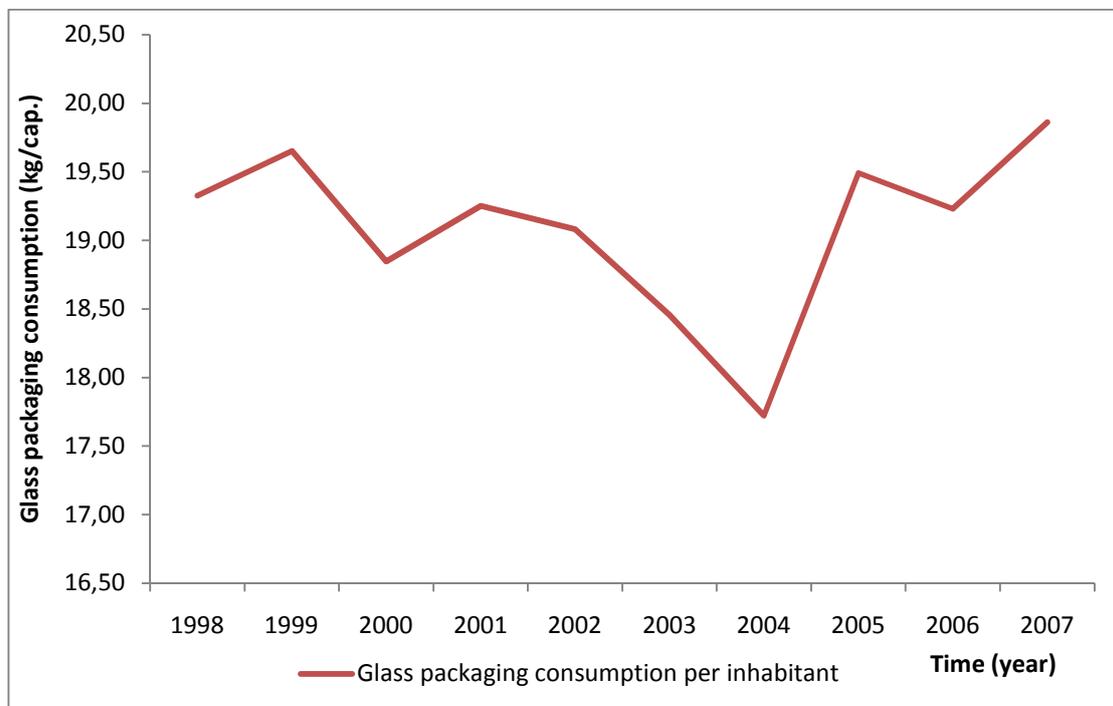
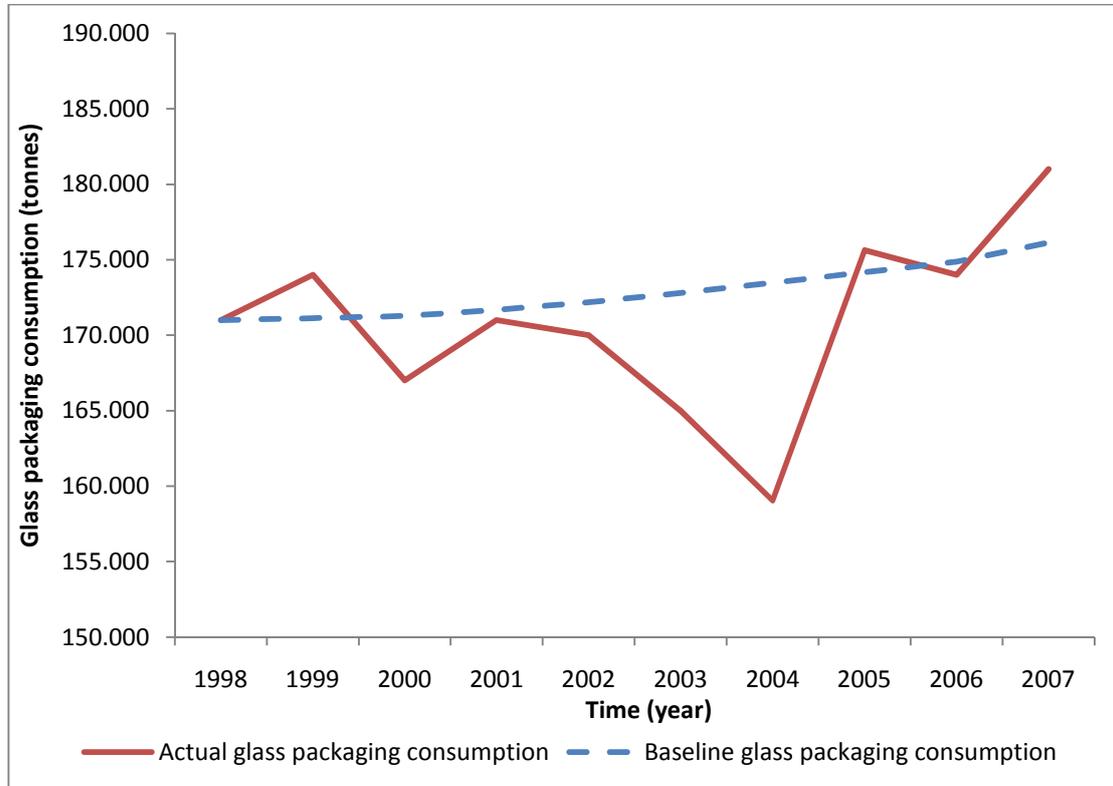


Fig. 62-63: Actual vs. baseline glass packaging consumption in Sweden, 1998-2007 - Glass packaging consumption per inhabitant in Sweden, 1998-2007

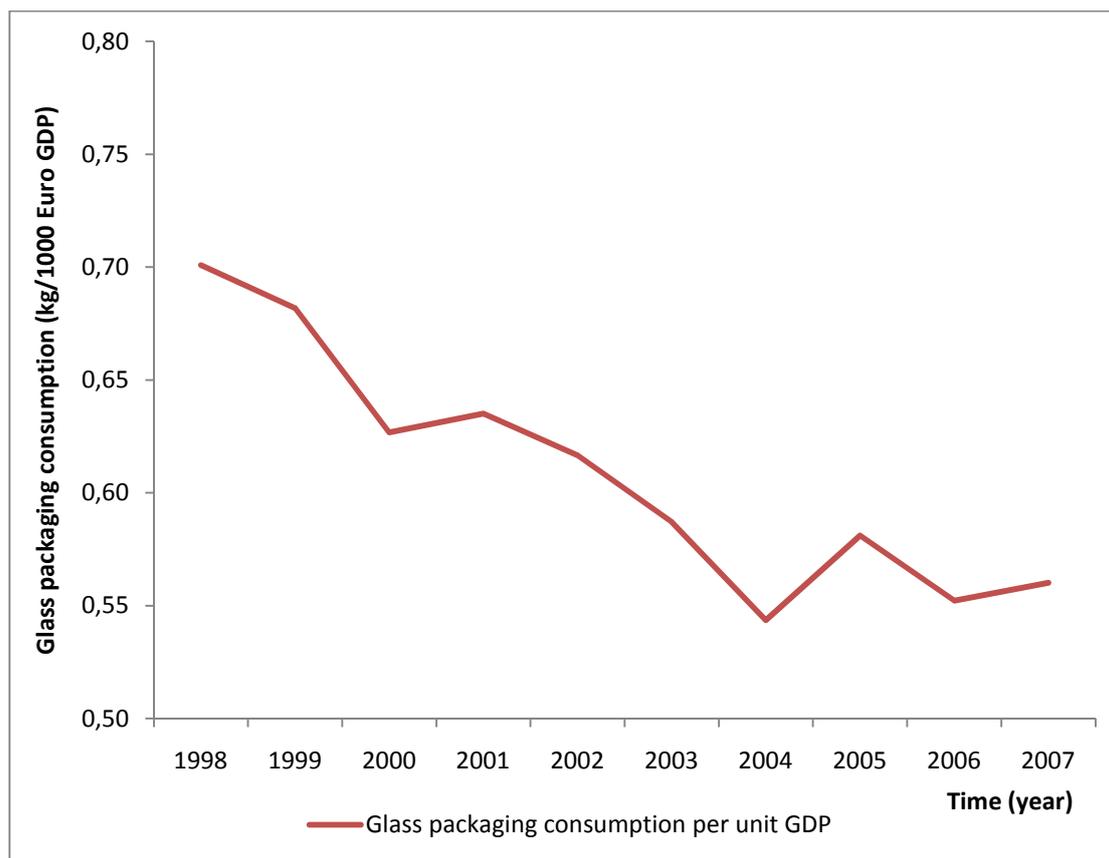


Fig. 64: Glass packaging consumption per unit GDP in Sweden, 1998-2007

Fig. 62 and 63 demonstrate a striking reduction of the glass packaging consumption in Sweden between 2001 and 2004, resulting to the actual consumption levels in 2004 being more than 14 ktonnes lower than the baseline for that year. This decline corresponds exactly with the reduction in the market share of Systembolaget from 65% to 54% (Fig. 65) during that period [Norström & Ramstedt, 2008]. This development suggests that the Swedish consumers were purchasing increasing amounts of alcohol abroad; these privately imported glass containers were not registered in the consumed packaging amounts, leading to the glass packaging waste generation decrease observed above.

Systembolaget sales started rising again after 2004 (58% market share in 2005) and the consumption statistics responded accordingly, reaching again the baseline levels. The actual figures at the end of the decade were only slightly higher than the baseline (5 ktonnes) and the per capita consumption had increased by less than 3%. It is quite interesting that one of the few cases where the consumption growth levels were satisfactory compared to those of the other Nordic countries was that of glass; the fact that this was not a result of policy interventions but simply of the consumption patterns of the Swedish is a further argument supporting the idea of Sweden's packaging waste minimization failure.

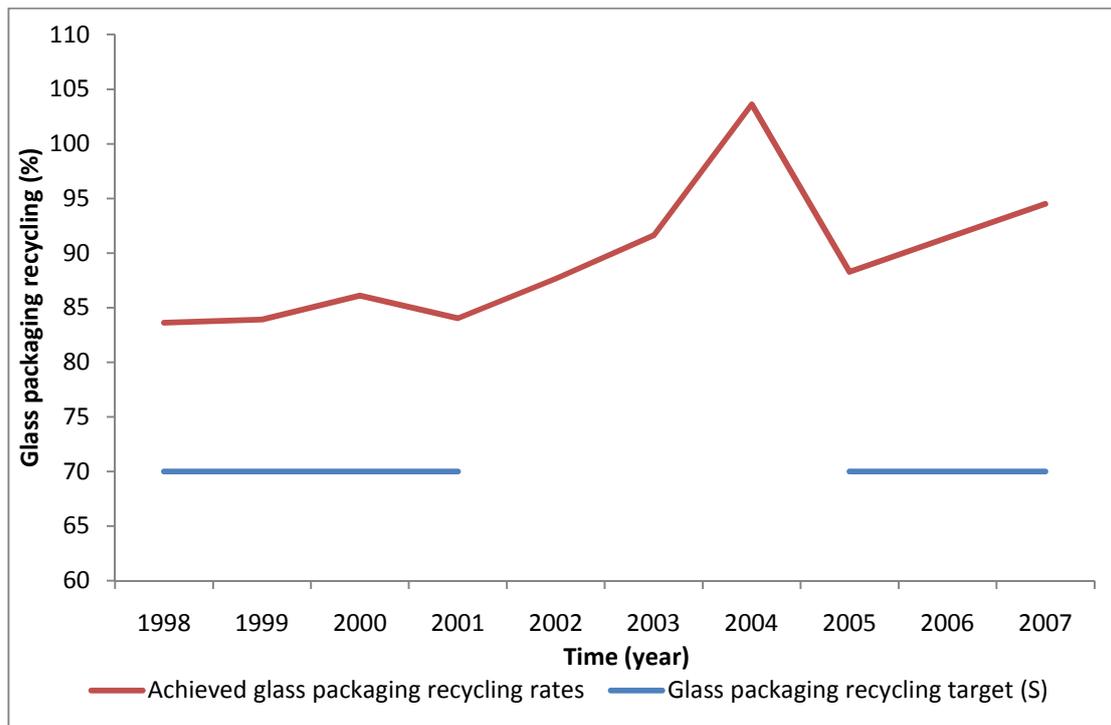
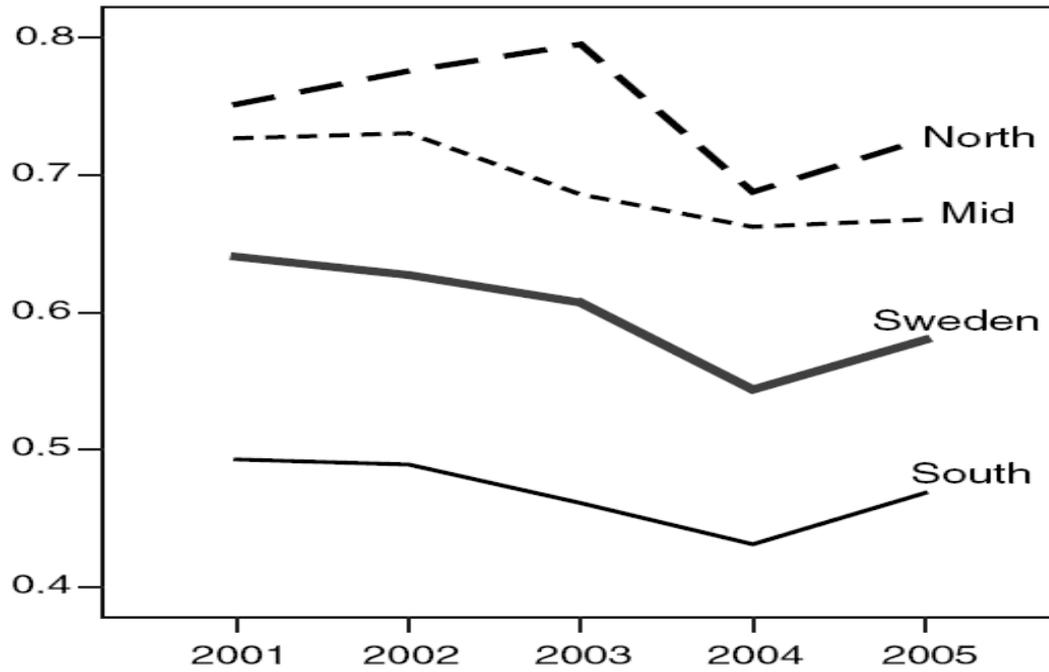


Fig. 65-66: The nationwide and per region market shares of Systembolaget (Y-Axis), 2001-2005 [Norström & Ramstedt, 2008] - Glass packaging achieved recycling rates vs. national targets in Sweden, 1998-2007

The consumption pattern is also influencing the development of the recycling rate. The trend between 2001 and 2005 corresponds again precisely with the market share of Systembolaget; during its decline the recycling rate was rising, reaching its peak in 2004 (above 100%), which was followed by a steep reduction in 2005. During these years, an increasing amount of unregistered glass containers was heading towards the

glass packaging collection system, with the 2004 rate signifying that the amount of recycled glass packaging was larger than what was officially considered to have been consumed in the country.

7.2.3.3. Metal

The following section will present the developments regarding the metal packaging consumption (absolute and per capita), intensity of use and recycling during the period 1998-2007. The structure of the national metal packaging recycling targets for both policy periods does not allow the verification of the targets attainment due to the lack of the data necessary; therefore, the achieved recycling rates will be presented against the EU targets.

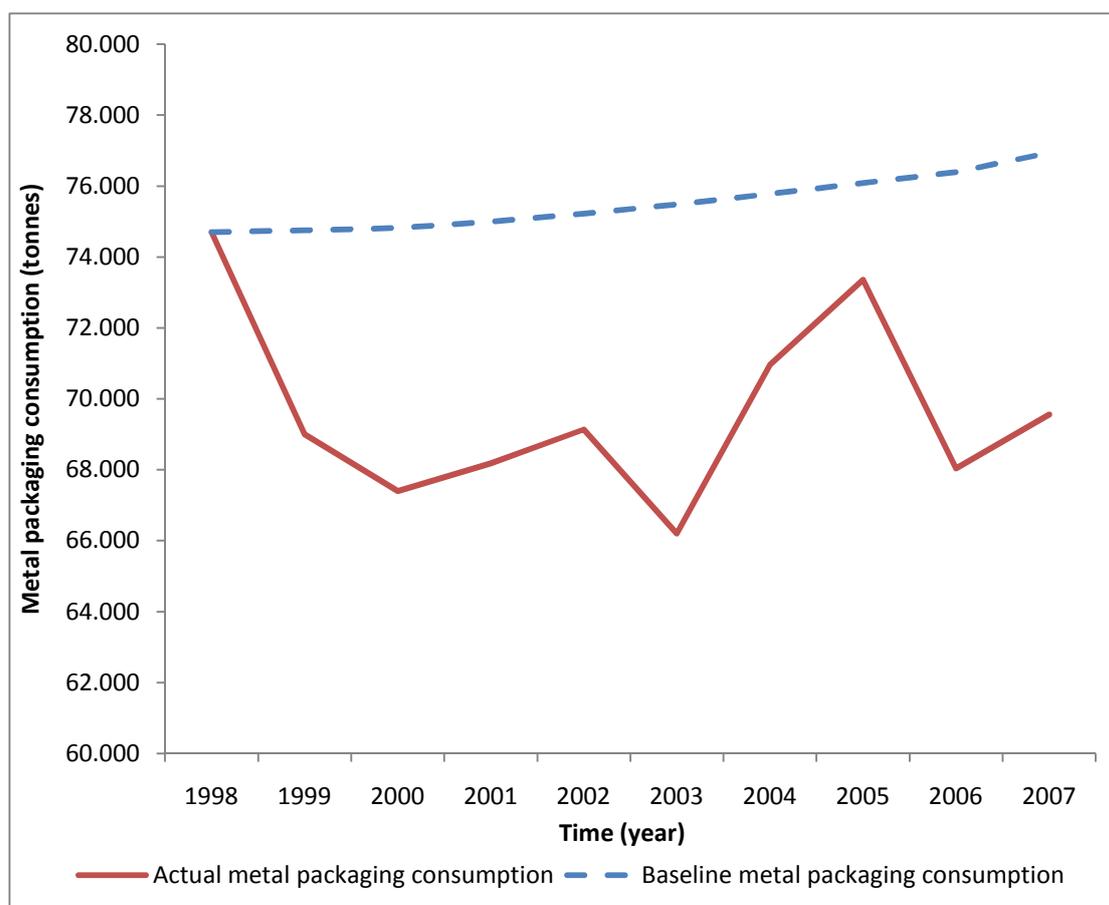


Fig. 67: Actual vs. baseline metal packaging consumption in Sweden, 1998-2007

The metal packaging consumption in Sweden has been kept below the baseline throughout the entire period, with the difference in 2007 being larger than 7 ktonnes. The per capita reduction, however, amounted to little more than 9.5% (Fig. 68), a figure much lower than the respective one in the Danish case; nevertheless, it should be kept in mind that the other group members increased their metal packaging consumptions. The same is true for the metal packaging IU, the close to 30% reduction of which is quite lower than that achieved by Denmark. The conclusion is that even when Sweden is successful in reducing the consumption of a packaging material, it is still falling quite behind the forerunners.

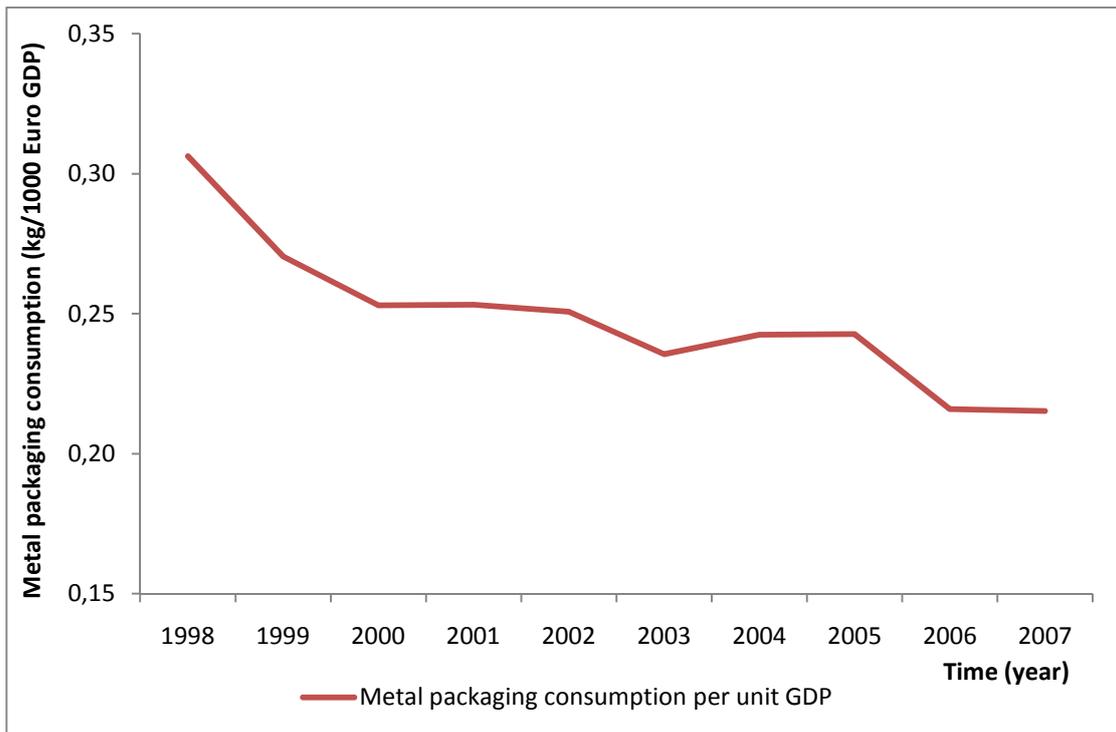
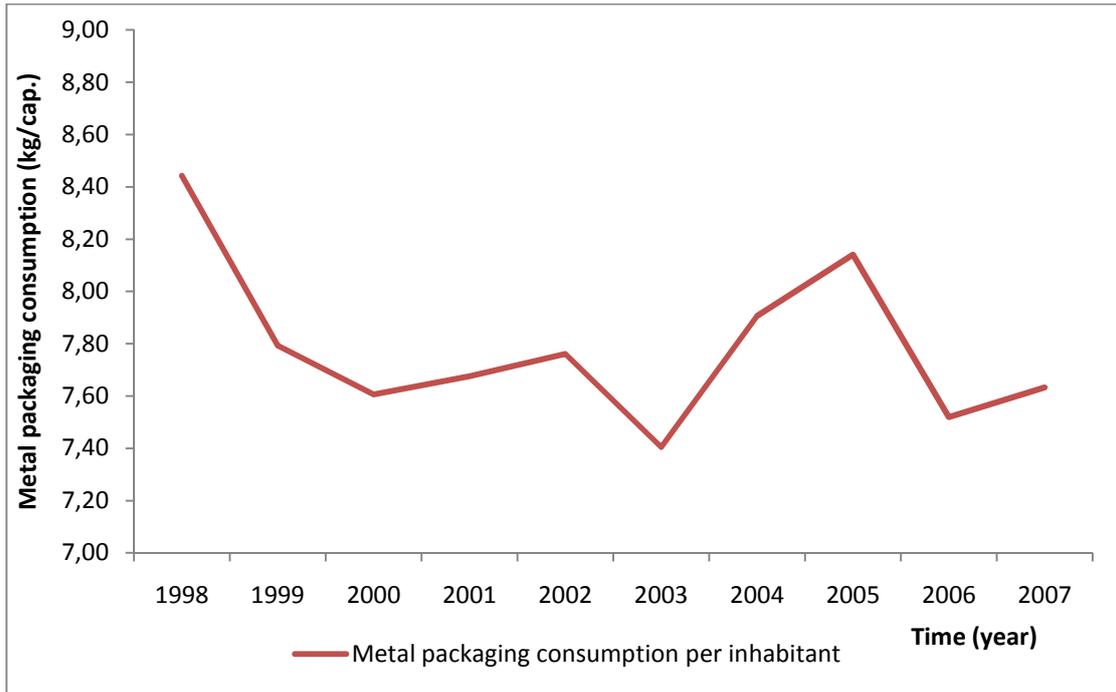


Fig. 68-69: Metal packaging consumption per inhabitant in Sweden, 1998-2007 – Metal packaging consumption per unit GDP in Sweden, 1998-2007

The trend that can be characterized as a “recycling crisis” between 1998 and 2000 is observed again in the case of metal packaging (Fig. 70); the rate fell by close to thirty percentage points during that period. The situation improved once again after 2000, but it did not become considerably better; a new gradual decrease in metal packaging recycling is being recorded after 2003 and in 2006, after a further steep drop by almost twenty percentage points, the achieved rate fell below the EU target

for metal packaging. These figures suggest that it is highly unlikely for the – seemingly quite ambitious- national targets concerning the various types of metal packaging to have been attained. The Swedish Ministry of the Environment [2003] stated that a large number of steel plate beverage cans is being imported in Sweden, which -although they are covered by producer responsibility- are not part of the deposit system. Additionally, the deposit system’s credibility is undermined by the consumers’ inability to distinguish between steel and aluminum cans and to obtain refunds for every can they purchase.

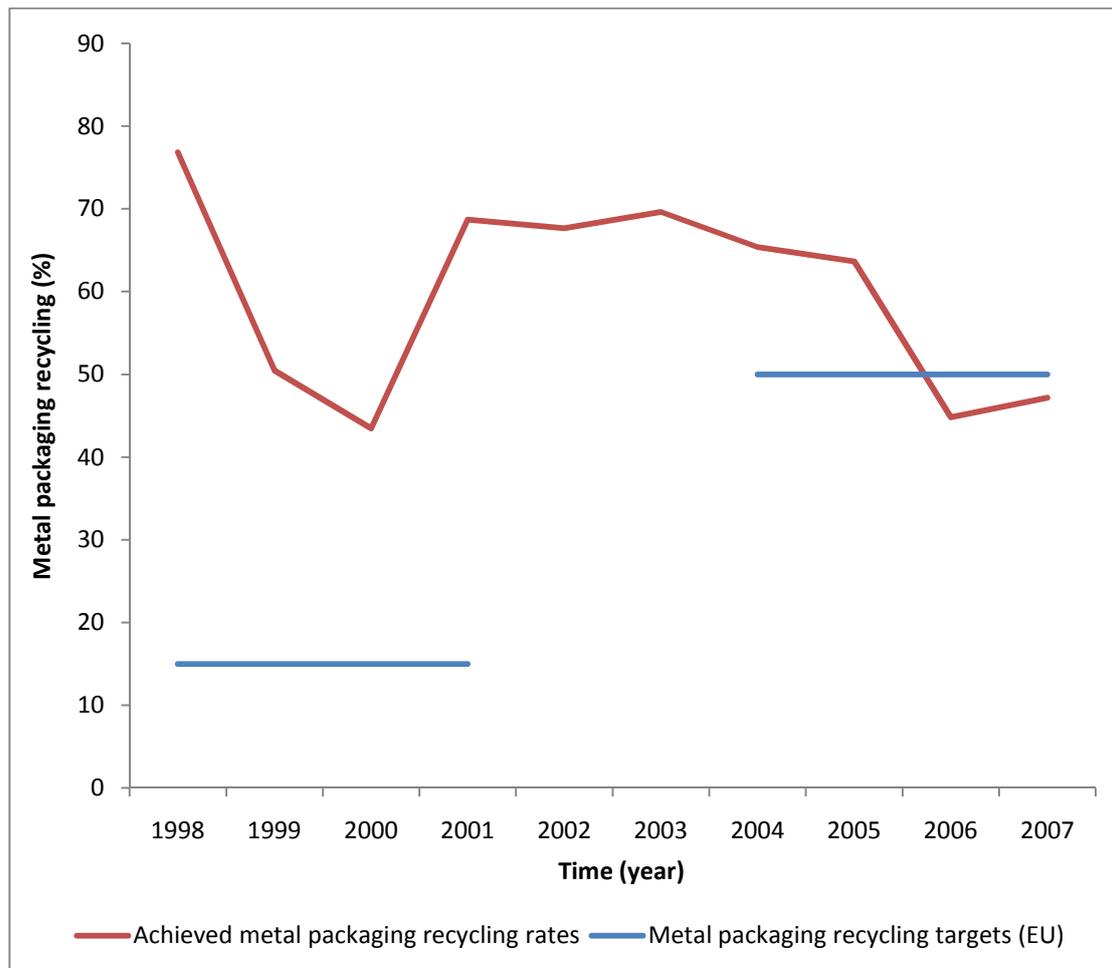


Fig. 70: Metal packaging achieved recycling rates vs. EU targets in Sweden, 1998-2007

7.2.3.4. Plastic

The following section will present the developments regarding the plastic packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007. The structure of the national plastic packaging recycling targets for both policy periods does not allow the verification of their attainment due to the lack of the data necessary; therefore, the achieved recycling rates will be presented against the EU targets.

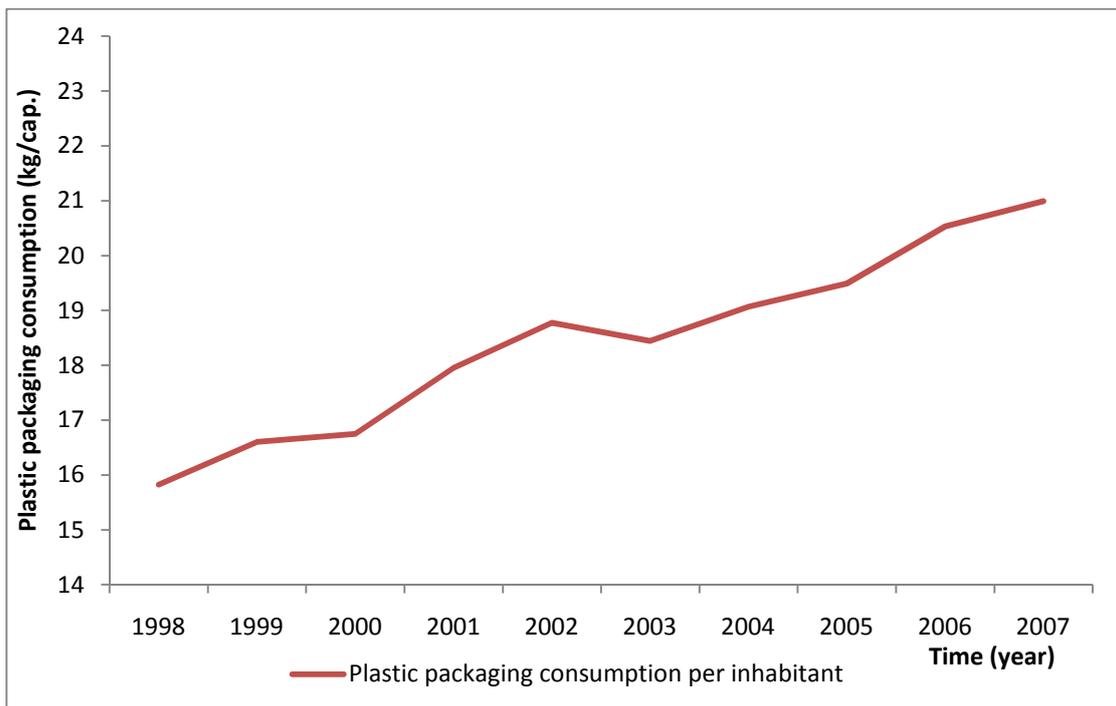
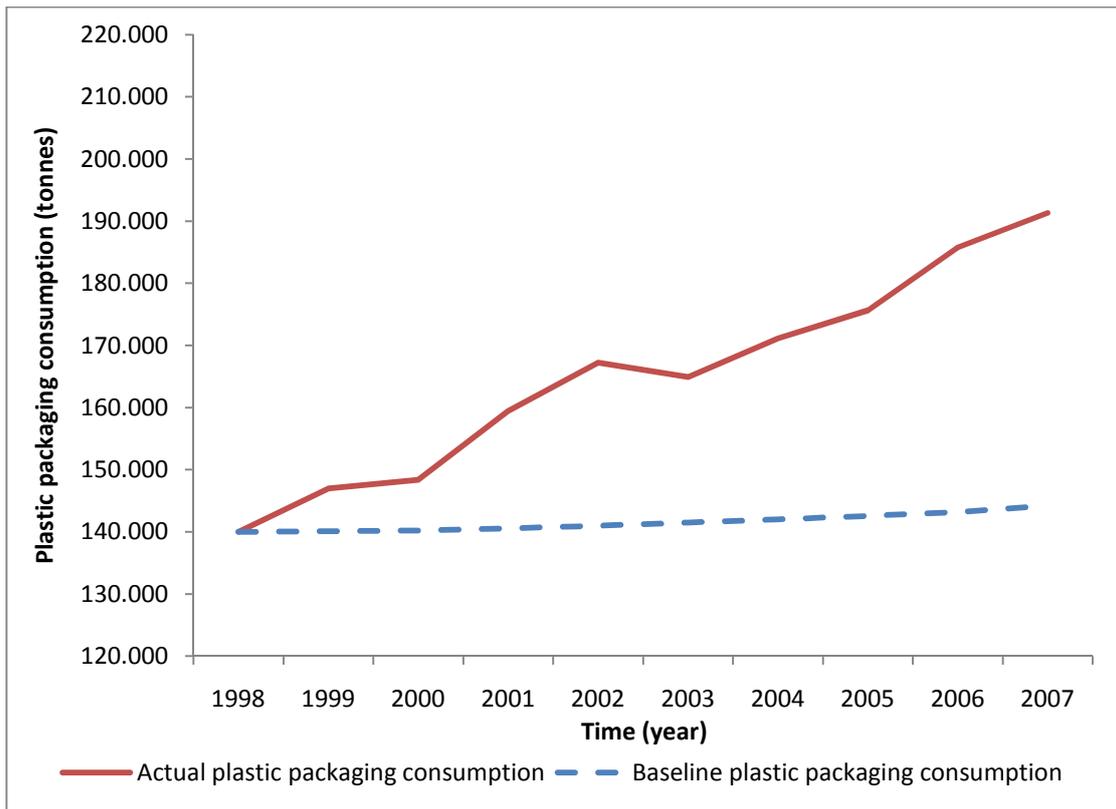


Fig. 71-72: Actual vs. baseline plastic packaging consumption in Sweden, 1998-2007 - Plastic packaging consumption per inhabitant in Sweden, 1998-2007

According to the baseline consumption growth scenario, the plastic packaging consumption in Sweden would rise by a little more than 4 ktonnes between 1998 and 2007; the actual rise, however, was higher than 50 ktonnes making plastic one more example of Sweden’s failure to control the increase of its packaging demand. A rise

of the material's per capita consumption by more than 30% was recorded during the decade, at the same time when the respective increases in Denmark and Finland were merely 6%-8%. Additionally, this is one of only three cases (outside of Norway) where the intensity of use of a packaging material was increased.

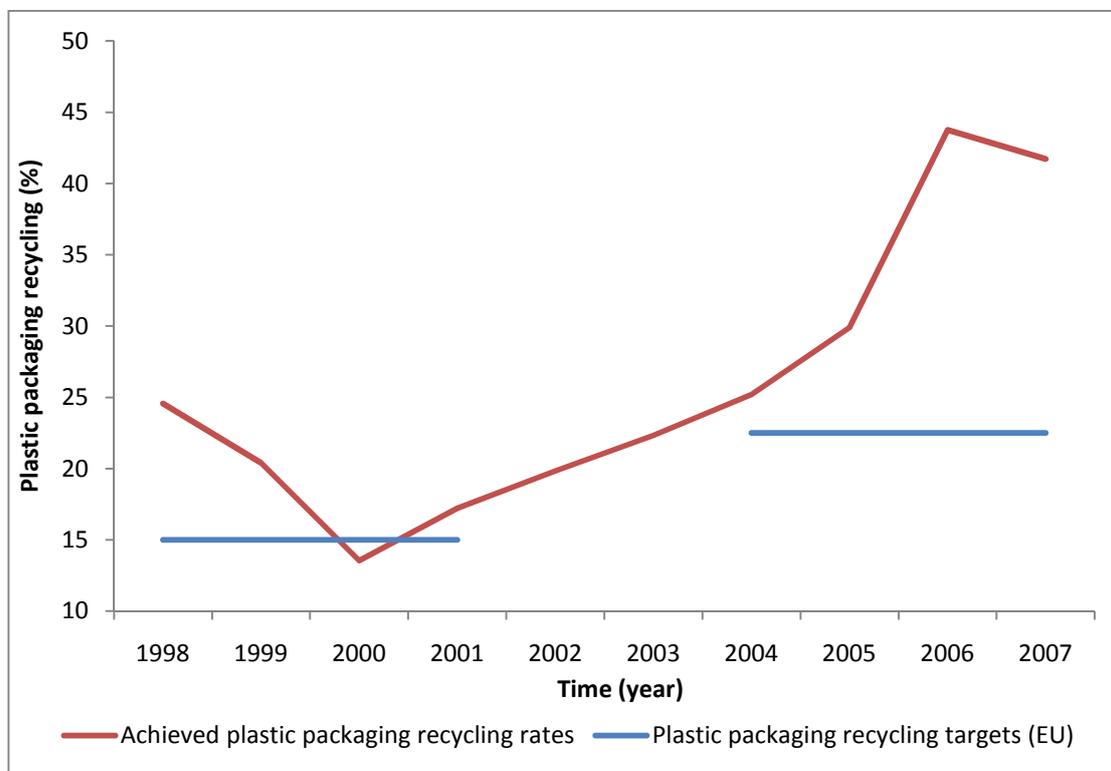
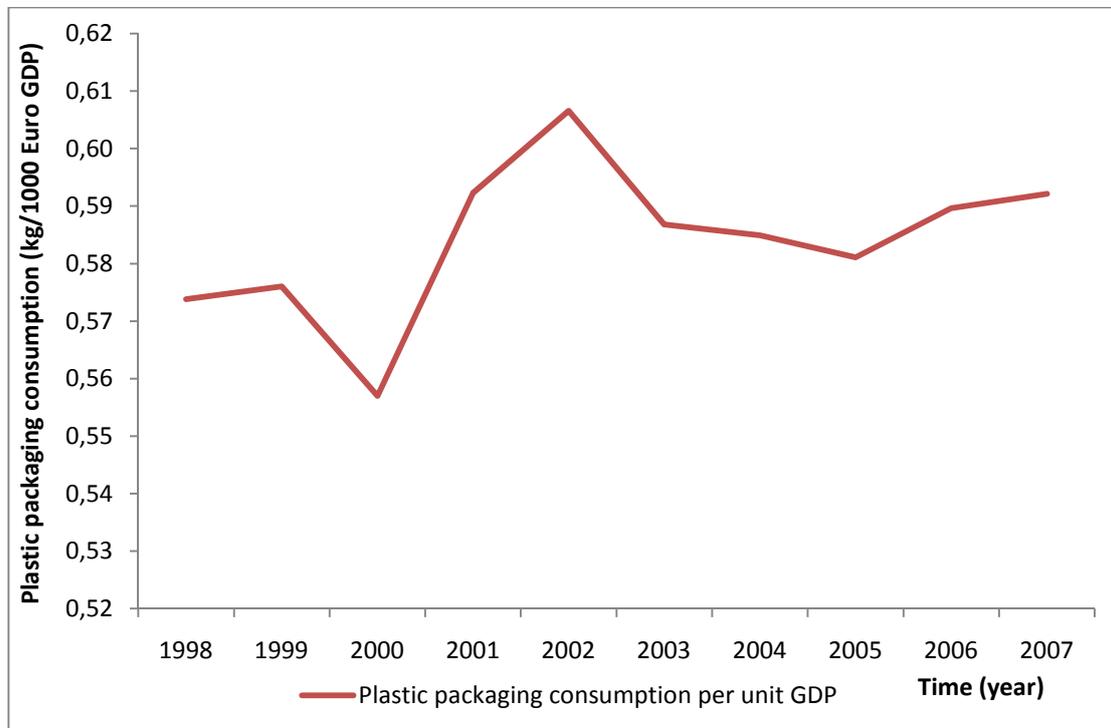


Fig. 73-74: Plastic packaging consumption per unit GDP in Sweden, 1998-2007 - Plastic packaging achieved recycling rates vs. EU targets in Sweden, 1998-2007

Once again, a decrease in recycling was recorded between 1998 and 2000, a period during which the plastic packaging recycling rate was almost cut in half (Fig. 74). A continuous rise of the rate is observed after that point, resulting in a threefold recycling increase up to 2006; in order to achieve this, the absolute amount of recycled plastic packaging had to increase by 300%. The EU recycling target for 2008 was already attained in 2003. The fact that Sweden has managed to be the best-performing Nordic country in this sector in 2007, as well as in 2001, suggests that both PlastKretsen and Returpak have worked in an effective way.

7.2.4. Discussion

Although the primary target of the Swedish producer responsibility scheme is declared to be the reduction of packaging weight and volume, there have been no quantifiable targets for a reduced generation of packaging waste -as was the case in Finland-, or at least certain policy measures aiming at waste minimization –such as the financial instruments used by the Danish government-. Therefore, without any concrete enforcement efforts in place, the orientation towards packaging waste minimization has not managed to produce any tangible results as demonstrated in Fig. 53-54.

The lack of overall packaging recycling targets that would be stricter than those enforced by the EU can be perceived as a shortcoming of the Swedish policy, given the very high recycling levels that were reached by 1998. This lack of incentives for further improvement may have been the driving force behind the significant drop of the rates to levels closer to the targets during the first years of the decade examined. Close to the end of the first policy stage the recycling rate began to rise again; the assumption that this rise was partially caused by the anticipation of more ambitious new targets can be made.

The turning point, however, also corresponds exactly with the introduction of the landfilling waste tax in 2000, which appears to be the main reason for the subsequent developments; its influence is also obvious in all separate packaging materials with glass being the only exception. There has been a sustained improvement of the overall packaging recycling rate from that year on, and the 1998 levels of overall packaging recycling were approached again in 2007. The ban imposed on the landfilling of combustible waste in 2005 -in combination with the incineration tax- could have had a positive effect towards the end of the decade.

It should be noted that glass was the only packaging material whose recycling rate did not decline between 1998 and 2000. The above 80% levels were maintained, a fact that can be probably attributed to the high target set, which did not allow any significant declines if it was to be attained. The existence of the glass collection system since 1986, preceding the establishment of the other PROs by almost a decade, is also a factor that should have resulted in a more widespread and effective operation of the system.

Fig. 75 demonstrates the development of the share of each packaging material in the overall packaging consumption between 1998 and 2007.

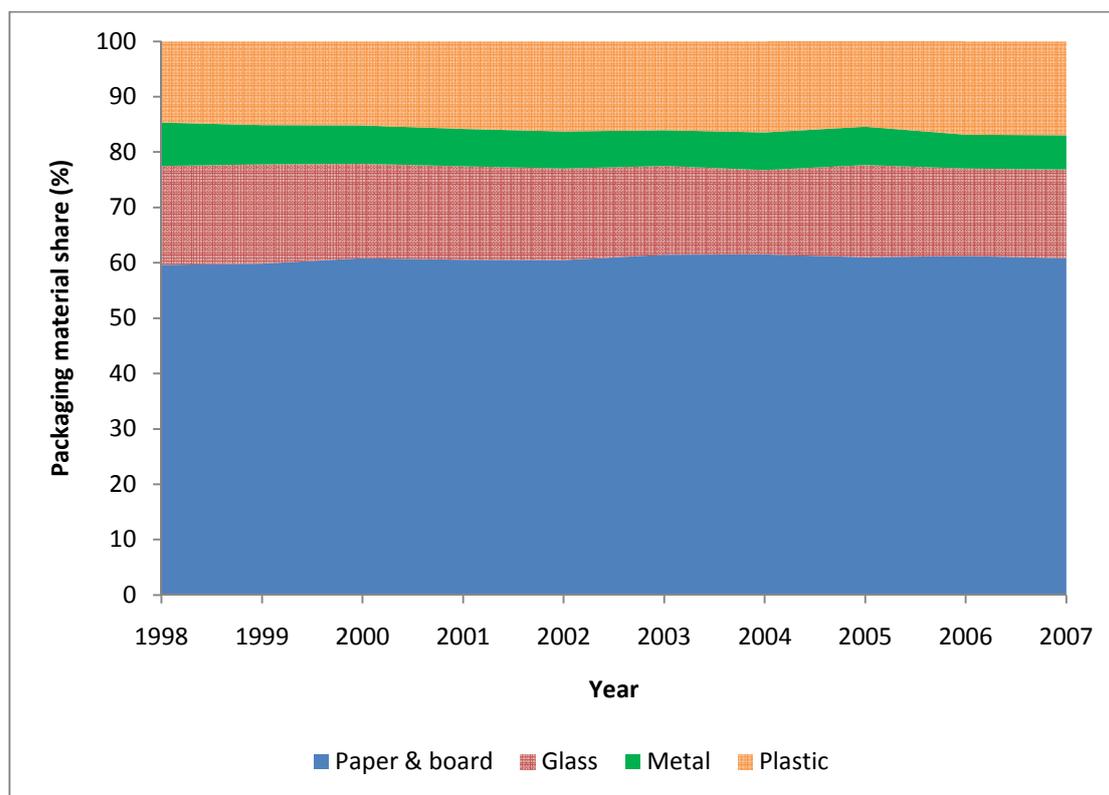


Fig. 75: The development of the share of each packaging material in the overall per capita packaging consumption in Sweden, 1998-2007

Generally, no significant changes have been observed in the share of each packaging material throughout the period examined. Considering both the consumption levels and the intensity of use for each material, as presented above, it is observed that between 1998 and 2007 paper & board and glass packaging went through a weak dematerialization process, metal packaging through strong dematerialization, while for plastic packaging a materialization process was recorded.

7.3. Concluding remarks

The implementation of the Extended Producer Responsibility principle is definitely the main element of the Swedish waste management policy. It is claimed that the system aims primarily at packaging waste minimization; however, the actual results suggest that Sweden is the Nordic country with the highest rise in paper & board packaging per capita consumption and with the second highest rise in overall and plastic packaging per capita consumption. This failure to control the packaging consumption growth is believed to be caused by the absence of any quantifiable targets or concrete policy measures that would enforce the realization of the theoretical concept through –for example- the promotion of reusability or improved packaging design.

The situation is relatively better with regard to material recycling. The introduction of the waste tax on landfilling has reversed the trend of decreasing recycling rates between 1998 and 2000 and led to considerably improved results. However, the 1998 recycling levels had not been reached again up to 2007 in many cases (including overall packaging). Sweden's efforts have been more successful concerning the glass and plastic packaging recycling rates, which appear to be consistently improving as time goes by.

It is being suggested that the main problem of the packaging waste collection systems, with an apparent influence on the achieved recycling and total recovery rates, is the inability to reach all consumers and to provide sufficient motivation for using them. The Ministry of Environment suggests that the collection systems should be expanded and come nearer to where the actual waste generation takes place. In order for this to happen, a closer cooperation between the PROs and the local authorities is required so as to adapt packaging collection systems to municipal waste collection systems, improve information provision to the citizens and resolve differences regarding the division of responsibilities.

Apart from the introduction of the producer responsibility scheme and the deposit systems for beverage containers, the Swedish packaging waste management employs several more policy instruments. The financial ones include the landfilling tax, the waste incineration tax and some municipal incentives aiming to guarantee improved participation of the citizens in the collection systems. On an administrative level, bans are enforced on the landfilling of combustible and organic waste, while there is also a multitude of campaigns and labeling initiatives on the informative level. When the packaging chain is considered, however, it becomes obvious that its phases above the waste collection level are not covered by any specific policy measures.

As far as the goals attainment is concerned, having a clear overview is not always possible because of the structure of the Swedish national targets in several cases. The verification of these targets' attainment requires the possession of data that were not available for this project. It can be argued, nevertheless, that Sweden generally manages to stay above the targets prescribed by the EU, although the attainment of some of its national targets could be deemed as doubtful. A notable exception of performance worse than the required is metal packaging recycling, whose 2007 levels were lower than the 2008 EU goal.

8. Policy evaluation: Norway

Norway is the only non-EU member among the countries studied in this project. Nevertheless, it maintains close ties with the EU, it is a member of the European Environment Agency and of the European Economic Area, as well as a participant in several EU programs, bodies and initiatives. Additionally, the focus on environmental issues is very strong in this country. These factors, combined with the fact that Norway has started reporting its packaging data to the Commission in 2006, make it interesting to examine how the policy field has evolved there during the same post-Directive period that has been studied in the other Nordic states.

The first part of the chapter will offer an overview of the Norwegian policy background and will describe all aspects of packaging use and packaging waste management in the country. The second part focuses on the results achieved by Norway and the developments regarding the packaging consumption, intensity of use, recycling and total recovery. A discussion on the data used in the case of Norway for the purposes of this project has been already made in Chapter 4.

8.1. Policy background

1994	Beverage containers taxation system
1995	EPR scheme introduction through voluntary agreements
1999	Deposit system for one-way beverage packaging – Waste landfilling and incineration taxation system

Table 21: Policy measures currently in effect in Norway (non packaging-specific measures that are relevant for packaging waste management are also included)

8.1.1. Packaging waste management

The Extended Producer Responsibility principle is the foundation of the packaging waste management policy system also in the case of Norway. What distinguishes the Norwegian example, however, from the Swedish or the Finnish ones is that the introduction of the EPR scheme was not solely a result of governmental legislative initiatives, but primarily the outcome of voluntary agreements between the state and the business stakeholders.

The local authorities in Norway have the responsibility for the collection and treatment of all household waste. In addition to this, they have the opportunity to cooperate with the established producer responsibility organizations: they can deliver waste to them, upon agreement, and receive payments for these quantities [The Environment Exchange, 2001].

The business sector, on the other hand, has entered since 1995 into a number of agreements with the government regarding the reduction, collection and recovery of packaging waste; they cover plastic, metal, carton packaging/drinking cartons, and corrugated cardboard/cardboard [Klif, 2010]. No agreement exists in the case of glass packaging but the industry operates as if one was actually in place. Regulations are

present only in the case of the recycling systems for beverage packaging. In order to offer some insight on what the voluntary agreements prescribe, the main points of the one covering metal packaging are presented here:

- The parties involved are the Ministry of the Environment and the representatives of the metal packaging chain,
- The purpose of the agreement is *“to reduce the environmental problems caused by metal packaging waste by reducing the quantity of such waste, by packaging optimization and by ensuring that such waste is collected and recovered whenever this is appropriate taking into account environmental and resource considerations and economic factors”*,
- The obligations of the metal packaging chain include the following:
 - the establishment and operation of a waste collection and recovery scheme,
 - the cooperation with the other packaging chains in order to optimize packaging (reduction of overall environmental impact, including the quantity of metal packaging waste),
 - the annual reporting of the work done and of the results achieved on packaging optimization, including overviews of the future plans,
- Targets are set for the collection and recovery of metal packaging waste,
- Information measures that are necessary for the implementation of the agreement shall be taken by the packaging chain,
- The annual amounts of produced, imported and exported metal packaging, along with the collected and recovered metal packaging waste quantities shall be reported to Klif (Klima- og forurensningsdirektoratet, the Norwegian Climate and Pollution Agency¹⁵).

The companies that produce or import packaging for the Norwegian market have the option of collecting their own packaging waste. Usually, however, they join one of the material companies that have been established in order to help producers undertake their responsibilities as described in the voluntary agreements. Five material PROs currently exist in Norway:

- Norsk Returkartong (carton packaging, beverage cartons)
- Norsk Resy (paper & board packaging, mainly corrugated and solid board)
- Norsk Glassgjenvinning (glass packaging)
- Norsk Metallgjenvinning (metal packaging)
- Plastretur (plastic packaging).

These companies are liable to ensure the attainment of the targets set for the collection and recovery of their respective materials; in order to do so they establish their separate collection schemes.

¹⁵ Up to January 2010 Klif was named SFT (Statens forurensningstilsyn, the Norwegian Pollution Control Authority)

The material PROs have also established an administrative company; Grønt Punkt Norge (formerly named Materialretur) is responsible since 1997 for the collection of licensing and recovery fees from the firms that put packaging on the Norwegian market. Its members that have an annual turnover below a specified threshold can pay a standard fee every year and are not obliged to report their packaging consumption, while the members belonging to the next turnover bracket can pay a standard fee per annum or declare their packaging consumption if they prefer so [Grønt Punkt Norge, 2010]. Grønt Punkt Norge is a member of the GreenDot scheme (as are REPA and PYR in Sweden and Finland respectively) and its members can use its labeling on their products in order to indicate that they have paid for the waste collection and recovery activities. Since 2008, Grønt Punkt Norge also operates the recovery schemes for beverage cartons, carton packaging and plastic packaging on behalf of the respective PROs.

8.1.1.1 Policy measures implemented

The pre-Directive era

Norway has a long-standing tradition of environmental policy initiatives; in the packaging field, recycling activities have existed since 1931 for fiber-based materials [Kaysen & Jakobsen, 2003]. A tax on non-refillable beverage containers was in place between 1974 and 1993 [The Norwegian Ministry of Finance, 2010]. The latter was replaced in 1994 by a new and broader beverage containers taxation system, which is differentiated based on the return rates achieved. This scheme consists of a fixed tax on all one-way containers and a variable tax on refillable and one-way containers, which depends on their return rates. The Ministry of the Environment decides annually on the level of the variable component of the tax. This taxation scheme is still in place for glass, PET and metal containers and has resulted to about 98% of soft drinks containers being refillable [ECOLAS-PIRA, 2005].

The current situation

The two major components of the Norwegian policy regarding the management of packaging waste (EPR and the beverage packaging tax) have already been discussed. A development related to the latter was the voluntary establishment of Norsk Resirk in 1999 by the industry and the retail trade sector. This company operates the deposit system for one-way beverage packaging (non-refillable plastic bottles and metal cans). According to its website, it is a non-profit company with the sole purpose of operating an effective return scheme aiming at the collection and recycling of as much one-way beverage packaging as possible [Norsk Resirk, 2010]. Norsk Resirk claims that 90% of the plastic bottles and 92% of the metal cans are returned and that all collected packaging is recycled. Finally, although not focused strictly on packaging, the taxes imposed on the landfilling and incineration of waste (1999) and the ban imposed on the landfilling of organic waste (2009) are still having an influence on packaging waste management in Norway.

8.1.1.2. Material flows

Fiber-based materials

The major share of the recovered paper & board packaging is transport packaging from the industry and trade (wholesale/retail) sectors. The main principle behind the operations of Norsk Resy is that the producers shall bear no costs related to the delivery of sorted paper packaging waste to the waste paper collectors, stimulating in this way the maintenance of a balanced recycling and recovery system [Kaysen & Jakobsen, 2003]. A waste producer that exceeds a specified annual quantity of paper & board packaging is obliged to handle, sort and deliver the used packaging for recovery. Norsk Resy has contracts with nearly all private paper collectors and municipal waste companies in Norway, which guarantee that paper & board waste can be delivered to them with no cost if they are source separated. Packers and fillers that use composite materials register directly to Grønt Punkt Norge, which calculates their fees on the basis of the materials' share in the packaging.

Regarding carton packaging, the collection takes place primarily from households through municipally organized systems. Returkartong buys source separated packaging waste from the municipalities at fixed prices and the recovery fees paid by the waste producers are used in order to cover the deficit between the sums paid to the local authorities and the income derived from the sales to recycling facilities. It should be noted that the reported collected amounts of carton packaging are based on analyses of samples of the paper & board waste fraction at various sorting facilities [Kaysen & Jakobsen, 2003].

Glass

The local authorities, although they have no obligation to separately collect glass packaging, perform separate collection of this material from private households. Private companies must make their own collection and transportation arrangements, however, and Norsk Glassgjenvinning has built up a system in order to serve particularly them. The material company maintains that all obliged packers, fillers and importers are registered with it because the tax reduction incentive eliminates any benefits of free-riding. In terms of statistics compilation, although private imports are not registered, an extra amount of glass packaging is added to the marketed quantities in order to compensate for them.

Metal

Metal packaging is collected from the households together with glass packaging and private firms have in this case also to make their own arrangements for collection and delivery to Norsk Metallgjenvinning. The packaging on which a deposit is imposed is collected through the system of Norsk Resirk. Norsk Metallgjenvinning also states that the structure of the beverage packaging taxation system is largely responsible for the elimination of free-riding cases among the obliged companies.

Plastic

Four separate collection schemes for plastic packaging exist, depending on the source: trade and industry, fish farming, agriculture and, finally, households. For the first three cases, agreements are made between Plastretur and sorting facilities where the firms can deliver their plastic packaging for free if they are source separated. In the last case, Plastretur has entered into agreements with local authorities for the collection and with sorting facilities for the preliminary handling of sorted household plastic packaging waste [Kaysen & Jakobsen, 2003]. A free-riding problem exists in the case of Plastretur because the identification of all firms that are obliged to register is occasionally difficult.

8.2. Achieved results and analysis

The developments in Norway with regard to the packaging consumption, intensity of use, recycling and total recovery will be presented and discussed in the following paragraphs.

Norway enforces its own national targets for packaging waste, which were first introduced in 1995 in order to cover the period up to 1999. The same targets were maintained during the renewal of the voluntary agreements with the industry in 2003 [Torrissen, 2008], while new goals were introduced after 2008. It should be kept in mind that where no national targets exist, the results achieved will be compared with the EU targets.

	<i>% Recycling (old)</i>	<i>% Total recovery (old)</i>	<i>% Recycling (new)</i>
Corrugated cardboard	65	80	80
Boxboard cartons	50	60	50
Beverage cartons	60	-	95
Glass	-	-	95
Plastic	30	80	30
EPS	50	60	-
Metal	60	-	60

Table 22: Norwegian national targets for packaging waste

8.2.1. Overall packaging consumption

The following section presents the development of the overall packaging consumption in absolute and per capita terms between the years 1999 and 2007, along with the overall packaging intensity of use during the same period.

The overall packaging consumption in Norway has followed a course of continuous growth during the period examined, leading to the actual packaging waste generation levels exceeding the baseline by more than 90 ktonnes in 2007 (Fig. 76). The rise in per capita consumption between 1999 and 2007 reached 22.5% and it was far higher than the respective figures of any other Nordic country, indicating the

alarming inability of Norway to achieve any form of packaging minimization. Even more enlightening is the fact that Norway is the only member of the group where a moderate increase (about 7%) of the overall packaging intensity of use has been recorded during these years (Fig. 78).

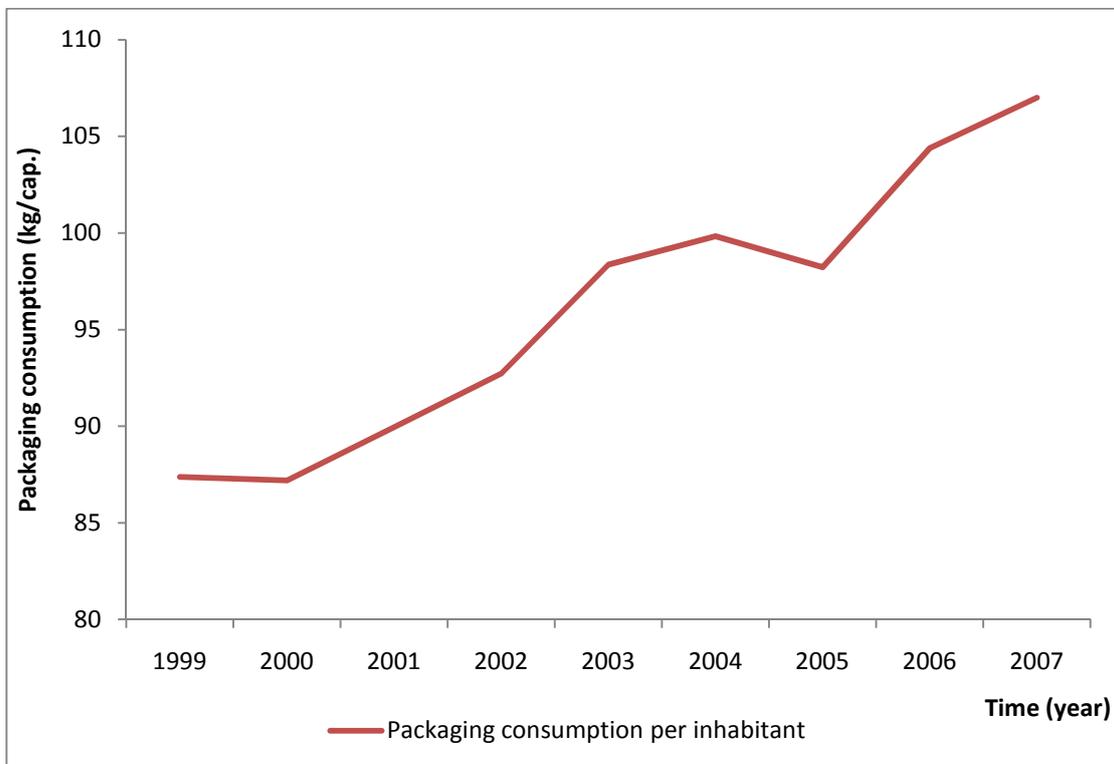
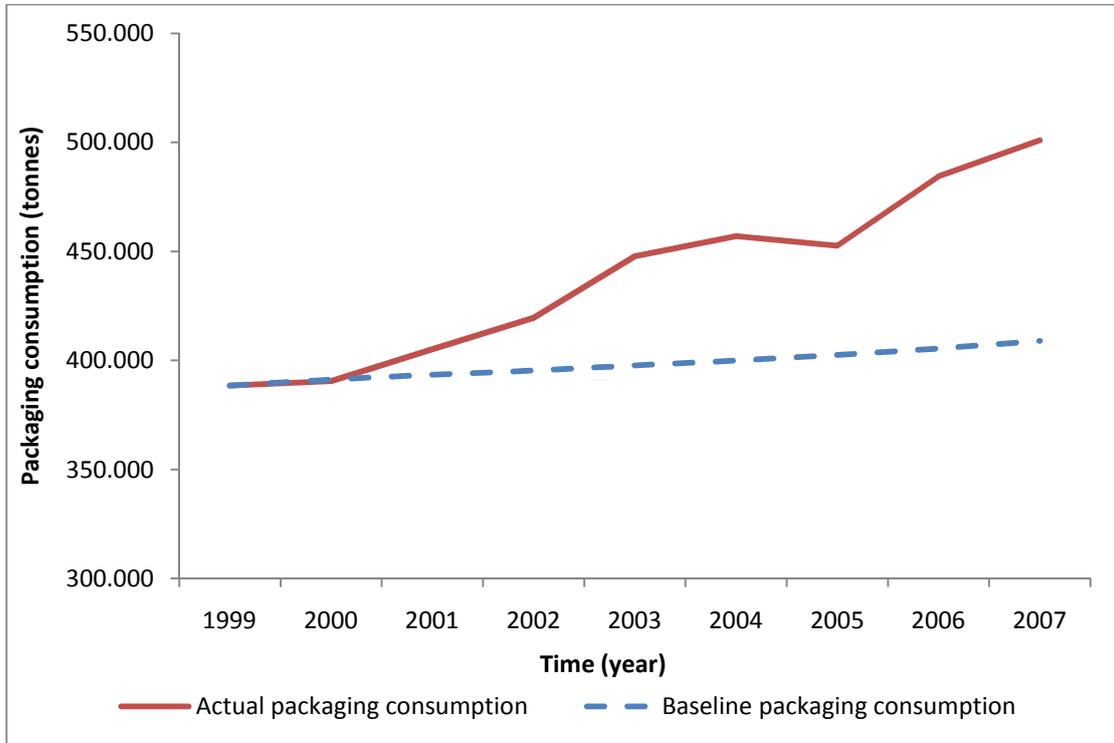


Fig. 76-77: Actual vs. baseline packaging consumption in Norway, 1999-2007 - Packaging consumption per inhabitant in Norway, 1999-2007

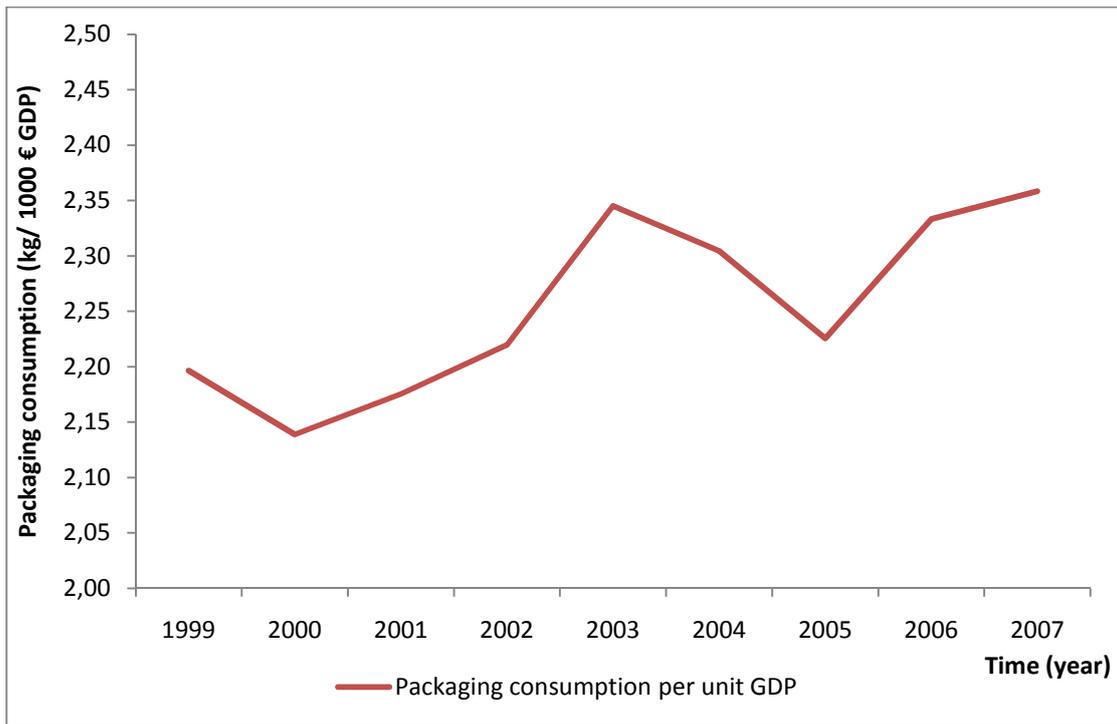


Fig. 78: Packaging consumption per unit GDP in Norway, 1999-2007

8.2.2. Overall packaging recycling and total recovery

The following section will illustrate the development of the recycling and total recovery rates achieved by Norway against the targets set during the 1999-2007 period.

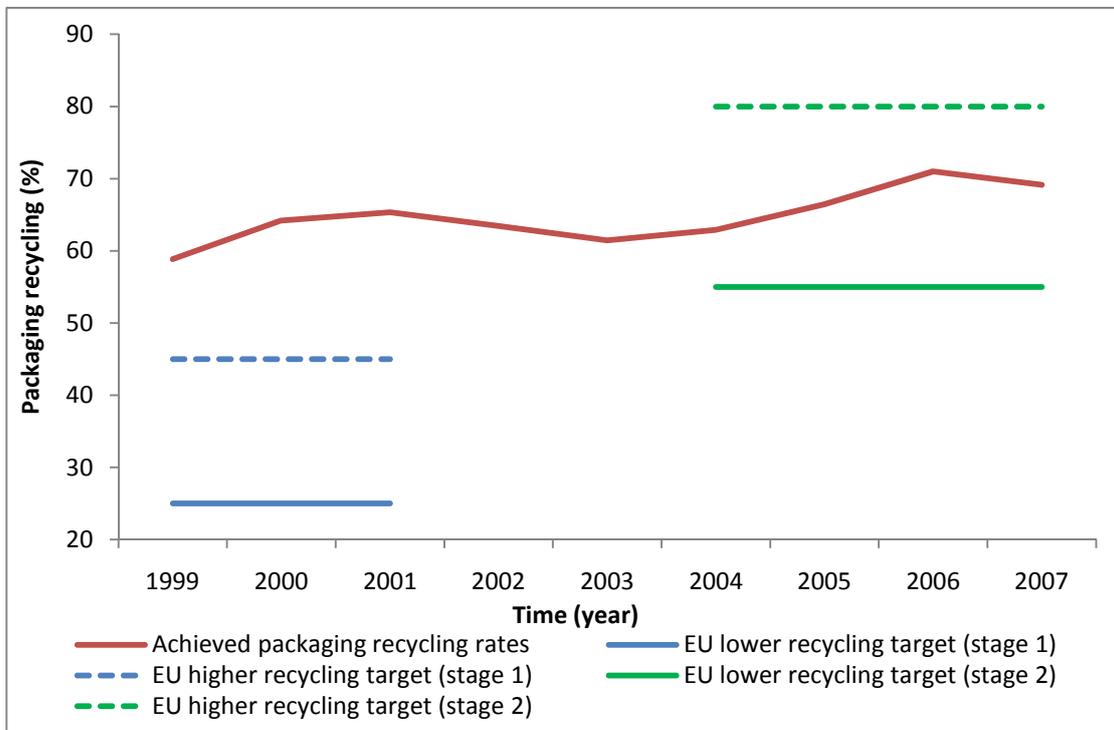


Fig. 79: EU packaging recycling targets vs. achieved packaging recycling rates in Norway, 1999-2007

No specific targets for the recycling of the overall packaging waste have been set at any point by Norway, so the results achieved in this field are compared with the targets set by the Packaging Directive during its two policy periods. It can be seen that the Norwegian packaging recycling rates were already in 1999 high enough to attain even the minimum EU target for 2007. The 65% rate achieved in 2001 (first milestone year of the Directive) was the highest among the group members, indicating that Norway had an effective packaging recycling system in place earlier than its Nordic counterparts. The rates remained relatively stable up to 2004 and after that point a further small increase is observed. The levels reached by the end of the period examined were not the best in the region anymore, but the differences with the forerunners in this field were quite small.

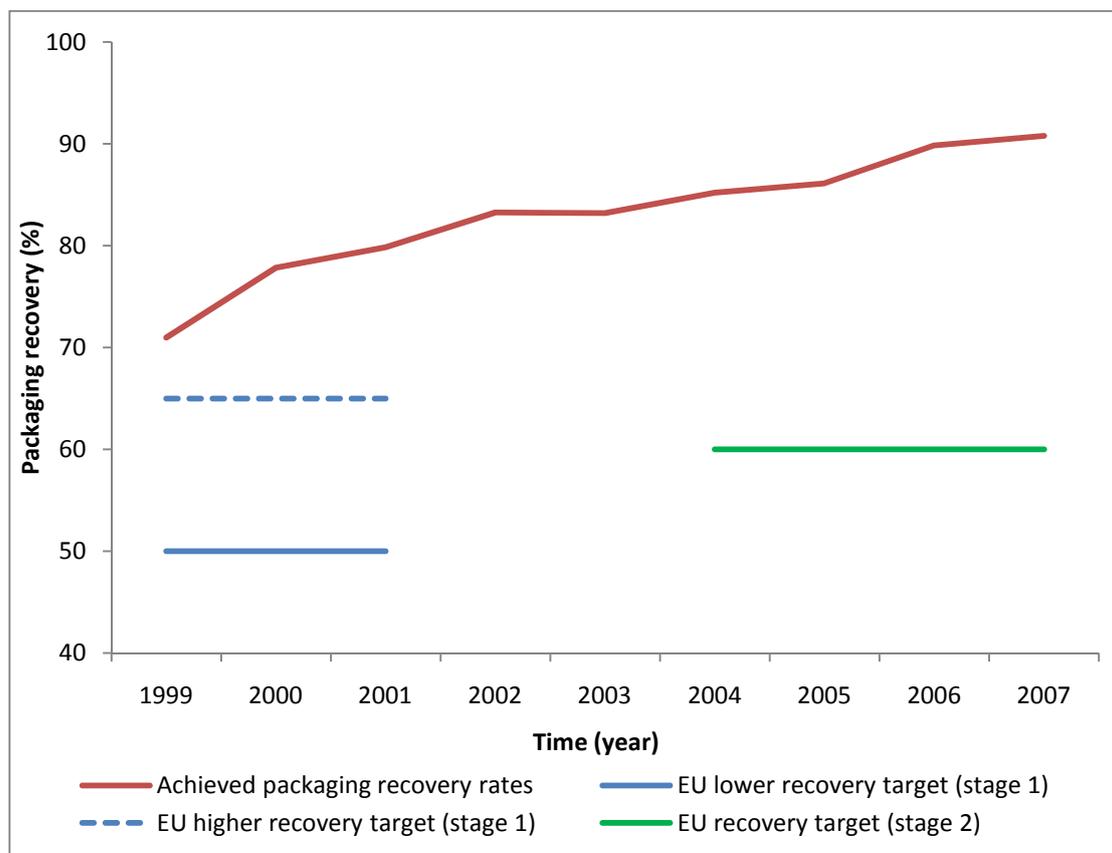


Fig. 80: EU packaging recovery targets vs. achieved packaging recovery rates in Norway, 1999-2007

No national targets exist also in the case of the total recovery for overall packaging and the results achieved are compared once again with the goals prescribed by the Packaging Directive. Similarly to overall packaging recycling, the Norwegian recovery rate in 1999 was already sufficient in order to attain the EU targets for both policy periods. A continuous rise of the rate is recorded nonetheless throughout the period at hand, and the total recovery is increased by almost twenty percentage points between 1999 and 2007 as a result. It should be noted that Norway ranked second among the Nordic countries both in 2001 and 2007, being the only one that came close to the very high total recovery rates achieved by Denmark.

8.2.3. Consumption, recycling and total recovery per material

8.2.3.1. Paper & board

The following section will demonstrate the developments regarding the paper & board packaging consumption (absolute and per capita), intensity of use and total recovery during the period 1999-2007.

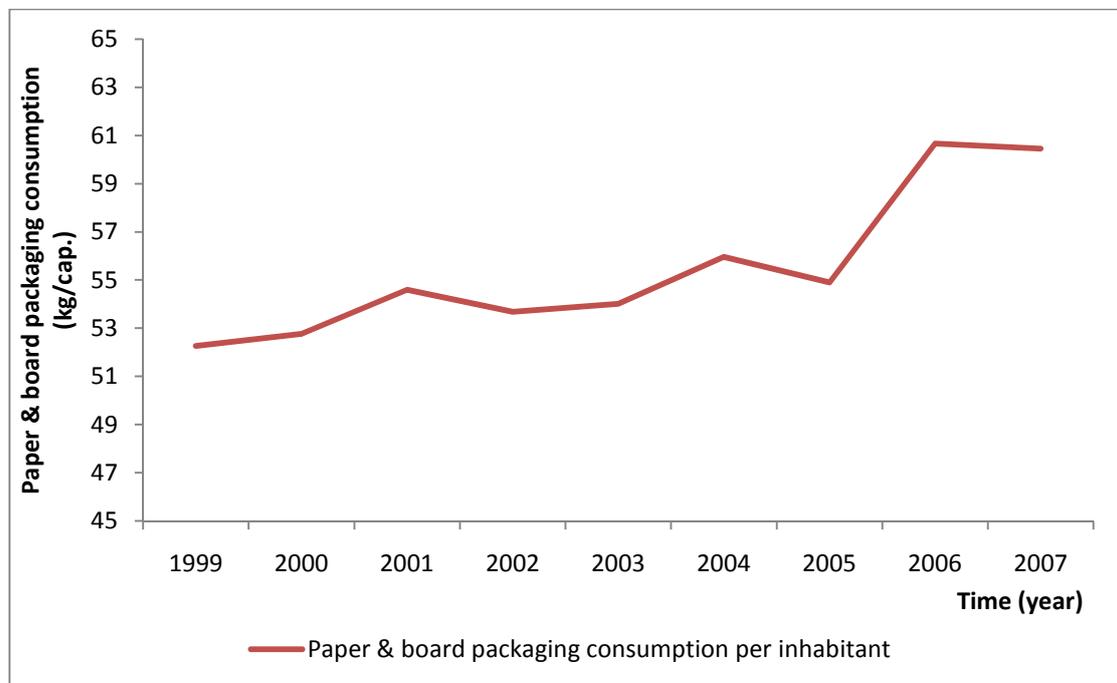
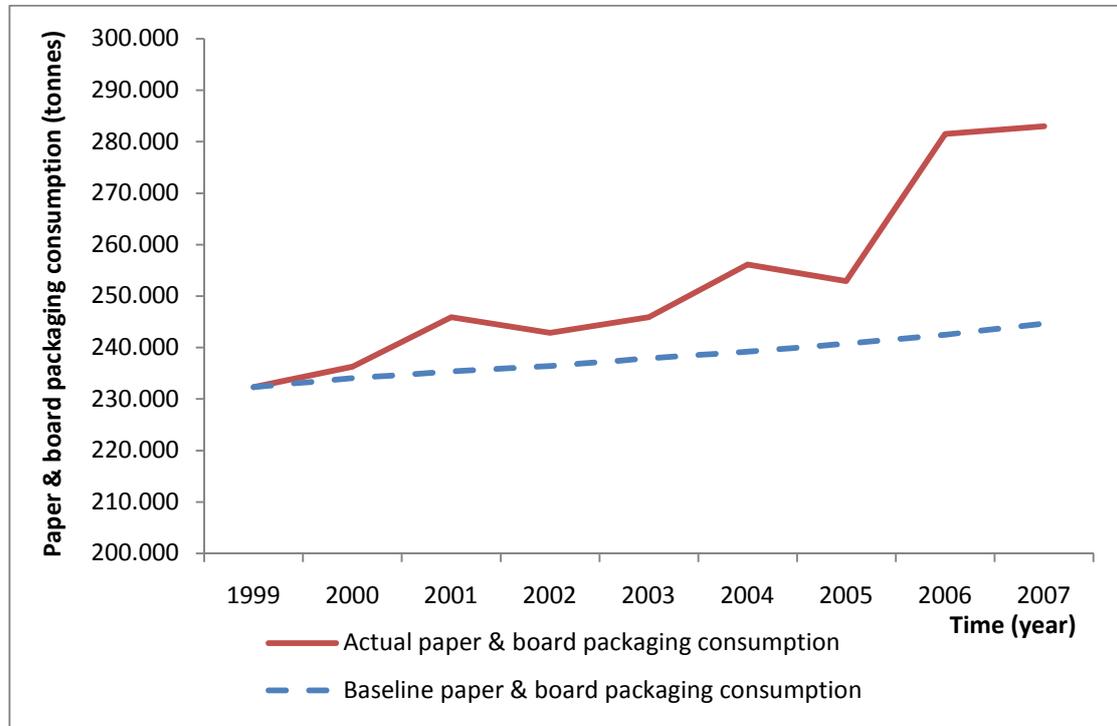


Fig. 81-82: Actual vs. baseline paper & board packaging consumption in Norway, 1999-2007 - Paper & board packaging consumption per inhabitant in Norway, 1999-2007

The paper & board packaging consumption in Norway has been generally increasing throughout the period between 1999 and 2007; the most striking observation made, however, is the steep rise recorded in 2006. The paper & board packaging consumption in 2007 was close to 40 ktonnes higher than the baseline, while the per capita consumption had increased by almost 16%, a figure comparable with those of Denmark and Sweden. Norway, however, also demonstrated a small increase of the paper & board packaging intensity of use (Fig. 83).

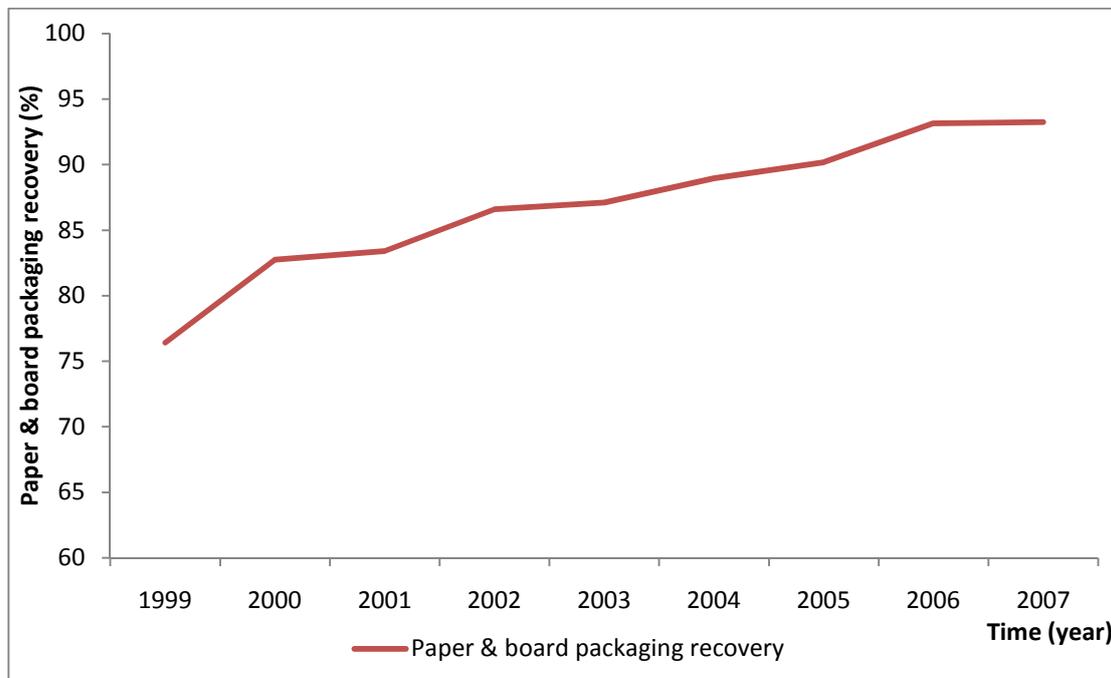
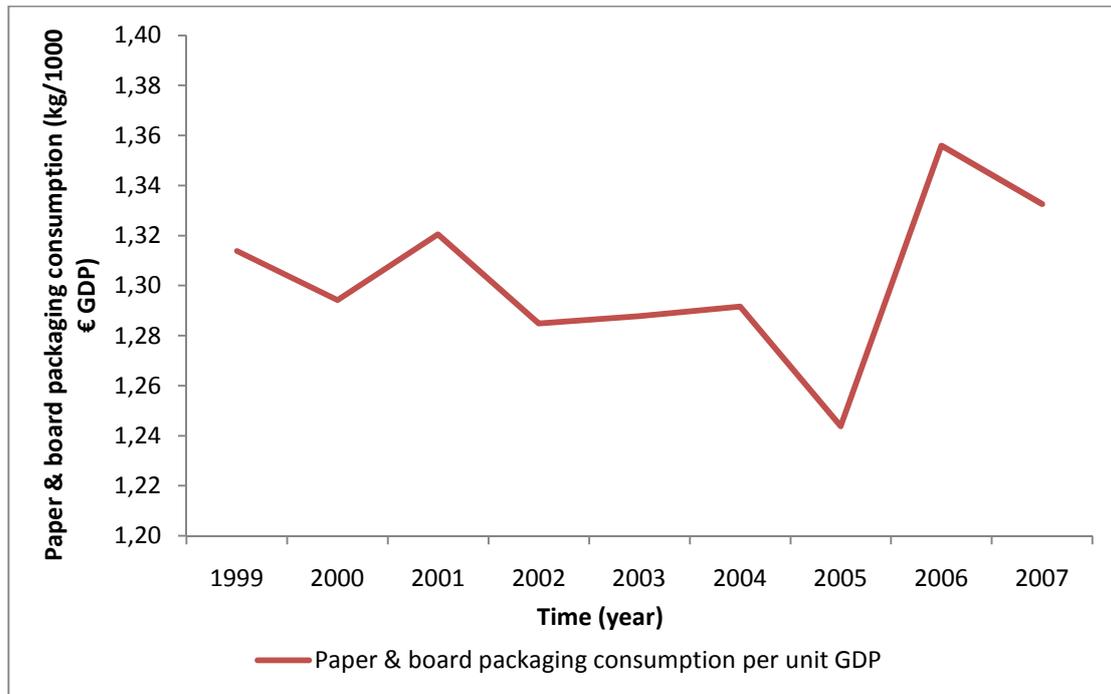


Fig. 83-84: Paper & board packaging consumption per unit GDP in Norway, 1999-2007 - Paper & board packaging achieved recovery rates in Norway, 1999-2007

No data concerning the paper & board recycling rates were offered by Klif for the purposes of this project; the dataset acquired included instead the total recovery rates for this packaging material during the 1999-2007 period. The development of paper & board packaging recycling and its comparison with the national and EU targets could not be, therefore, depicted. Fig. 84, however, demonstrates that the total recovery has been growing consistently during the period at hand, with the overall rise reaching seventeen percentage points during this nine-year time span. In addition to this, the rate achieved in 2007 was very close to those of Denmark and Finland, with all of them reaching above 90% levels. It should also be noted that the national total recovery targets for corrugated cardboard (80%) and cardboard (60%), which were introduced in the first set of Norwegian packaging goals (pre-2008), were attained at an early stage; the actual rates have been higher than the targets already since 1999 for corrugated cardboard (reaching 96% in 2007) and since 2000 for cardboard (85% in 2007).

8.2.3.2. Glass

The following section will demonstrate the developments regarding the glass packaging consumption (absolute and per capita), intensity of use and recycling during the period 1999-2007.

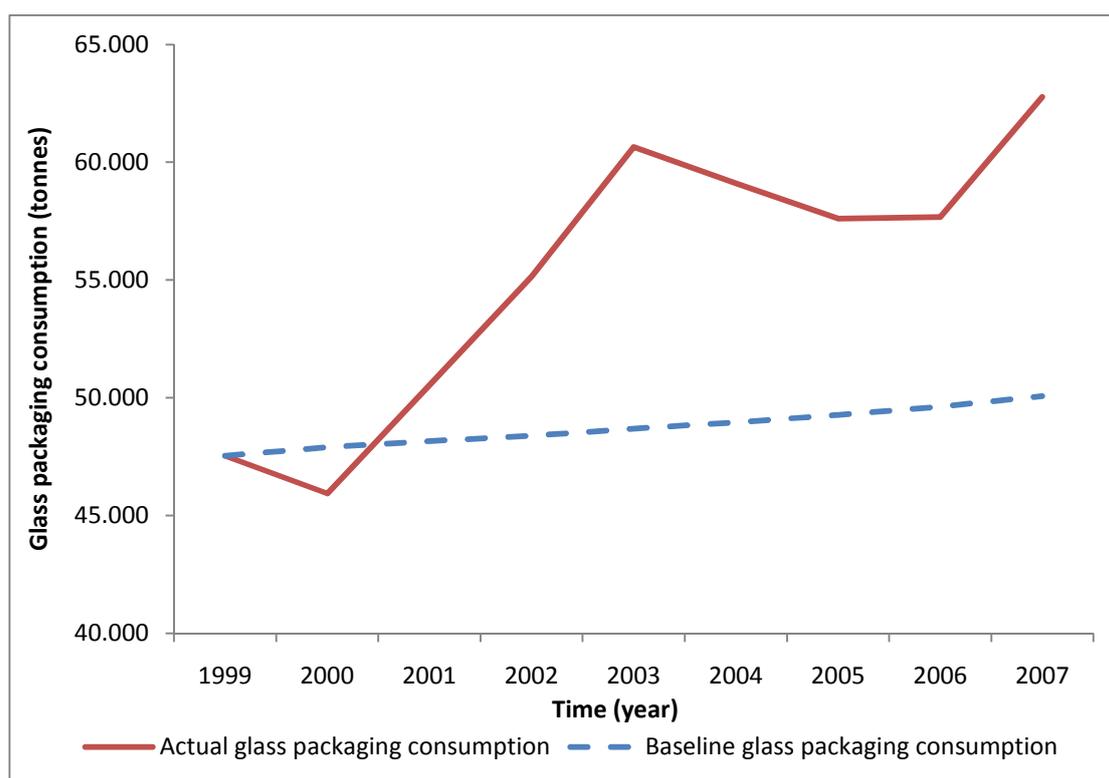


Fig. 85: Actual vs. baseline glass packaging consumption in Norway, 1999-2007

The glass packaging consumption in Norway grew by more than 15 ktonnes between 1999 and 2007 and exceeded the baseline levels by more than 12.5 ktonnes at the end of the period examined. A significant rise during the 2001-03 period was followed by three years of relative stability, but a further increase was recorded in the

final year. The per capita consumption was raised during the same time by about 25%, surpassing the Finnish increase by a small margin, thus registering the highest rise among the group members. Moreover, Norway was the only country to demonstrate an increase in the glass packaging intensity of use (almost +10%).

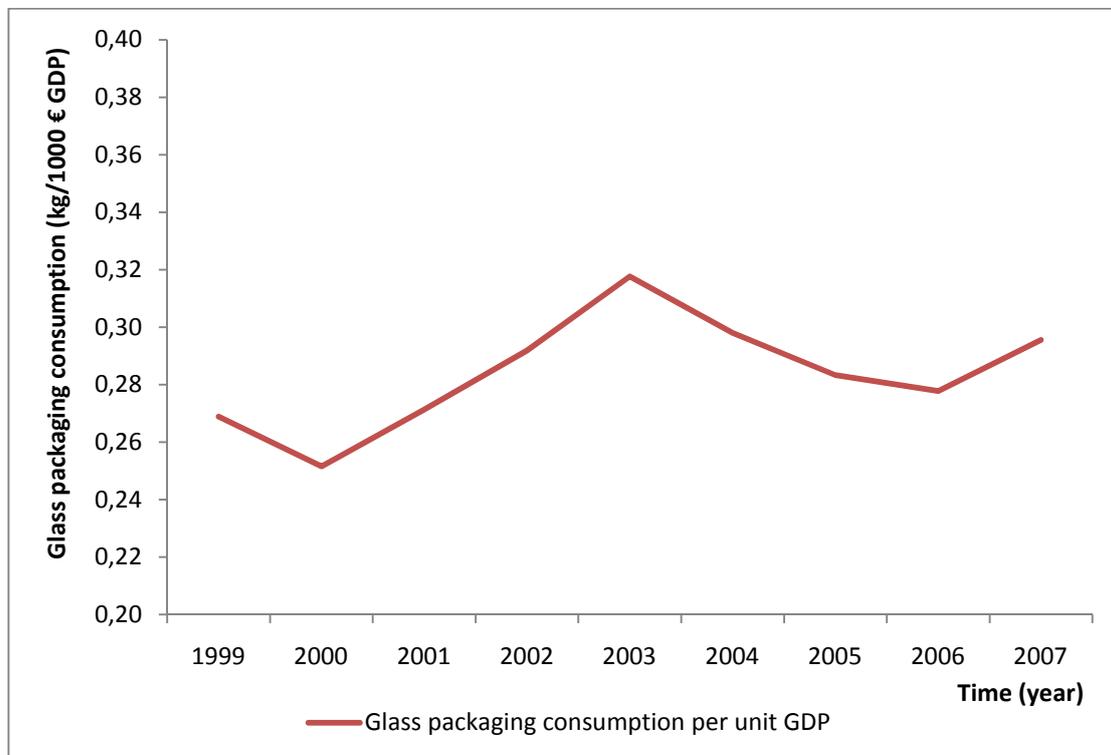
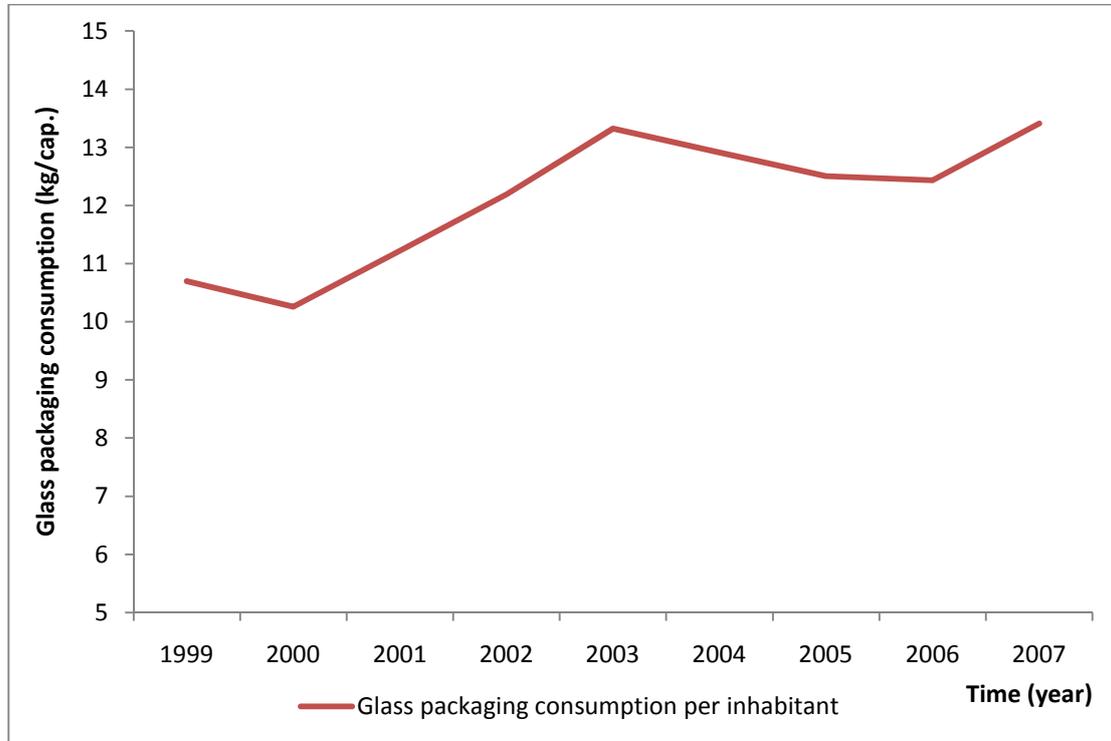


Fig. 86-87: Glass packaging consumption per inhabitant in Norway, 1999-2007 - Glass packaging consumption per unit GDP in Norway, 1999-2007

A national target for glass packaging recycling was set in Norway only after 2008 and, therefore, had no influence upon the results of the period examined; it should be mentioned, however, that it is extremely high, requiring 95% recycling of glass packaging. Due to the lack of a target prior to this point, the results achieved by Norway will be compared with the targets prescribed by the EU Packaging Directive for its two policy periods.

The glass packaging recycling levels were very high already in 1999 (80%), peaked in 2001, when –having reached 88%– were the highest among the Nordic countries and during the next four years were kept rather stable, albeit slightly lower (two to five percentage points compared to 2001). An increase is recorded again during the last years of the period, and in 2006 the 100% barrier was broken; a recycling rate higher than 99% was recorded for 2007, leaving Norway second only to Denmark in this category.

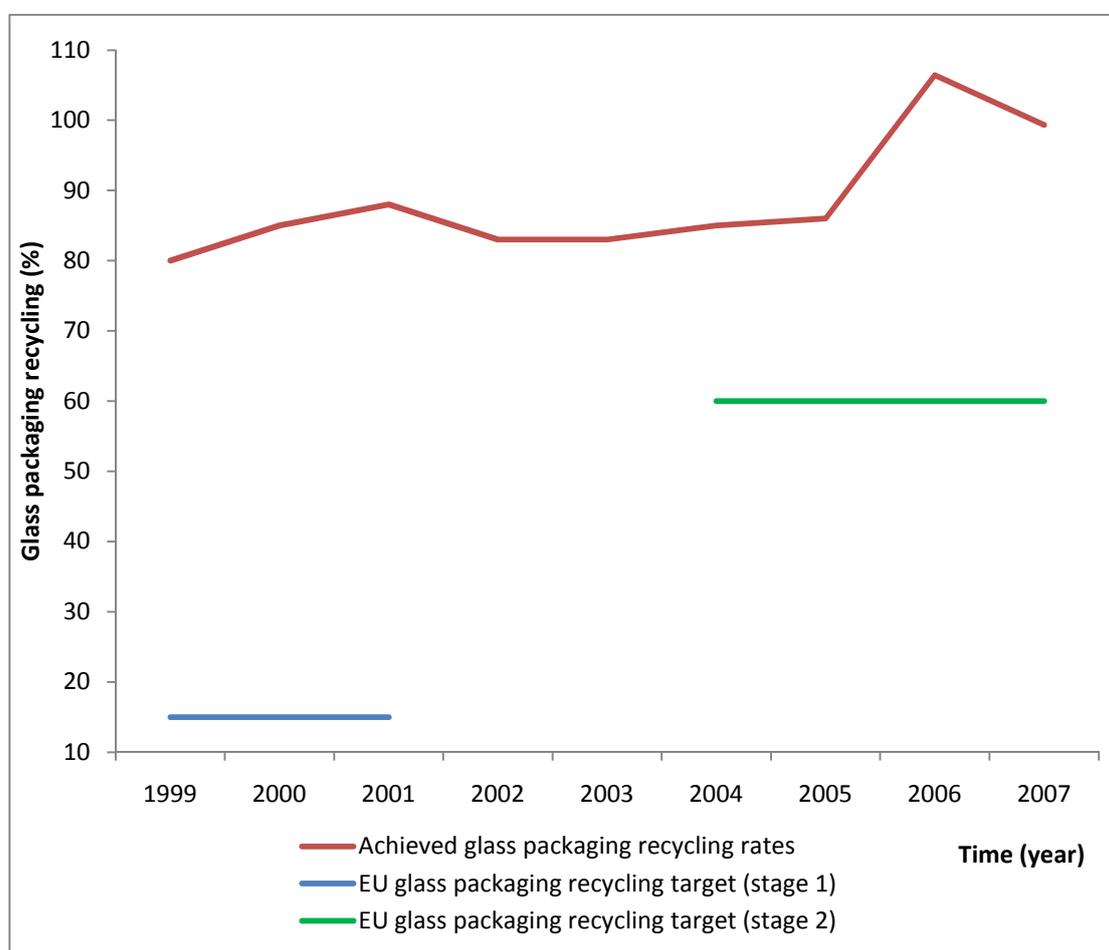


Fig. 88: Glass packaging achieved recycling rates vs. EU targets in Norway, 1999-2007

8.2.3.3. Metal

The following section will demonstrate the developments regarding the metal packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1999-2007.

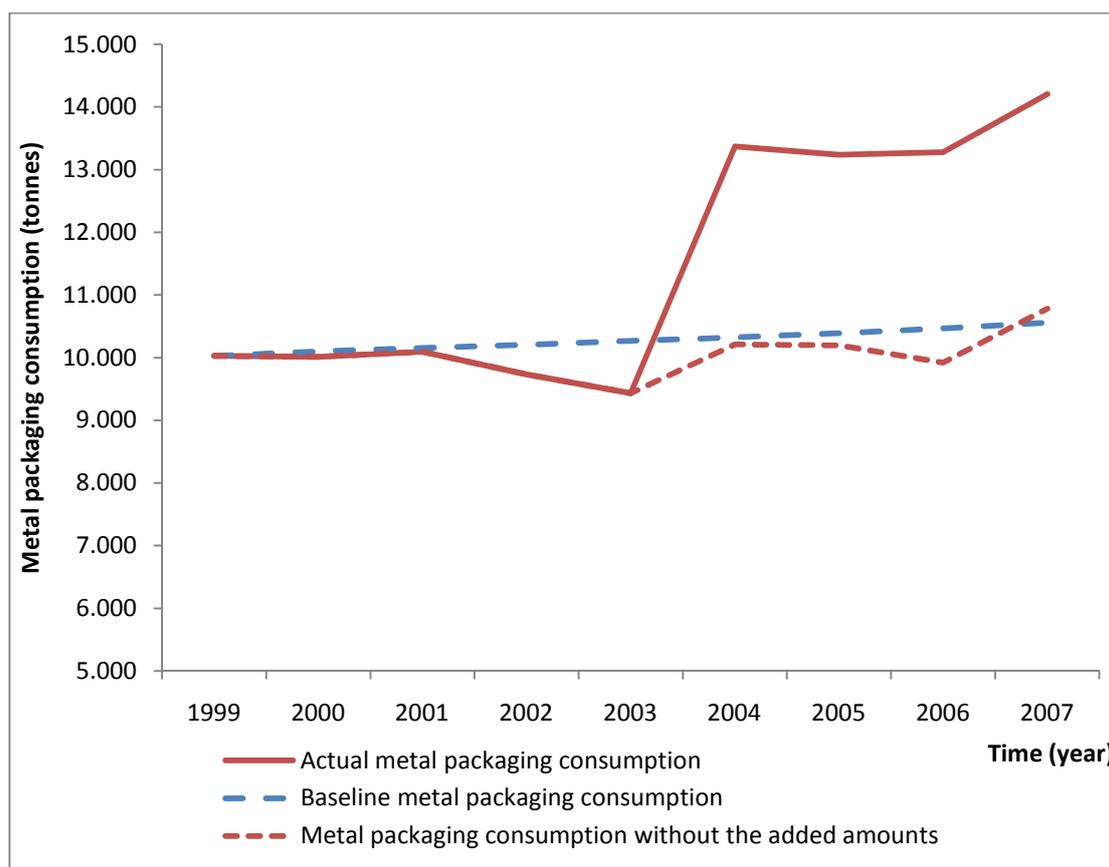


Fig. 89: Actual vs. baseline metal packaging consumption in Norway, 1999-2007

When looking into the Norwegian metal packaging consumption during the period examined, the 4-ktonne increase in 2004 draws the attention. This is attributed to the addition to the data from that year on of the quantities of metal packaging that had previously contained hazardous materials. The data reported to the Commission since 2006 include these quantities as well and, therefore, these are the absolute figures that are directly comparable to those of the other Nordic countries. If, however, the consumption development in Norway is to be examined, it should be mentioned that although the metal packaging waste generation appears to have been increased by more than 4 ktonnes between 1999 and 2007, the situation is rather different when the additional amounts (the ones that contained hazardous materials) are not taken into account. In that case, the metal packaging consumption appears to have stayed below the baseline for the best part of the period and reached it only in 2007, having grown by merely 700 tonnes during these years.

Similar is the situation when looking into the development of the metal packaging per capita consumption between 1999 and 2007 (Fig. 90). When the post-2003 additional quantities are taken into account, the per capita consumption demonstrates an increase of 34.5% between 1999 and 2007, which is lower only from that of Finland. If, however, the extra packaging continues to be omitted from the statistics for the sake of data consistency, then the 1999-2007 increase is limited to 2%. Moreover, when the metal packaging IU is considered (Fig. 91), the addition of the

extra amounts leads to an almost 18% increase, while their omission to a higher than 10% reduction of the metal packaging intensity of use.

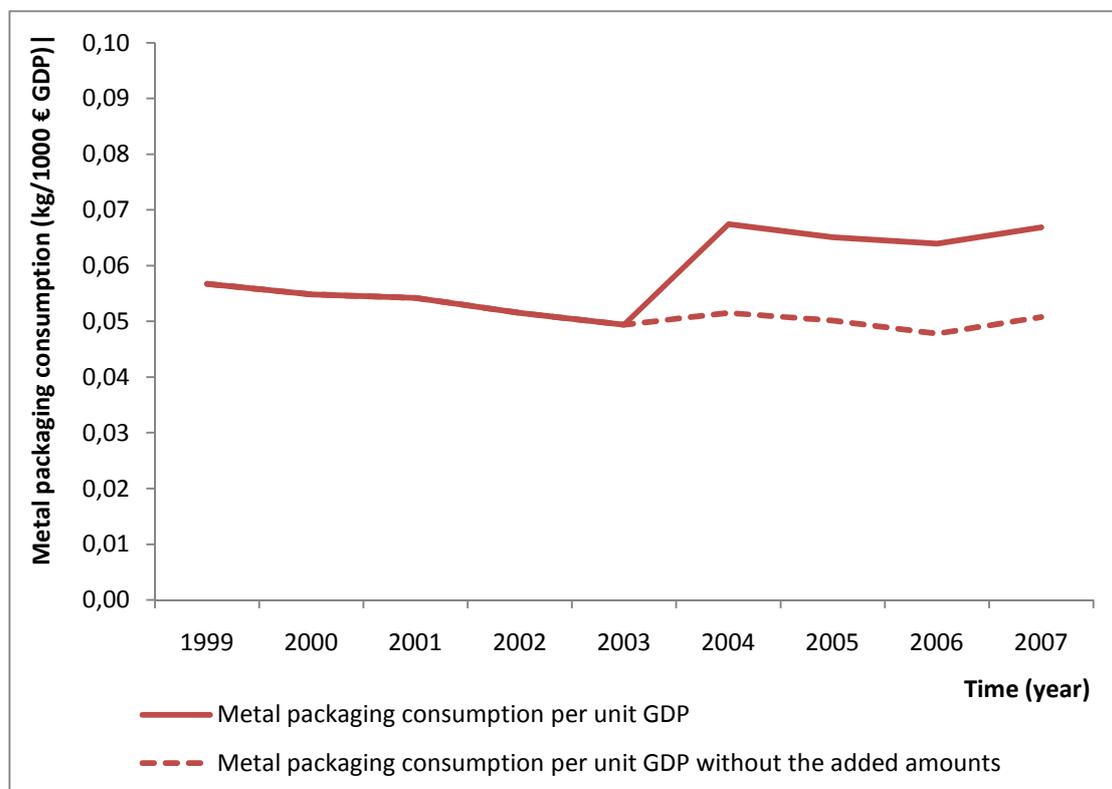
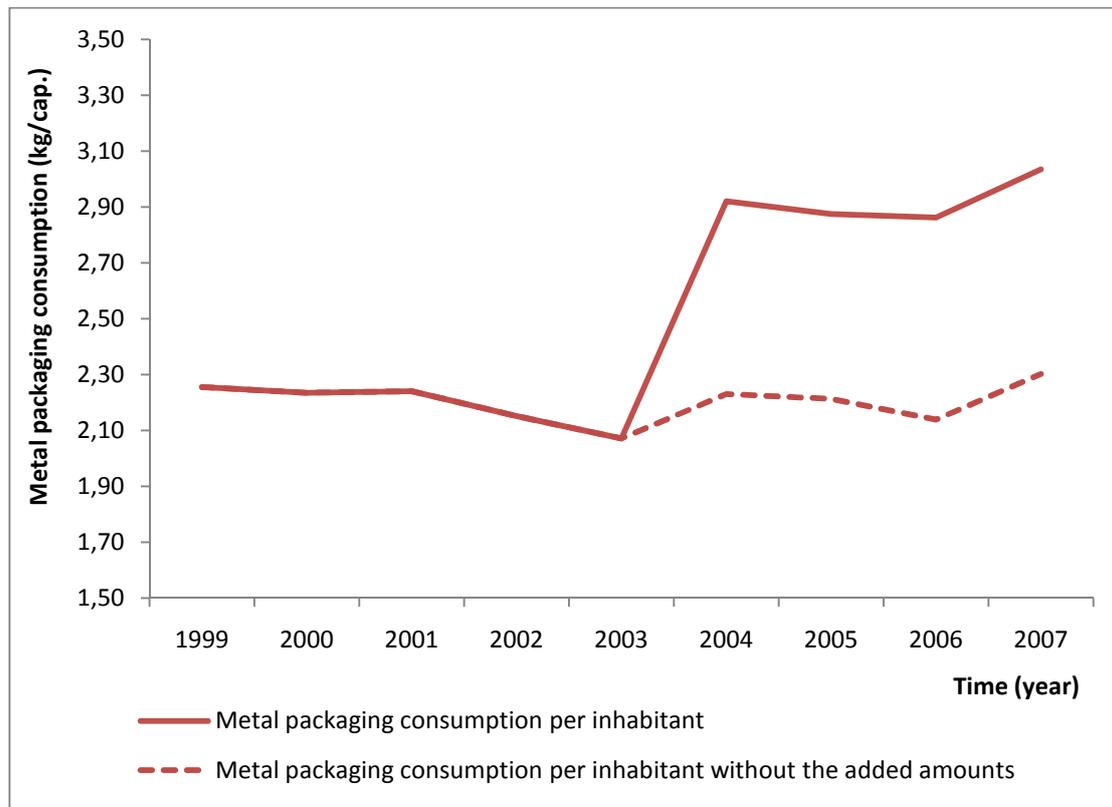


Fig. 90-91: Metal packaging consumption per inhabitant in Norway, 1999-2007 - Metal packaging consumption per unit GDP in Norway, 1999-2007

The influence of the additional amounts' inclusion in the metal packaging data is far less significant with regard to metal packaging recycling. The somewhat decreased rates during 2004-05 are observed in both cases and the inclusion of packaging that contained hazardous materials only makes this decline slightly steeper. After 2005, the rates with and without the added amounts are practically the same.

At the beginning of the period at hand, the recycling rates were much lower than the target set; due to a growth of twenty-five percentage points up to 2003, however, the target was attained in 2002. A further increase came about after 2005 but the 2007 rate was lower than those of Denmark and Finland, a fact worth mentioning since Norway was considerably ahead of these countries in 2001.

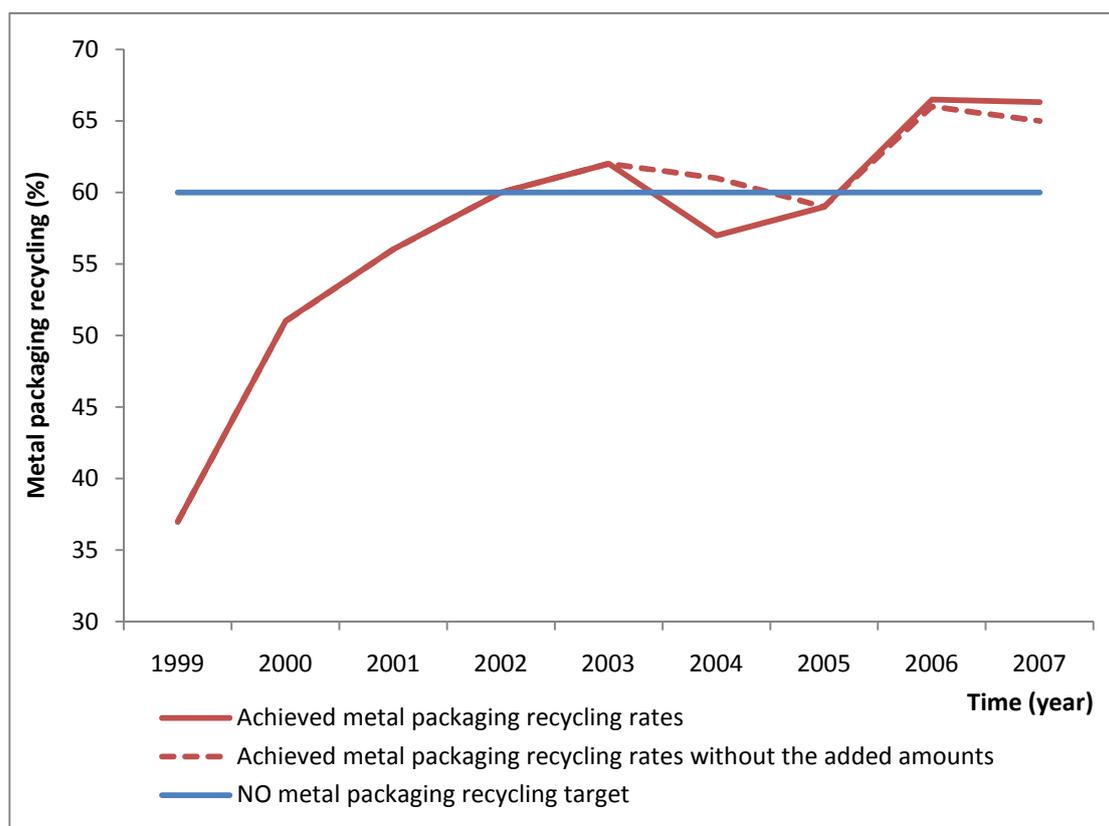


Fig. 92: Metal packaging achieved recycling rates vs. national targets in Norway, 1999-2007

8.2.3.4. Plastic

The following section will demonstrate the developments regarding the plastic packaging consumption (absolute and per capita), intensity of use and total recovery during the period 1999-2007.

The plastic packaging consumption increased by more than 42 ktonnes between 1999 and 2007, while the baseline levels were exceeded by about 37 ktonnes at the end of the period examined. The plastic packaging per capita consumption increase was the highest among the Nordic countries, reaching almost 36% during the period

1999-2007, while the plastic packaging intensity of use was also the most increased of the group (+19%).

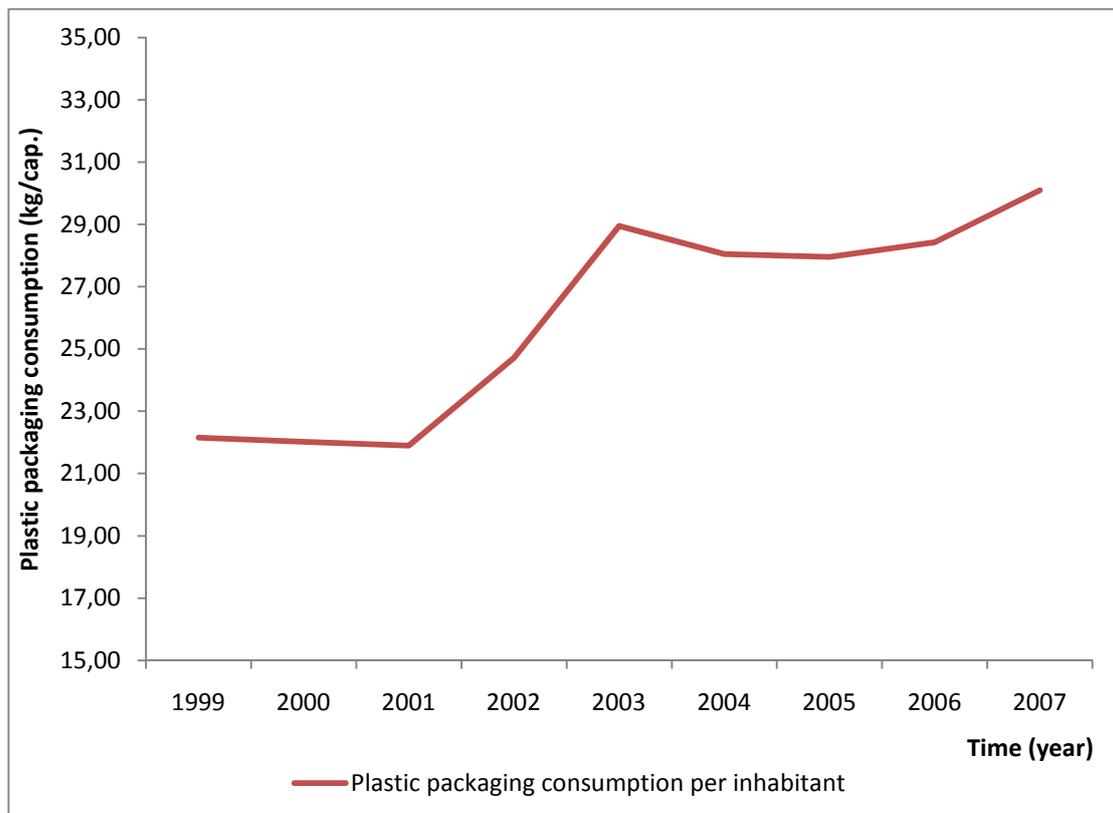
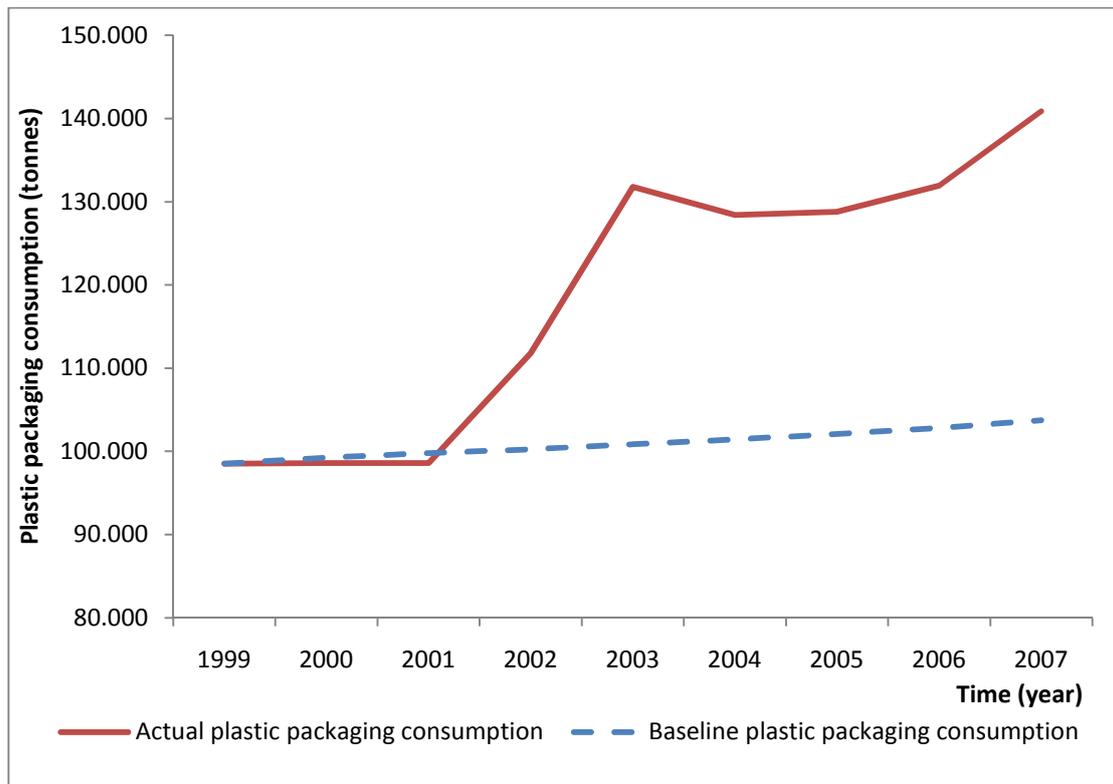


Fig. 93-94: Actual vs. baseline plastic packaging consumption in Norway, 1999-2007
 - Plastic packaging consumption per inhabitant in Norway, 1999-2007

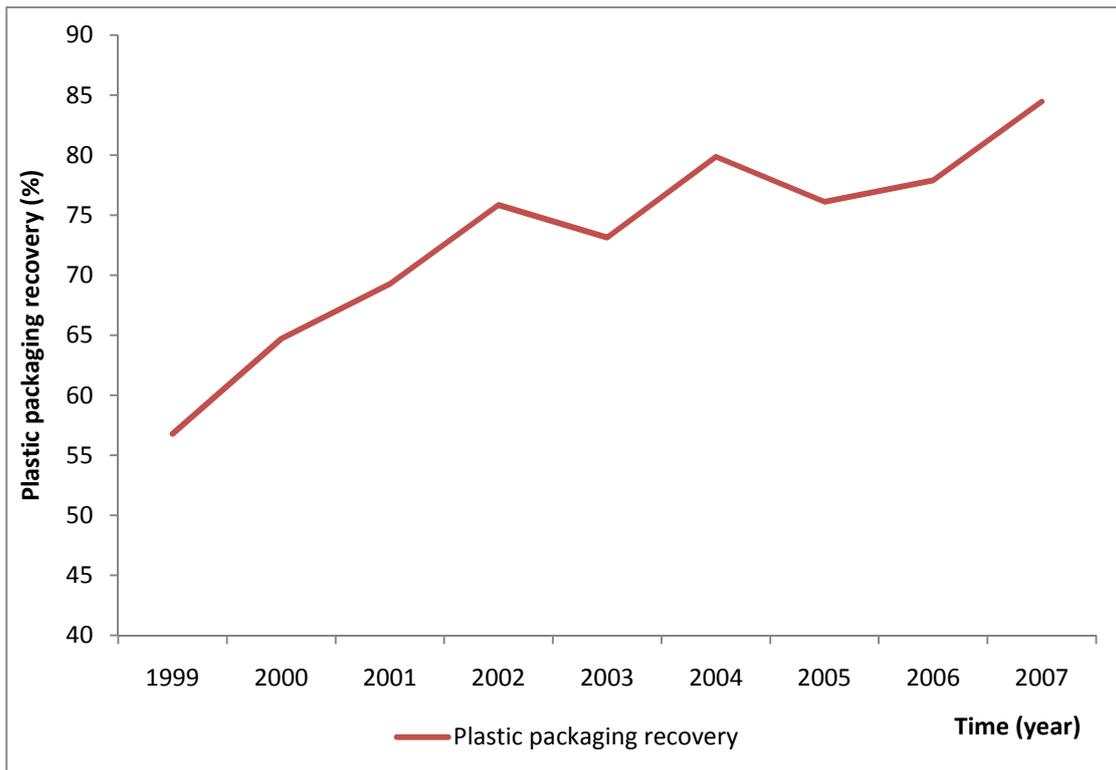
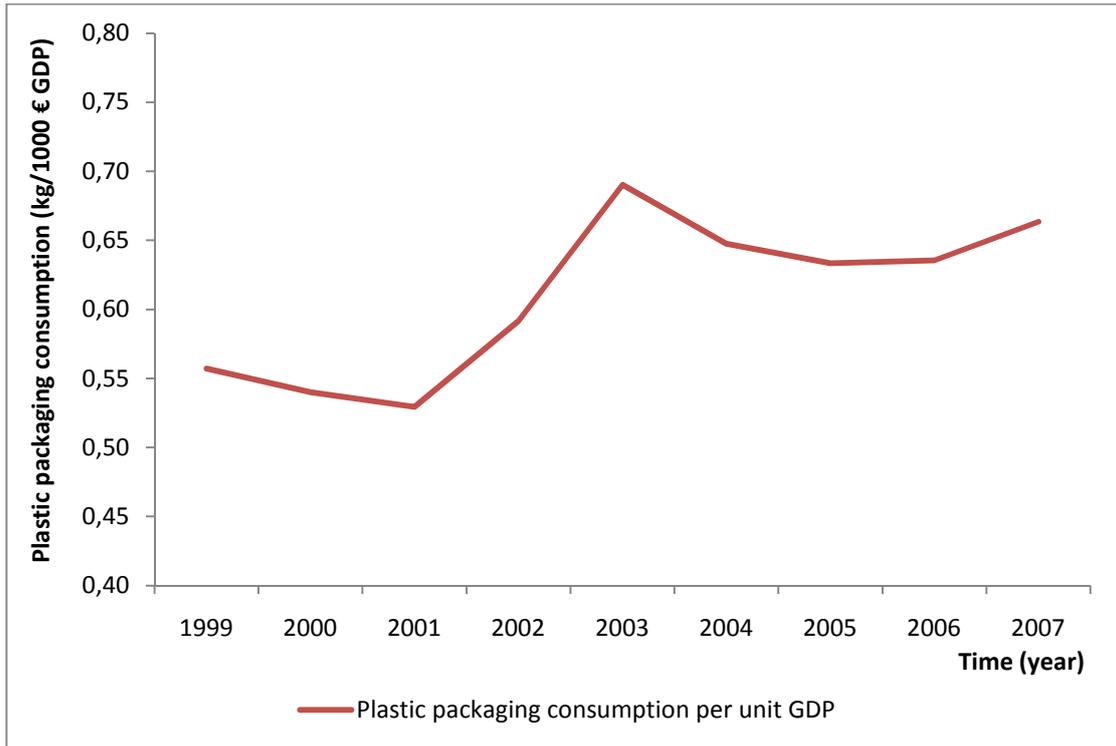


Fig. 95-96: Plastic packaging consumption per unit GDP in Norway, 1999-2007 - Plastic packaging achieved recovery rates in Norway, 1999-2007

No data concerning the plastic packaging recycling rates were offered by Klif for the purposes of this project; the dataset acquired included instead the total recovery rates for this packaging material during the 1999-2007 period. The development of plastic packaging recycling and its comparison with the national and EU targets could

not be, therefore, depicted. Fig. 96, however, demonstrates that the total recovery has been growing almost consistently during the period at hand, with the overall rise approaching eighteen percentage points during this nine-year time span. In addition to this, the rate achieved in 2007 was second only to that of Denmark among the group members, with the same place taken also in 2001. It should also be noted that the national total recovery targets for plastic packaging (excluding EPS packaging, 80%) and EPS packaging (60%), which were introduced in the first set of Norwegian packaging goals (pre-2008), were attained; plastic packaging reached the 80% mark in 2004 (85% in 2007), while EPS packaging has been consistently above 60% since 2003 (78% in 2007).

8.2.4. Discussion

The Norwegian initiatives with regard to packaging waste minimization do not include the introduction of quantifiable targets –as Finland did- and are expressed solely through the producer responsibility scheme. The demand of the state authorities to be informed annually by the packaging chains about the efforts made towards packaging minimization and the results achieved through these appears –in theory- to be a kind of enforcement within an EPR scheme that Sweden is lacking; the requirement that future plans of the industry are submitted to the authorities in advance and the encouragement of cooperation between the various packaging material chains are also measures towards the same direction. The results, however, indicate that these initiatives have been unsuccessful; the fact that Norway demonstrates the highest packaging consumption increase in the group is somewhat surprising, considering the existence of the aforementioned provisions along with the introduction of a taxation system, which covers an important area of the packaging market (beverage containers), that has been specifically designed in order to promote reusability. The magnitude of the problem is also suggested by the rise of the packaging intensity of use, especially since a decline of agriculture and manufacturing relative to the service sector is observed, and efforts to promote high-tech and information technology companies have been made in recent years.

Considering the paper & board packaging consumption, what is even more noteworthy than the increase recorded is that, while up to 2005 there was a rather steady rise, a growth by 30 ktonnes was recorded in just one year (2006). This change was also singlehandedly responsible for the rise in overall packaging consumption during the same time. It is considered highly unlikely that such a development could be attributed to actual changes in the consumption patterns. Looking into the data provided by Klif, it is established that the cause of this change lies with the figures for corrugated cardboard; it could be assumed that a change in the data collection methods utilized in order to compile the statistics may have led to the calculation of this higher figure. Klif [2010] states various factors that may have an influence on the accuracy of the reported amounts, such as errors in foreign trade statistics, confusion regarding the definition of packaging, underestimations of the generated waste amounts in order to fulfill the agreements more easily, and the existence of free riders;

methodological changes aiming to circumvent such parameters could lead to data revisions and appear as significant fluctuations, such as those observed in paper & board packaging.

Moving on to the glass packaging consumption, a parameter with a possible influence on the development presented in Fig. 85 could be the fact that the share of reusable packaging for non-soft drink beverages (e.g. beer) is considerably lower than the one for soft drinks (44% for beer compared to 98% for soft drinks) [ECOLAS-PIRA, 2005]. On the other hand, the 2006/07 recycling rates were impressive, exceeding 100% during the former year (possibly due to the recycling of privately imported alcoholic beverages containers) and almost reaching it during the latter. It is apparent that the dependence of the tax levels on the return rates has been a very effective measure, a position that is maintained also by the glass packaging PRO, which states that all obliged companies are participating in its system because of this initiative.

In the case of metal packaging, the beverage containers taxation scheme could have been one of the driving forces behind the marginal increase in consumption (when the hazardous materials-containing packaging is not added to the figures); the reason is that it makes one-way packaging (such as metal cans) more expensive than the reusable types -even when the same return rates are achieved- in order to promote reusability. Regarding metal packaging recycling, a post-1999 increase is observed, indicating that Norsk Resirk (established in that year), which ensures nearly total recycling of metal cans, has been successful in promoting metal packaging recycling in general in Norway.

Fig. 93 demonstrates a steep increase of the plastic packaging waste generation in 2002-03 and a more “balanced” development after that point. Considering that the recorded amounts of plastic packaging consumed are identical during the first 3 years of the period examined, it could be assumed that these were partly estimated and the subsequent rise was a result of changes in data collection methodologies that led to more accurate results, depicting the actual situation in a better way than the earlier approaches. The situation is quite similar to that for paper & board packaging discussed above, allowing similar assumptions for the mechanisms responsible to be made.

Fig. 97 demonstrates the development of the share of each packaging material in the overall packaging consumption between 1999 and 2007. Generally, the changes in the share of each material throughout the period examined are not significant –some fluctuations are probably a result of statistical reasons-, and only a very limited substitution of paper & board packaging by plastic can be said to have taken place. Considering both the consumption levels and the intensity of use for each material, as presented above, it is observed that between 1999 and 2007 all packaging materials went through a materialization process; an exception is provided by metal packaging

when the post-2003 additional amounts are not considered, in which case a weak dematerialization process is observed.

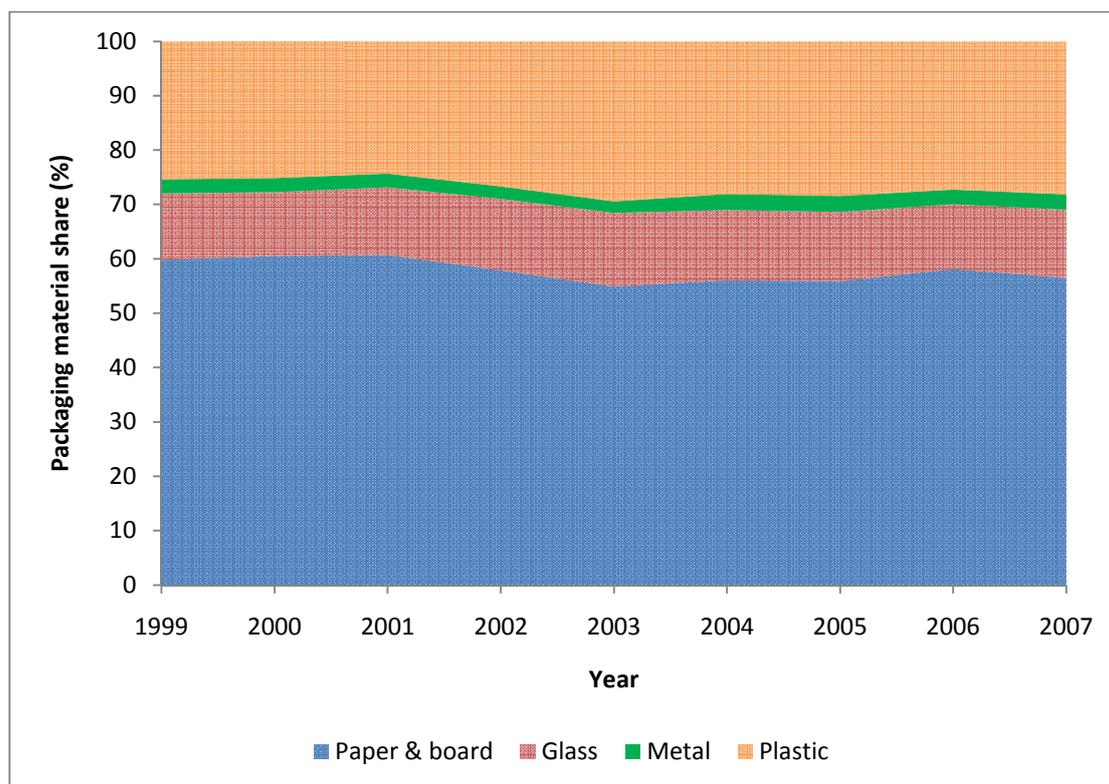


Fig. 97: The development of the share of each packaging material in the overall per capita packaging consumption in Norway, 1999-2007

8.3. Concluding remarks

Norway is one more Nordic country that based its packaging policy initiatives on the concept of extended producer responsibility, with the characteristic that distinguishes it from Finland and Sweden being the use of government-industry agreements, which were the first step towards the development of the EPR scheme. An array of provisions included in these agreements aimed at ensuring that packaging minimization would be achieved but the results presented in this chapter indicate that this did not come to fruition. By having the worst performance among the group members with regard to the realization of the first priority described in the waste hierarchy, Norway appears to be the least successful Nordic country in terms of packaging waste policy results.

Bad results in reducing the packaging waste generation aside, Norway performs quite well in terms of the recycling and total recovery rates achieved. Despite not ranking first in any category, it can almost always be found occupying the second place or –at least- coming close to the top performers. These consistently good results are an indication of the proper functioning of the producer responsibility scheme in terms of packaging waste management, manifested through the establishment of effective collection and recovery networks covering both the industry/trade sectors

and the private households alike. If the Norwegian results are compared to the targets set by the Commission, it is seen that the 2008 goals in every single category were more than attained already in 2007, a feat that no other Nordic country has accomplished.

Other than the -purely administrative in nature- introduction of producer responsibility, Norway relies to a large extent on a financial instrument, namely the beverage packaging taxation scheme. It is difficult to determine whether this system has been effective; the rising consumption of glass packaging is indicating that it is not offering as strong incentives as it is supposed to, while the 98% share of reusable packaging for soft-drinks containers is clearly a success of the system. Another financial instrument that influences packaging developments, although not aiming directly at packaging, is the waste taxes imposed on incineration and landfilling activities.

The entire length of the packaging chain is covered by the Norwegian policies, although the main focus is theoretically on packaging optimization (“packaging making” step of the chain). Product reuse (“packaging making” and “consumption” steps) is primarily promoted through the beverage packaging taxation scheme and recycling (“waste collection” step) through the work of the PROs and the taxation on beverage containers, while the final disposal issue (“waste management” step) is addressed primarily through the landfilling and incineration waste taxes.

9. The case of the Netherlands

The developments in the packaging policy field in the Nordic countries following the introduction of the EU Packaging Directive and the progress made by them regarding the packaging consumption and packaging waste recovery have been presented and discussed up to this point. The next step in this project will be devoted to the comparison of the quantitative results achieved by Denmark, Finland, Norway and Sweden with those reported by another country. The choice was made to use the Netherlands in this “reference country” role due to its long history with packaging policies. A packaging policy framework existed there even before the introduction of the EU Directive (since 1991) and various policy initiatives have followed since, including both regulatory measures and voluntary agreements between the state and stakeholders from the business sector. The fact that the Dutch initiatives have been considered progressive relative to the European ones provides a further justification for looking into a Dutch vs. Nordic comparison.

It is beyond the scope of this project to provide an in-depth analysis of the policy history of the Netherlands and an overview of the various measures implemented; the presentation of the results achieved during the whole 1998-2007 period is also not of the essence. Rouw [2009] has provided a comprehensive analysis of the Dutch case - both in terms of initiatives and of their effectiveness- and her work is an invaluable source of information for anyone seeking to gain an insight into the Dutch case. It has been decided, therefore, to devote this chapter only to the comparison of the Nordic results with the Dutch in three points in time: the beginning of the decade examined in this project (1998), the first milestone year set by the Directive (2001) and the latest year for which data have become available (2007). An attempt to provide some explanations about the situation presented will be made, based on the aforementioned work by Rouw.

9.1. Packaging consumption and material intensity of use

Table 23 presents the overall packaging consumption per inhabitant in the five countries, while Tables 24 and 25 focus on the packaging consumption per material.

	<i>Total packaging consumption (kg/cap.)</i>			<i>Per capita total packaging consumption change 1998-2007 (%)</i>
	<i>1998</i>	<i>2001</i>	<i>2007</i>	
Denmark	158.3	161.6	156.2	-1.31
Finland	82.39	88.22	91.08	+10.6
Norway ¹⁶	87.37	89.95	107.0	+22.5
Sweden	108.0	113.7	123.8	+14.6
Netherlands	162.2	161.8	180.2	+11.1

Table 23: Per capita total packaging consumption development between 1998 and 2007 in the Nordic countries and the Netherlands

¹⁶ It should be reminded that 1999 figures are used in the case of Norway instead of 1998 data

	<i>Paper & board packaging consumption (kg/cap.)</i>			<i>Per capita p.&b. packag. consumpt. change 1998-2007 (%)</i>	<i>Glass packaging consumption (kg/cap.)</i>			<i>Per capita glass packaging consumpt. change 1998-2007 (%)</i>
	<i>1998</i>	<i>2001</i>	<i>2007</i>		<i>1998</i>	<i>2001</i>	<i>2007</i>	
DK	82.2	91.3	95.2	+15.8	33.2	34.3	19.3	-41.9
FIN	47.8	51.6	50.3	+5.23	10.6	11.8	13.1	+23.6
NO	52.3	54.6	60.5	+15.7	10.7	11.2	13.4	+25.4
S	64.4	68.8	75.3	+16.9	19.3	19.3	19.9	+2.76
NL	85.8	86.1	94.8	+10.4	29.1	32.0	35.0	+20.2

	<i>Metal packaging consumption (kg/cap.)</i>			<i>Per capita metal packag. consumpt. change 1998-2007 (%)</i>	<i>Plastic packaging consumption (kg/cap.)</i>			<i>Per capita plastic packaging consumpt. change 1998-2007 (%)</i>
	<i>1998</i>	<i>2001</i>	<i>2007</i>		<i>1998</i>	<i>2001</i>	<i>2007</i>	
DK	10.3	7.96	6.44	-37.4	32.5	28.1	35.2	+8.26
FIN	6.41	7.95	8.98	+40.1	17.6	16.9	18.7	+6.34
NO	2.26	2.24	3.03	+34.5	22.2	21.9	30.1	+35.8
S	8.44	7.68	7.63	-9.60	15.8	18.0	21.0	+32.7
NL	15.2	13.2	13.4	-11.3	32.1	30.4	37.0	+15.3

Tables 24-25: Paper & board and glass packaging per capita consumption development between 1998 and 2007 in the Nordic countries and the Netherlands - Metal and plastic packaging per capita consumption development between 1998 and 2007 in the Nordic countries and the Netherlands

The first fact that is demonstrated in the tables above is that the Netherlands is consuming far more packaging per capita than any Nordic country. Denmark, with its already high packaging waste generation, falls some 24 kg/cap. behind the Netherlands in 2007, while the Finnish consumption is almost half the Dutch one. What is even more alarming, however, is that the packaging consumption in the Netherlands is increasing; it is noteworthy that its difference with Denmark was only 4 kg/cap. in 1998. All packaging materials –with the exception of metal- demonstrate consumption rises by 10-20% between 1998 and 2007, while the decrease observed in metal packaging is considerable but still not comparable with that achieved by Denmark.

During the period 1998-2005 the packaging policy frameworks in effect in the Netherlands (Packaging Covenants II and III) had set quantitative prevention targets based on the GDP growth. These targets proved to be ineffective, similar to what happened in the case of Finland. The frameworks that followed after 2005 (Packaging

Decree and Framework Agreement, which spans up to 2012) did not include any provisions for the reduction of packaging waste generation; the only mention that is made is that producers and importers should use as small amounts of packaging materials as possible. It should be noted that quantitative prevention targets were enforced in the Netherlands during the 1991-1997 period, requiring specific weight decreases compared to the consumption of a base year, and they had proved to be effective. However, the shift to GDP-related targets -and the overall elimination of prevention goals later on- resulted in these double-digit rises recorded for overall packaging and for the various materials. A packaging tax was introduced in 2008, with the government hoping that it will provide a disincentive for excessive packaging consumption; reports, however, maintain that the tax level is too low and, therefore, not capable of influencing the producers' and consumers' behavior [Rouw, 2009].

	Overall packaging IU 2007 (kg/1,000 € GDP)	Overall packaging IU change 1998-2007 (%)
DK	4.38	-14.6
FIN	2.94	-16.1
NO	2.36	+7.37
S	3.49	-10.8
NL	6.17	-6.20

	Paper & board IU 2007 (kg/1,000 € GDP)	Paper & board IU change 1998-2007 (%)	Glass IU 2007 (kg/1,000 € GDP)	Glass IU change 1998-2007 (%)	Metal IU 2007 (kg/1,000 € GDP)	Metal IU change 1998-2007 (%)	Plastic IU 2007 (kg/1,000 € GDP)	Plastic IU change 1998-2007 (%)
DK	2.67	+0.28	0.54	-49.7	0.18	-45.8	0.99	-6.27
FIN	1.62	-20.1	0.42	-6.23	0.29	+6.29	0.60	-19.3
NO	1.33	+1.42	0.30	+9.93	0.07	+17.9	0.66	+19.1
S	2.12	-9.04	0.56	-20.1	0.22	-29.7	0.59	+3.19
NL	3.24	-6.79	1.20	+1.45	0.46	-25.1	1.27	-2.63

Tables 26-27: Overall packaging intensity of use development between 1998 and 2007 in the Nordic countries and the Netherlands - Material-specific intensity of use development between 1998 and 2007 in the Nordic countries and the Netherlands

The Netherlands exhibits the decreased intensity of use that is expected from a developed economy; the reduction achieved, however, is less significant than those of the Nordic countries. An interesting fact is that while the Dutch per capita packaging consumption is about 15% higher than the Danish, the difference in intensity of use reaches almost 41%. Glass is one of the rare occasions where the IU of a packaging

material is increased in 2007 compared to 1998 in a country besides Norway; if Norway is again not considered, the reductions achieved by the Netherlands in the other material categories are consistently lower than those of at least two Nordic countries in every case.

9.2. Packaging recycling and total recovery

Table 28 presents the overall packaging recycling and total recovery rates in the five countries, while Tables 29 and 30 focus on the packaging recycling and total recovery per material.

	<i>Packaging recycling (%)</i>			<i>Packaging total recovery (%)</i>		
	<i>1998</i>	<i>2001</i>	<i>2007</i>	<i>1998</i>	<i>2001</i>	<i>2007</i>
Denmark	50.0	57.2	61.2	88.5	90.2	102
Finland	44.6	47.2	70.8	55.5	62.1	81.1
Norway	58.9	65.3	69.1	71.0	79.8	90.8
Sweden	74.9	63.2	71.5	81.8	65.6	77.7
Netherlands	62.4	64.6	65.9	84.2	68.2	91.5

Table 28: Packaging recycling and total recovery development between 1998 and 2007 in the Nordic countries and the Netherlands

A very small increase of the Dutch overall packaging recycling between 1998 and 2007 is demonstrated; the Netherlands manages to perform better only than Denmark in 2007 despite the fact that its 1998 rate was higher than that of Finland (by about eighteen percentage points) or Norway (by three and a half percentage points). It is apparent that, after a strong start achieved through the pre-Directive Packaging Covenant I, no substantial improvements have been accomplished during the decade, at the same time when most of the Nordic countries raised their recycling rates by ten to twenty-five percentage points.

Several parameters that may have had an influence on this development could be proposed. The business sector in the Netherlands has had significant power in the negotiations that led to the establishment of the various packaging policy frameworks. It is claimed that the branch organizations did tend to promote the positions of companies that were unwilling to perform major changes, while firms already focused on innovation were not offered any further incentives in order to strengthen their efforts [Rouw, 2009]. In the Nordic countries, on the other hand, even in cases where voluntary agreements have been reached between the state and the economic actors, the governments appear to have been much more decisive and have kept the leading role in policy development; the Dutch government, in comparison, has been characterized as lacking vision and leadership qualities. No inherently counterproductive phenomena such as the lowering of the recycling targets, which took place in the Netherlands in 2006, have been recorded in the North.

Another disadvantage of the Netherlands lies within the choices made regarding the responsibility allocation. First of all, the retail sector is not shouldering the weight

it should be based on its importance in the packaging chain, contrary to the situation in the Nordic countries. Moreover, there are ambiguities over which actor (producers, local authorities) is responsible for what action (collection, recycling, etc.). Such cooperation problems were also mentioned in Sweden, another country where the recycling rates were not improved despite their initially high levels. Finally, another Dutch shortcoming has been the transfer of the responsibility for already existing and successful collection systems (paper & board, glass) to new organizations that did not utilize the existing expertise. The Nordic approach has been different in this case also; for example, the Swedish glass packaging collection system, which predated the introduction of the producer responsibility scheme, remained independent under the new framework since it was already successful.

The situation is better for the Netherlands when the total recovery rates are examined. Despite the fact that the improvement was not great in this case either, the Dutch rate was lower only than the Danish one both at the beginning and at the end of the decade. The introduction of total recovery targets has had a positive influence but it is stated that they may be causing a shift away from recycling and towards energy recovery, something which is undesirable based on their relative positions on the waste hierarchy [Rouw, 2009].

	<i>Paper & board packaging recycling (%)</i>			<i>Paper & board packaging total recovery (%)</i>			<i>Glass packaging recycling (%)</i>		
	<i>1998</i>	<i>2001</i>	<i>2007</i>	<i>1998</i>	<i>2001</i>	<i>2007</i>	<i>1998</i>	<i>2001</i>	<i>2007</i>
DK	58.2	64.9	60.5	97.9	98.2	99.6	75.0	76.0	128
FIN	57.1	58.0	87.6	72.1	74.0	95.5	63.3	49.7	81.1
NO	-	-	82.2	76.4	83.4	93.3	80.0	88.0	99.3
S	84.4	68.7	73.5	93.3	68.9	73.5	83.6	84.0	94.5
NL	69.7	65.2	73.6	90.0	65.2	96.7	85.0	78.1	80.6

	<i>Plastic packaging recycling (%)</i>			<i>Plastic packaging total recovery (%)</i>			<i>Metal packaging recycling (%)</i>		
	<i>1998</i>	<i>2001</i>	<i>2007</i>	<i>1998</i>	<i>2001</i>	<i>2007</i>	<i>1998</i>	<i>2001</i>	<i>2007</i>
DK	6.65	13.9	21.8	93.9	95.7	97.7	40.1	40.2	86.8
FIN	10.2	14.8	18.4	20.1	43.9	43.0	15.2	42.2	70.3
NO	-	-	29.8	56.8	69.3	84.5	37.0	56.0	66.3
S	24.6	17.2	41.7	35.2	31.5	78.3	76.8	68.7	47.2
NL	14.2	20.8	25.9	70.2	39.7	71.5	79.7	77.7	84.1

Tables 29-30: Paper & board and glass packaging recycling and total recovery development between 1998 and 2007 in the Nordic countries and the Netherlands - Metal and plastic packaging recycling and total recovery development between 1998 and 2007 in the Nordic countries and the Netherlands

The paper & board packaging recycling rates reflect the same trends that were described above. Despite a second-only-to-Sweden performance in 1998, the Dutch rate was surpassed by Finland and Norway in 2007. Meanwhile, the total recovery rates were quite better, being close to the Nordic forerunner (Denmark) in 2007.

The situation in the Netherlands has deteriorated during the decade with regard to glass packaging. The recycling rate for this material exceeded those of all Nordic countries in 1998, but by 2007 it had decreased and fallen in the last place. The Dutch targets for this material have been consistently high (although never actually attained) and more ambitious than the Nordic ones in most cases. However, the glass packaging collection system for households in the Netherlands relies primarily on bottle banks (with the exception of beer bottles that are reused), while in the North deposit systems are playing a central role in the achievement of high glass packaging recycling levels (e.g. Dansk Retursystem), glass packaging reuse and end-of-life recycling is widespread (e.g. Finland), or the separate collection of glass packaging straight from the households is implemented (e.g. Norway).

Metal packaging is the material category in which the Netherlands has to present the best results compared to the Nordic countries. A very high recycling rate was reached already in 1998 and –despite not rising by much- it was the second best in 2007, with Denmark being marginally better and the other countries falling far behind. The unusual Dutch household collection system, with the metal packaging waste being put into the bulk household waste, appears to be highly effective.

Finally, plastic packaging recycling is one more area where the Netherlands does not demonstrate a particularly impressive performance. The recycling targets have been fluctuating, but in general appear to have been quite unambitious after the expiration of Packaging Covenant I. The major problem, however, has been the lack (up to 2009-10) of collection systems for plastic packaging waste from households. The only effort aiming at this share of the market was the deposits on plastic bottles, a situation that changes with the introduction of municipal collection systems. On the other hand, both Sweden and Norway, which perform better than the Netherlands, complement their deposit systems for plastic bottles with household collection systems for all plastic packaging waste. The lack of provisions for households can be also held accountable for the lower total recovery rates achieved.

9.3. Concluding remarks

The comparison with the Nordic countries does not prove to be particularly favorable for the Dutch side. The greatest problem is undoubtedly the excessive packaging consumption, which -apart from being greater than those of the rest- is rising with a rather high rate. Certain similarities are detected between the Dutch case -at some points in its history- and the Swedish and Finnish ones: the Netherlands shares with Finland the experience of introducing failed GDP-based minimization targets; it shares with Sweden the encouragement of the business sector to work towards minimization without the introduction of any policy measures that would

make this requirement more tangible. The -common in all three cases- end result has been per capita packaging consumption rises by more than 10% within the decade, although the Nordic countries have at least the advantage of starting from a much lower consumption level.

The situation concerning the recycling rates is better but is still characterized by the inability to build on the foundations set by Packaging Covenant I. In 1998 the Netherlands was recording rates that were better than those of most Nordic countries; in 2007, however, various cases of remarkable progress were demonstrated in the North but no significant improvement in the Netherlands. The superiority of 1998 was lost and the Netherlands now falls behind at least two of the Nordic countries in most categories. It is noteworthy that the Dutch targets are usually more ambitious; most of the times, however, they are not attained and not backed by specific policy measures.

It is not possible to determine what the exact problems and shortcomings of the Netherlands are when compared with the Nordic countries in general; this is of course a consequence of the fact that each one of them has its own distinct policy characteristics and it is, therefore, not wise to treat them as a homogeneous group. Some general remarks, however, can be made.

The two major differences can be found in the approaches towards the role of the business sector and responsibility allocation. The Dutch choice of allowing the packaging industry to hold a major role in the designing of policy frameworks is not encountered in the North; voluntary agreements exist there too but the state is, in general, the most important actor, it enforces its will more decisively and uses its regulatory power more than the Dutch government in order to steer the industry towards the actions required. The Norwegian paradigm, where the packaging policy is also largely based on voluntary agreements, can be much enlightening with respect to this; an in-depth review of the Norwegian case and the reasons behind the failure of their minimization efforts is needed, but despite the actual outcome it cannot be claimed that the Norwegian policy makers did not take measures aiming at shaping and closely monitoring the actions of the industry.

The fact that the Dutch system is in a state of perpetual restructuring does not help either. The Nordic countries have opted for clear structures that remained unchanged throughout the period at hand, within which each actor has very specific tasks and obligations; none of these factors exists at a satisfactory level in the Netherlands. Moreover, while the whole packaging chain is mobilized and participates in the efforts to address the packaging waste issue in the North, this is not the case in the Netherlands where the packaging industry bears a disproportionate share of the weight compared to the retail sector.

Finally, with regard to the type of policies used, it appears that the Netherlands has “avoided” to a large extent the implementation of economic instruments. We have encountered a variety of such instruments in the North: packaging taxes that are

general or specific (e.g. for beverage containers), deposit systems for various types of packaging, financial incentives for citizens in order to participate in recycling schemes, etc. Such instruments are rare in the Netherlands, often quite new (e.g. the packaging tax of 2008) and of dubious effectiveness.

10. The case of Greece

One more case of national packaging policy and its effectiveness during the period following the introduction of the EU Packaging Directive is included in this project, with Greece having been selected as the country examined. The primary reason for this choice was the author's personal interest for the developments in the packaging policy field in his home country. Moreover, Greece is a country where environmental awareness is not as widespread as in Northern Europe, both among the general populace and the government ranks; the actions through which such an awareness is expressed in the material use field (e.g. reuse, recycling, etc.) do not have a long-standing tradition there, as is the case in the North. It is considered, therefore, interesting within this context to determine how does Greece compare with countries where the environmental element of public policy making is well established –and has been so for quite longer-; moreover, some recommendations will be offered, concerning certain aspects of the packaging waste policies already examined, which Greek policy makers could utilize in an effort to create an effective packaging waste management system.

The first part of the chapter will provide an overview of the Greek policy background and will describe all aspects of packaging waste management in the country. The second part focuses on the results achieved by Greece and the developments regarding the packaging consumption, intensity of use and recycling; the results will be compared –as done in the previous chapters- with the targets set. Finally, a framework based upon the policy initiatives encountered elsewhere in this report will be offered as a starting point for an effort to improve the Greek national policy covering packaging use and packaging waste management.

10.1. Policy background

The issue of packaging waste management was introduced for the first time into the Greek public policy sphere in 1994, when the (then) Ministry of the Environment, Spatial Planning and Public Works established a commission aiming at the introduction of regulations for the management of municipal waste and the development of integrated policies on a country-wide level based on the principles of sustainable development and the EU environmental law framework; one of the high-priority issues for that commission was packaging waste management [Μωράκη, 2006]. A multitude of actors began getting involved with the issue roughly around the same time. The ministry retained the role of the authority responsible for shaping and implementing environmental policies concerning packaging waste and for harmonizing the national legislation with the corresponding European. The local authorities, being the parties responsible for the municipal solid waste collection and final disposal activities, began implementing pilot programs of packaging materials collection, which remained, however, isolated and small-scale efforts. The industrial sector was represented in the aforementioned ministerial committee; moreover, some initiatives were undertaken, such as the specialization of some companies on the recovery of packaging materials (e.g. PET bottles) or a small number of efforts

aiming at packaging waste minimization (e.g. increased volume of detergents packaging) [Μωράκη, 2006]. In addition to these, the Aluminium Association of Greece had established HERRA (Hellenic Recovery and Recycling Association, Ελληνική Ένωση Αξιοποίησης Ανακύκλωσης [ΕΕΑΑ]) in 1992, which operated some recycling programs in cooperation with municipalities and several schools [OECD, 2000]. The retail sector was also mobilized to a certain extent, with some supermarket chains undertaking actions such as the collection of cardboard packaging, the participation in recycling schemes for aluminum cans and glass bottles, the substitution of plastic with other materials in foodstuff packaging items and the use of paper bags instead of plastic ones. Universities have been involved as advisors or initiators of pilot schemes, having cooperated with local authorities, the private sector and relevant ministries in the designing and implementation of various recycling projects; various NGOs also have tried to participate in the efforts, focusing on information provision to the general public, although their appeal is limited compared to that of similar organizations in Western and Northern Europe.

The need to transpose the EU Packaging Directive into the Greek legislation was addressed by the Law 2939/2001. It is stated that its aims are the following [Εφημερίς της Κυβερνήσεως, 2001]:

- preventing the production of packaging waste by minimizing the overall packaging volume and the harm induced upon the consumers' health and the environment,
- reducing the final disposal of packaging waste by encouraging reuse systems and material recovery/recycling systems and by encouraging energy recovery systems,
- setting quantitative targets for recycling and other forms of utilization of packaging waste along with medium- and long-term timeframes,
- designing and implementing return, collection and utilization systems with the involvement of all interested parties,
- introducing packaging labeling,
- setting the basic requirements for the composition and nature of reusable and utilizable packaging,
- promoting source separation for the achievement of high levels of recycling and recovery,
- setting standardization procedures for packaging,
- setting measures and conditions for the cooperation of all involved in packaging management based on the "polluter pays" principle and responsibility sharing,
- setting information systems for the consumers in order to adjust public perception and behavior,
- setting information systems for the public with regard to technical standards.

This framework law set the general terms and conditions for packaging management in Greece. According to these, the volume and weight of packaging

should be kept to the minimum levels needed for fulfilling health and safety requirements and for being accepted by the public, while packaging should be designed, manufactured and made commercially available in ways allowing its reuse or the waste utilization and minimizing the effect on the environment from the disposal of packaging waste or of remains of packaging waste management processes. Packaging should also be manufactured in ways promoting products with the least effect on the environment and the materials used should not reduce the utilization possibilities; the minimization of the presence of harmful and other hazardous substances and materials in the emissions, ashes or wastewaters after the incineration or landfilling of packaging waste or of remains of packaging waste management processes should also be ensured. Special requirements are introduced for the reusable and utilizable nature of packaging and a National Organization for the Alternative Management of Packaging and Other Products (NOAMPOP, Εθνικός Οργανισμός Εναλλακτικής Διαχείρισης Συσκευασιών και Άλλων Προϊόντων [ΕΟΕΔΣΑΠ]) is established in order to pursue the aims of the legislation. NOAMPOP enforces the European Commission standards and, when such standards do not exist, it can set national ones. All parties involved in packaging management should possess an alternative management certificate and all actors involved in manufacturing or purchasing packaging should submit annually a report to NOAMPOP regarding the implementation of the terms and conditions included in the law along with their relevant planning for the following year.

According to Law 2939/2001, actors dealing with packaging are obliged to organize systems (or to participate in existing ones) for the alternative management of the packaging involved in their activities. Such systems aim at i) the return or collection of used packaging or packaging waste, and ii) the reuse or utilization of the collected packaging or packaging waste. Alternative management systems are also open to imported products under conditions that do not impose discriminations upon them. These systems can be designed individually by the economic actors or participation in collective systems can be preferred; all alternative management systems, however, must be approved by NOAMPOP.

The law prescribes that packaging suppliers and manufacturers are obliged to collect their packaging from specified locations and use it for the production of new products; packers and packaging importers have to collect and source separate packaging waste and are responsible for their reuse or the transportation to certified utilization facilities. Packaging circulators must also collect used packaging or packaging waste and not circulate packaging without the appropriate labeling. Sanctions and penalties of administrative, civic and penal nature are set for cases of non-compliance, while incentives are offered to actors involved with alternative management systems, based on the legal framework for the encouragement of private investments. Finally, it is determined that the financial resources of NOAMPOP are provided by the fees charged for the approval of alternative management systems and

the issuance of certificates, the fines imposed for non-compliance and funding from the ministry and the EU.

The state of affairs in the Greek packaging policy field can be best summarized by the following fact: although the establishment of NOAMPOP is prescribed by the national framework law of 2001, the organization had not become operational yet as of June 2010, while during that period it had not even been staffed. An intermediate authority temporarily substitutes NOAMPOP during these nine years, the Bureau for the Alternative Management of Packaging and Other Products (BAMPOP, Γραφείο Εναλλακτικής Διαχείρισης Συσκευασιών και Άλλων Προϊόντων [ΓΕΔΣΑΠ]), which is part of the Ministry for the Environment, Energy and Climate Change since 2009.

Three collective and one independent alternative management systems have been approved in Greece so far [Ministry for the Environment, Energy and Climate Change, 2009]. The most important among them is the Collective System for the Alternative Management of Packaging “RECYCLING” (CSAMP “RECYCLING”, Σύστημα Εναλλακτικής Διαχείρισης Συσκευασιών “ΑΝΑΚΥΚΛΩΣΗ” [ΣΣΕΔ “ΑΝΑΚΥΚΛΩΣΗ”]), developed and operated by the Hellenic Recovery Recycling Corporation (HeRRCo, Ελληνική Εταιρία Αξιοποίησης Ανακύκλωσης [ΕΕΑΑ]). HeRRCo is a joint venture, established in 2001 and owned by economic operators (65%) and the local authorities, represented by their national association (35%). Packaging operators can transfer their obligations to HeRRCo, regardless of whether they are shareholders or not, and the activities of the system are organized in close partnership with the local authorities [HeRRCo, 2010]. Four types of action are promoted through HeRRCo: i) financing and development of a “blue bins” network for the collection of household packaging waste (the network covers about 60% of the population), ii) provision of incentives to companies involved in the collection of packaging waste from the industry and the trade sectors, iii) actions focused on packaging waste from large producers and areas of professional activities (e.g. the HoReCa sector), iv) establishing agreements with various shareholders aiming at the utilization of packaging waste for energy generation.

Apart from the “RECYCLING” system, the Collective System for the Alternative Management of Mineral Oils Packaging “Center for Alternative Environmental Management” (CAEM, Κέντρο Εναλλακτικής Περιβαλλοντικής Διαχείρισης [ΚΕΠΕΔ]) is also operational in Greece. The companies participating in this initiative cover about 95% of the Greek lubricants market. Metal and wooden packaging management is undertaken by contractors who collect it from wherever necessary, while plastic and paper & board packaging is collected in dedicated bins placed close to points of interest (e.g. gas stations); containers belonging to the system are also placed in industrial sites [Ministry for the Environment, Energy and Climate Change, 2009]. The third collective system currently operational in Greece was established in 2008 and, therefore, it is of no interest for the purpose of this project. Finally, the sole independent system is run by a major supermarket chain. It offers in-store collection stations for private brand products’ packaging (reusable and recyclable glass

packaging, paper, plastic, metal). Consumers are entitled to a refund, which they claim in cash or offer to charity.

10.2. Achieved results and analysis

The developments in Greece with regard to the packaging consumption, intensity of use and recycling will be presented and discussed in the following paragraphs.

In terms of the targets set, Greece has maintained all the goals described in the European Packaging Directive for both its policy periods without any changes. It should be reminded that Greece has been granted the permission to have a different deadline for attaining the EU targets and, therefore, the first policy period ends in its case in 2005 (instead of 2001) and the second in 2011 (instead of 2008).

10.2.1. Overall packaging consumption

The following section presents the development of the overall packaging consumption in absolute and per capita terms between 1998 and 2007, along with the overall packaging intensity of use during the same period.

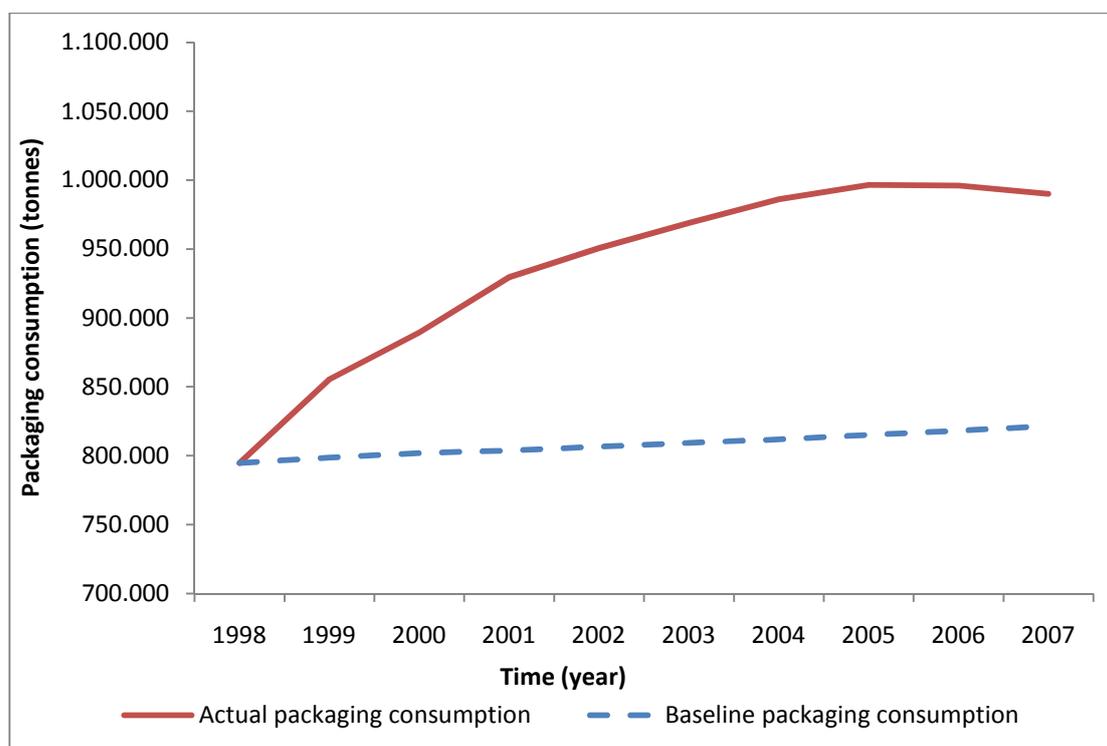


Fig. 98: Actual vs. baseline packaging consumption in Greece, 1998-2007

The actual packaging consumption in Greece was increased by about 195 ktonnes during the decade and the baseline levels were exceeded by more than 168 ktonnes in 2007. It can be seen in Fig. 98 that the increase was stronger between 1998 and 2001, while packaging waste generation peaked in 2005 and has remained stable since then. The per capita consumption appears to have increased by 20.5% during the same time, a rise much higher than those of all countries examined so far (with the exception of Norway), but the 2007 figure of 88.6 kg/cap. is the lowest encountered in this project.

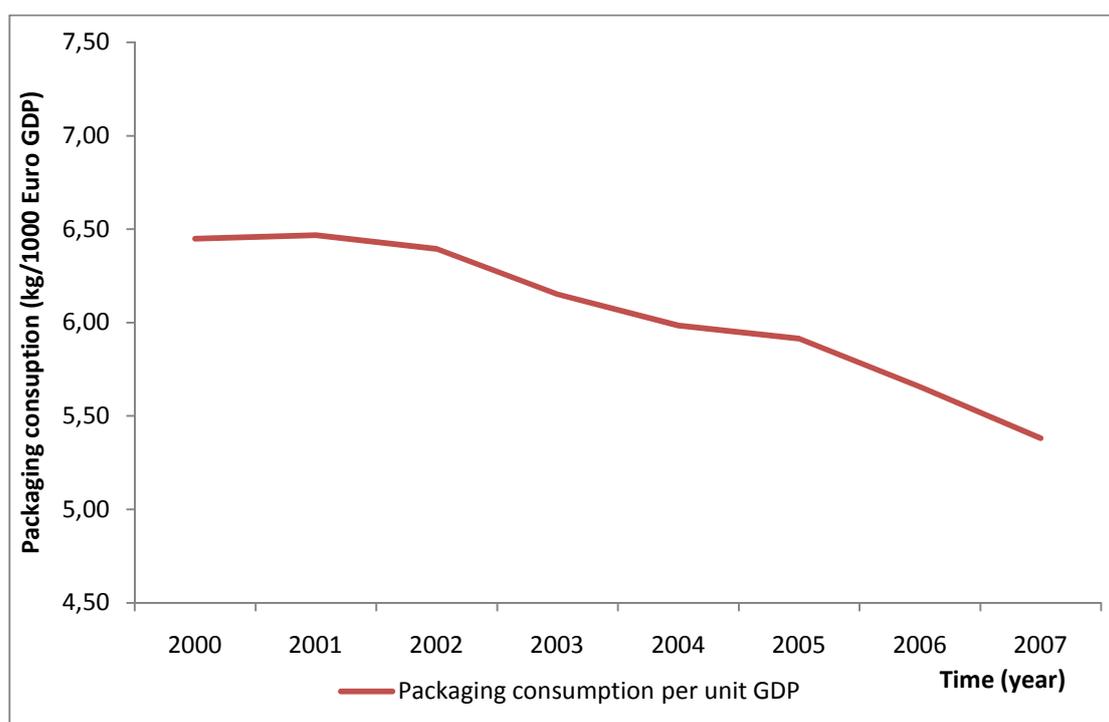
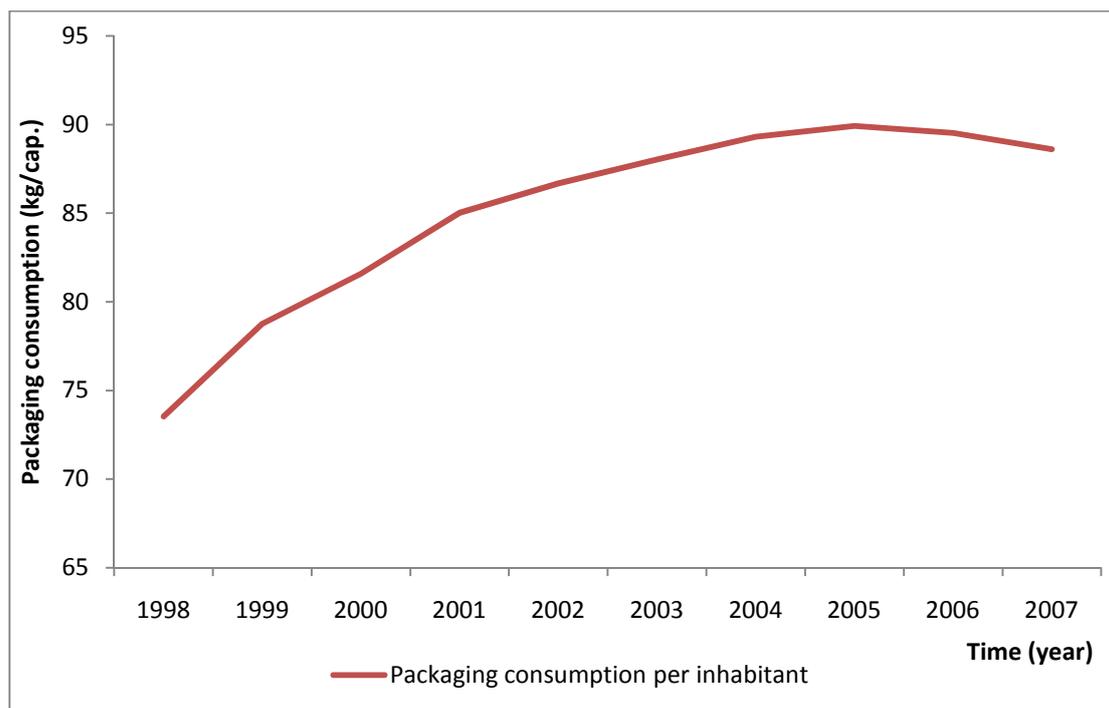


Fig. 99-100: Packaging consumption per inhabitant in Greece, 1998-2007 - Packaging consumption per unit GDP in Greece, 2000-2007

The developments in packaging intensity of use are examined during the period 2000-2007 because Eurostat does not make available any data concerning the Greek GDP prior to 2000. A higher than 20% decrease of the packaging IU was recorded, which is the best performance encountered in this project; unlike the situation in the per capita consumption, however, Greece demonstrated the second highest (after the Netherlands) packaging IU in 2007 among the countries examined.

10.2.2. Overall packaging recycling and total recovery

The following section will illustrate the development of the recycling rates achieved by Greece against the targets set during the 1998-2007 period. Since no other recovery activities apart from material recycling take place in Greece, the recycling rates are in this case equal to the total recovery rates and no separate mention to the latter will be made.

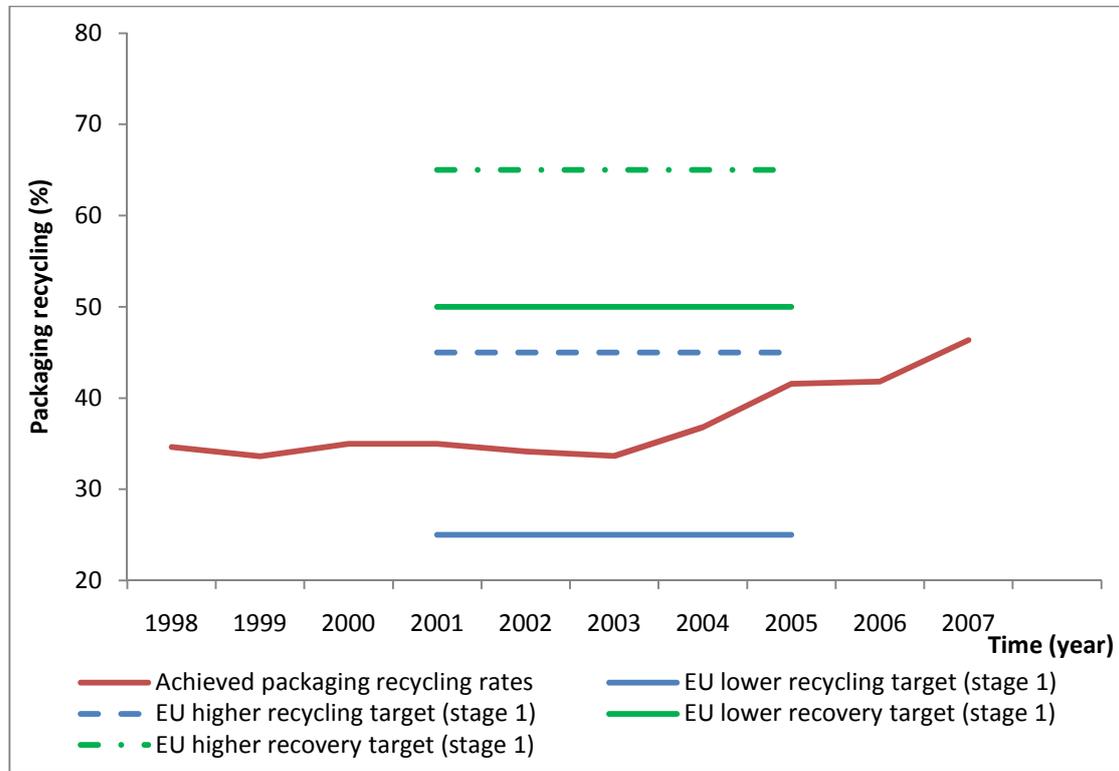


Fig. 101: EU packaging recycling and total recovery targets vs. achieved packaging recycling rates in Greece, 1998-2007

As mentioned above, the EU targets for the first policy period were transposed into the national legislation through the Law 2939/2001 of 2001 and Greece had its deadline for their attainment extended up to 2005. The second policy period targets were incorporated into the framework law through the Joint Ministerial Decision 9268/469 of 2007; they are not presented, therefore, in Fig. 101.

The packaging recycling rate remained rather constant in Greece up to 2003; the absolute recycled packaging quantity, however, was increased by more than 50 ktonnes (+18%) between 1998 and 2003, indicating that a considerable effort was made in the recycling field. The rise of the recycled amounts is even stronger after 2003 and –combined with the stabilization of the packaging waste generation– resulted in an increase of the recycling rate by almost thirteen percentage points up to 2007. The Greek rate was always above the minimum recycling target for the first policy period and by 2005 it had approached the maximum target of 45%; the total recovery target, on the other hand, was never attained, as a result of Greece relying only on recycling in order to fulfill its commitments towards the EU.

Since Greece was at its first milestone year in 2005, a comparison of its recycling rate during this year with the rates that the other countries achieved in 2001 is more representative of its progress than a year-per-year comparison. The 41.5% rate of 2005 is relatively close to the Finnish 2001 result (47.2%) but falls behind all the other countries examined by sixteen to twenty-four percentage points, an outcome indicative of the Greek shortcomings in terms of the policy initiatives introduced and of their implementation.

10.2.3. Consumption and recycling per material

10.2.3.1. Paper & board

The following section will demonstrate the developments regarding the paper & board packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

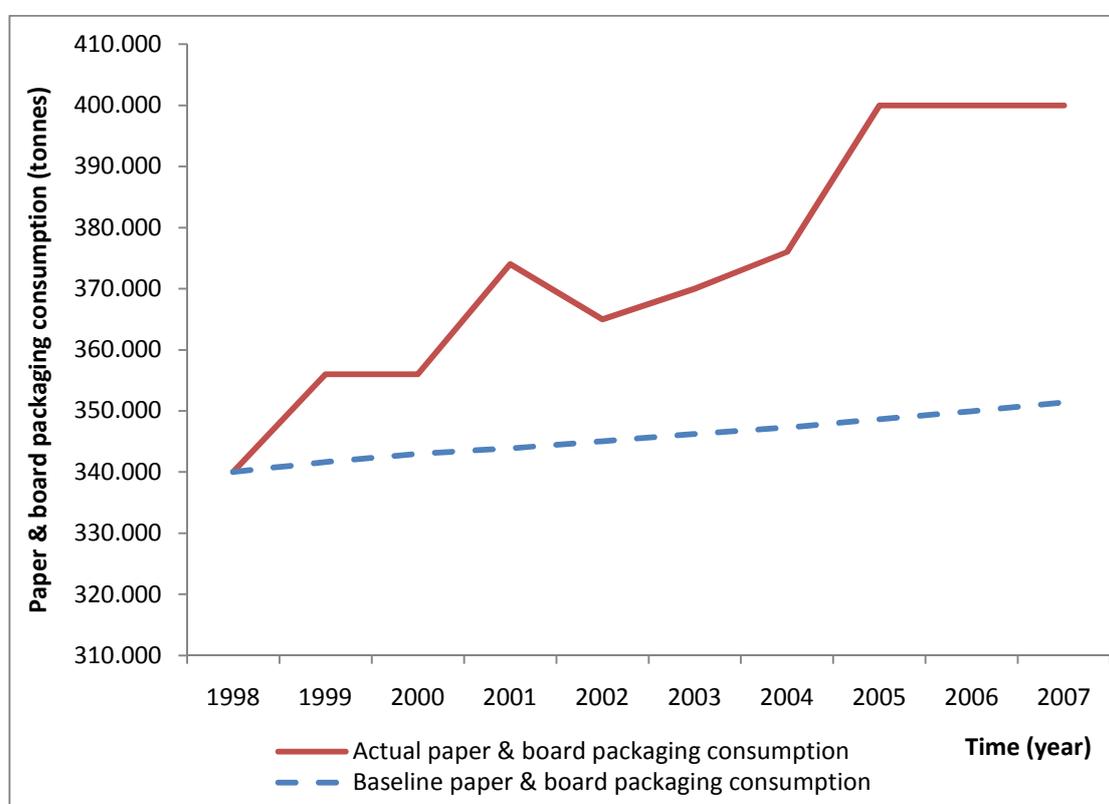


Fig. 102: Actual vs. baseline paper & board packaging consumption in Greece, 1998-2007

The paper & board packaging consumption has demonstrated an almost uninterrupted increase during the period at hand, leading to a peak and stabilization after 2005. The rise recorded during that 8-year time span reached 60 ktonnes, resulting in a higher than 48 ktonnes difference between the baseline and the actual consumption in 2007. The per capita consumption was increased by close to 14%, a figure comparable to those of most countries encountered thus far, where paper & board packaging waste generation increases in the range of 10%-17% were recorded. The intensity of use was reduced by almost 16% during the 2000-2007 period, with

only Finland having demonstrated a better figure (-20%) among the countries participating in this project.

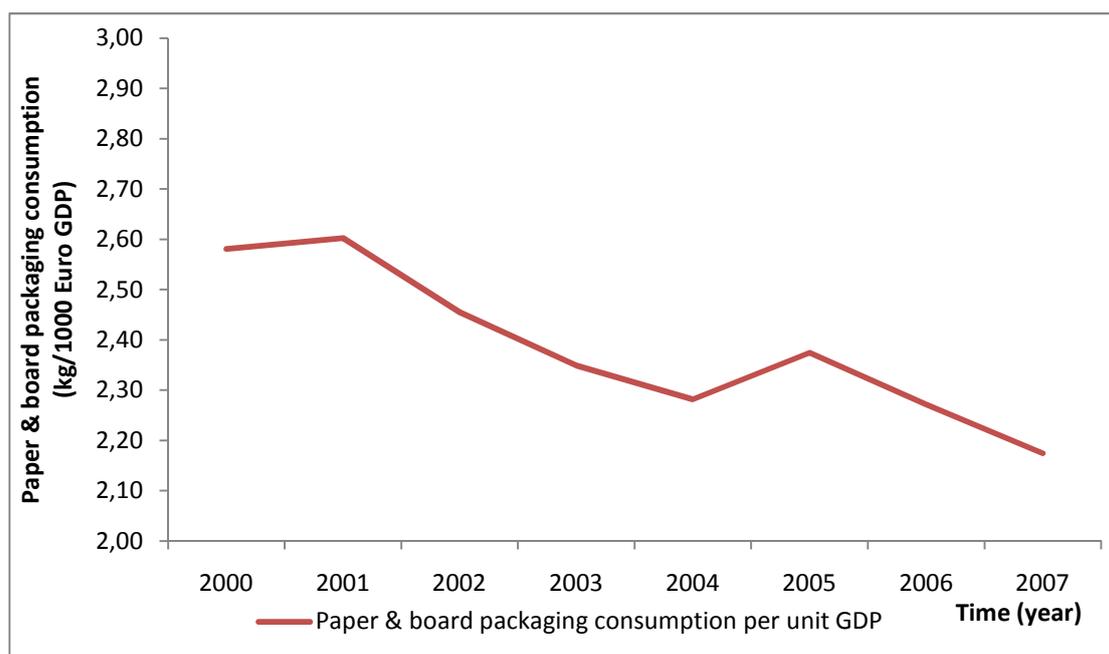
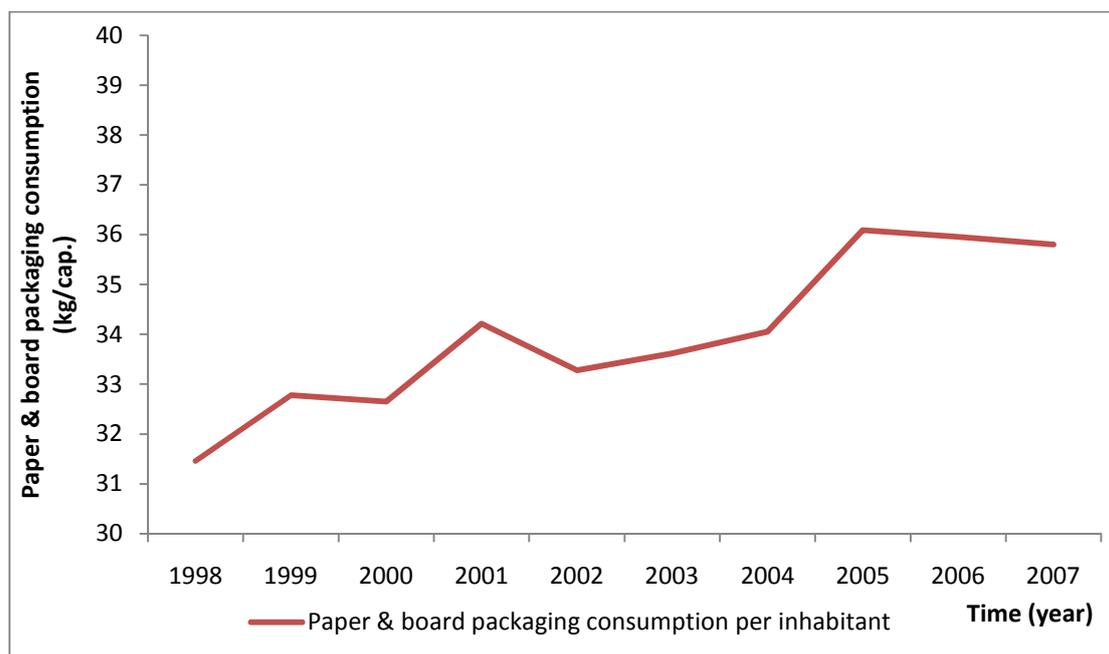


Fig. 103-104: Paper & board packaging consumption per inhabitant in Greece, 1998-2007 - Paper & board packaging consumption per unit GDP in Greece, 2000-2007

In terms of paper & board packaging recycling (Fig. 105), Greece had reached rates exceeding 60% already in 1998, making the EU target attainment rather irrelevant. No significant progress was made in this field, however, during the timeframe examined, with the increase of the amounts recycled following closely the rises in waste generation; follow-up data from the upcoming years are required in

order to determine if the considerable increase in 2007 was a permanent or temporary development (e.g. a case of statistical inconsistency). It should be mentioned that the Greek rate (72.5%) for the 2005 milestone year has been excellent –taking also into account the limitations of the country- as demonstrated through its comparison with the 2001 figures of the rest of the participants: the Greek performance is the best of the group and the only one above 70% by the end of the first policy period.

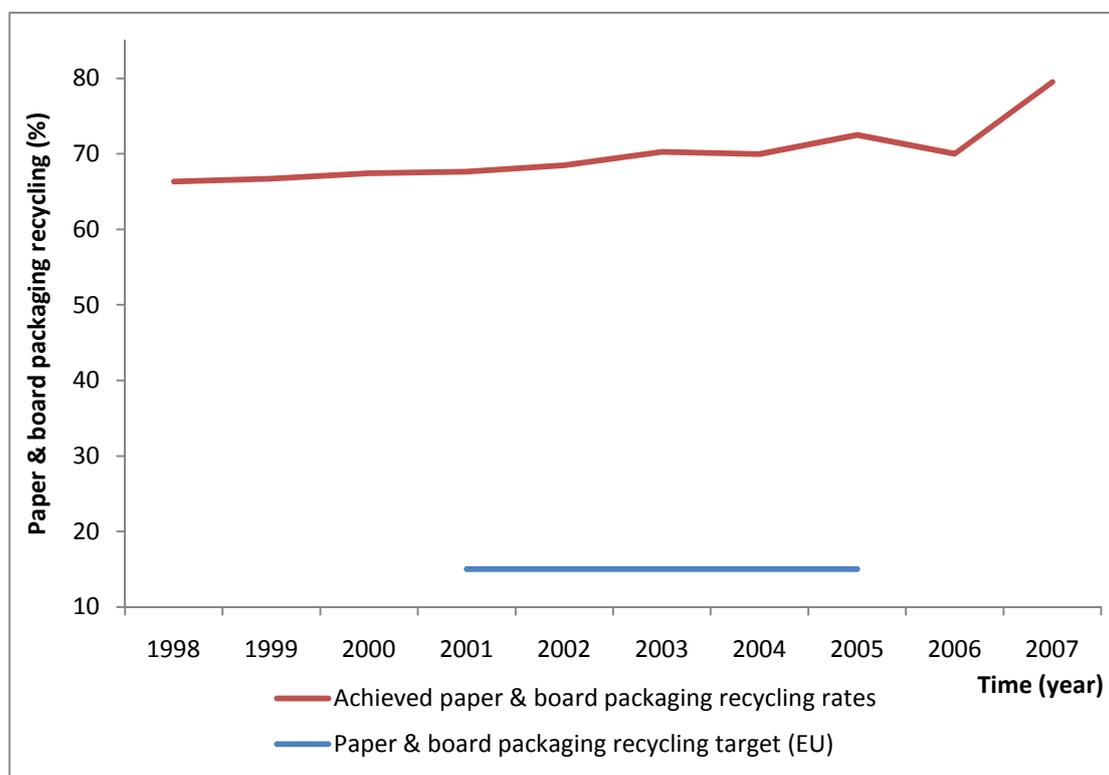


Fig. 105: EU paper & board packaging recycling targets vs. achieved recycling rates in Greece, 1998-2007

10.2.3.2. Glass

The following section will demonstrate the developments regarding the glass packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

The development of the glass packaging consumption in Greece (Fig. 106) can be characterized as rather strange; a slight increase during the 1999-2004 period was followed by a one-year peak (+24 ktonnes) and, finally, the glass packaging waste generation dropped by 57 ktonnes in 2006 and became lower than the baseline. These fluctuations are difficult to explain, given the absence of any policy measures being introduced or of any apparent changes in the consumption patterns of the Greek population. The scenario that seems most probable is, therefore, that these developments are attributed to the data collection methods applied in the case of this material, creating several questions about their reliability. Nevertheless, what the data reported suggest is that the per capita consumption was reduced during the period at hand by 9%, making Greece the only country besides Denmark that accomplished a

decrease in this category. Moreover, the glass packaging IU appears to have dropped by 37.5% between 2000 and 2007, a figure which is once more second only to that of Denmark.

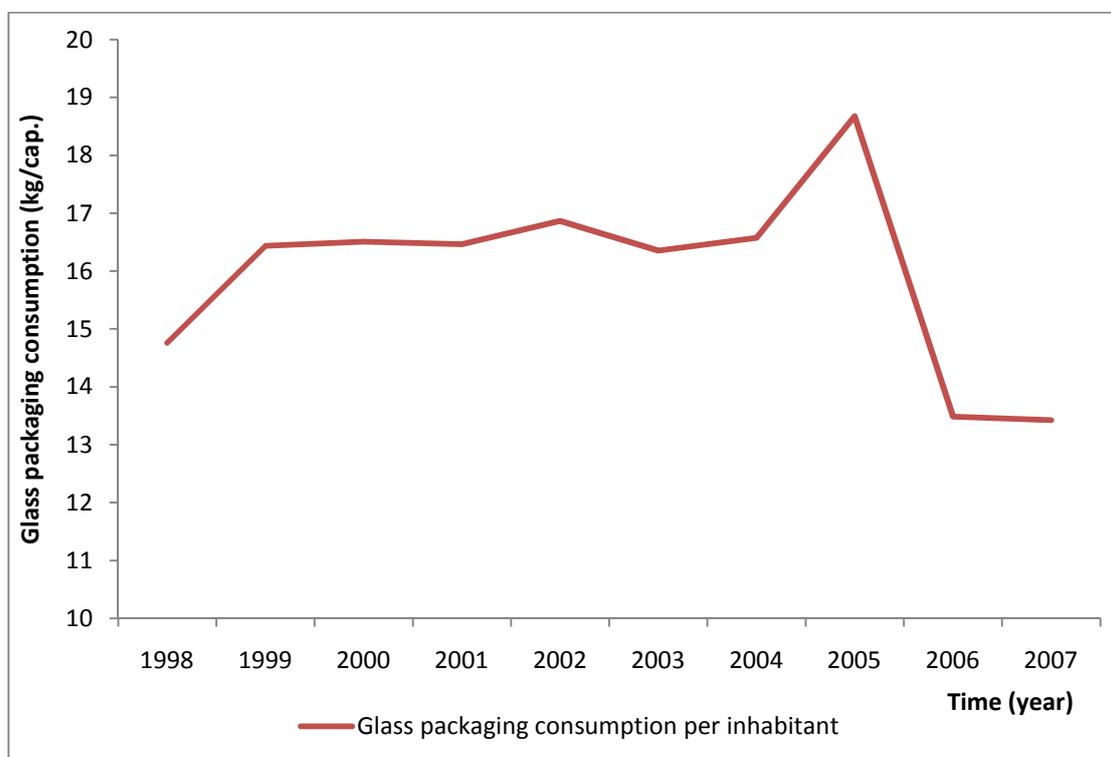
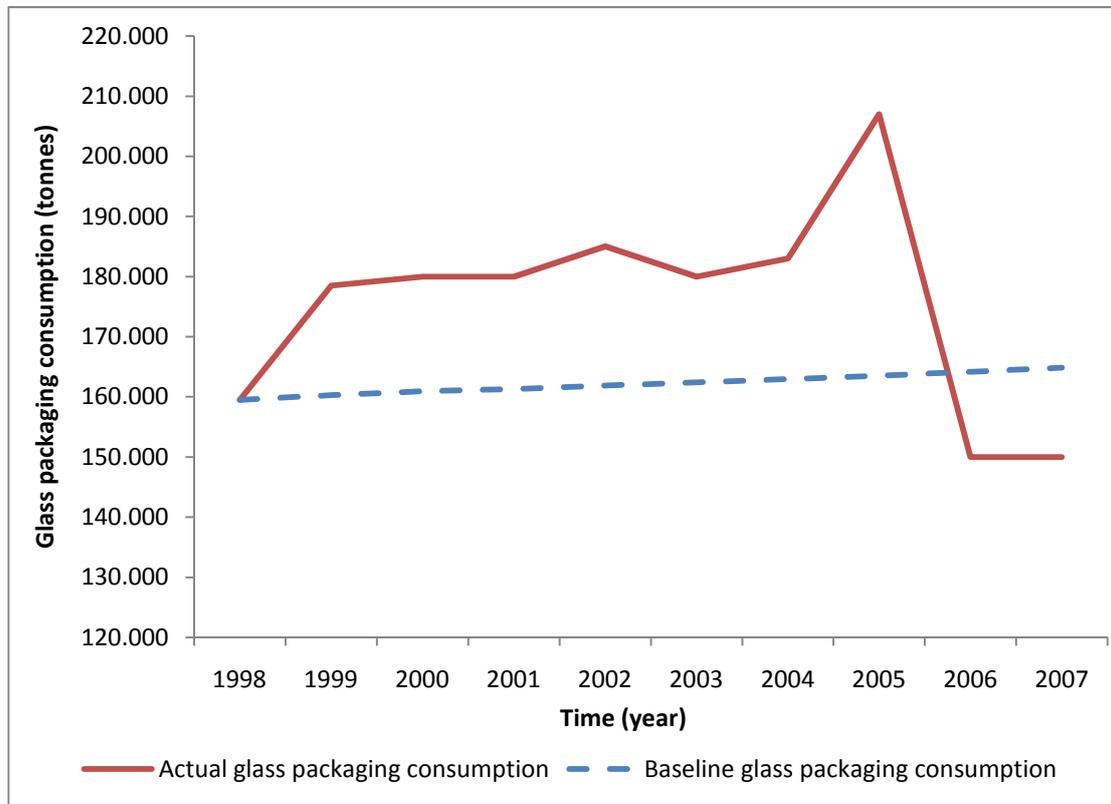


Fig. 106-107: Actual vs. baseline glass packaging consumption in Greece, 1998-2007
 - Glass packaging consumption per inhabitant in Greece, 1998-2007

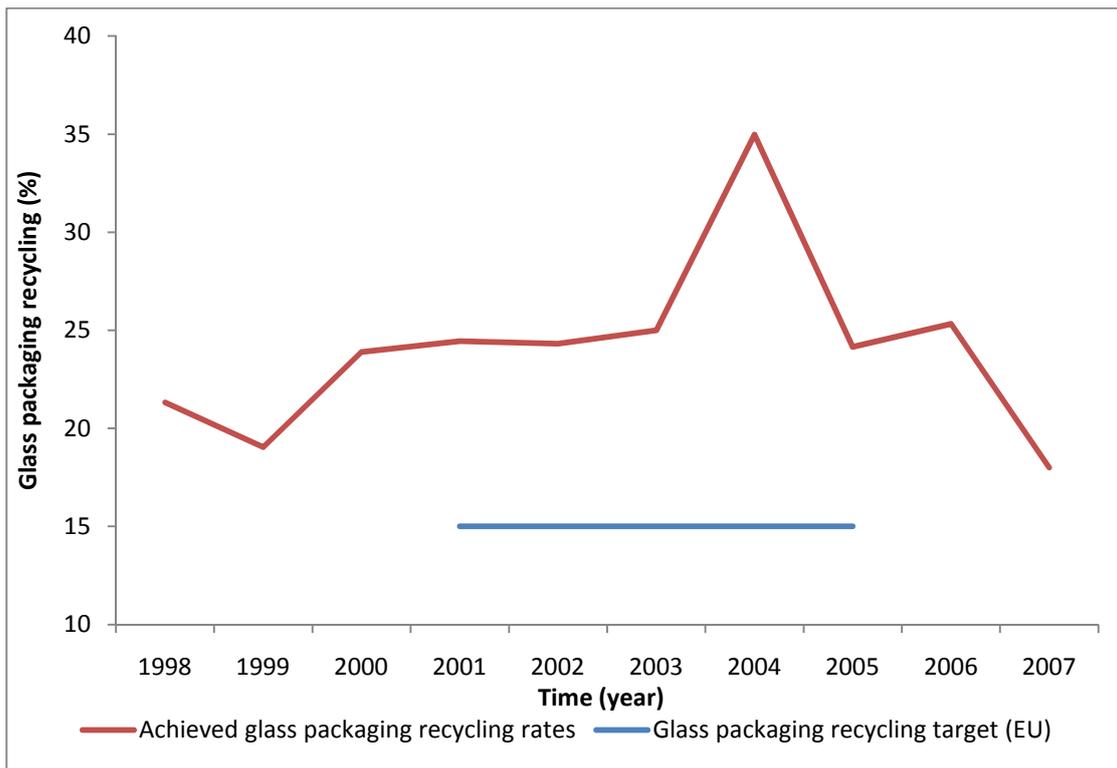
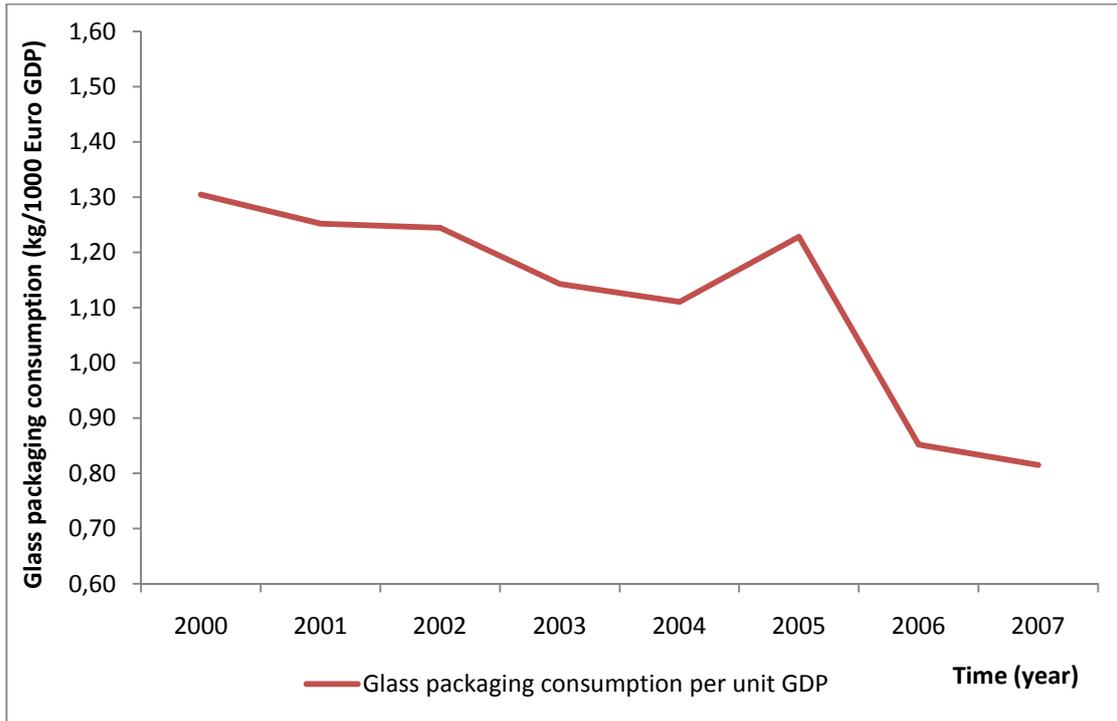


Fig. 108-109: Glass packaging consumption per unit GDP in Greece, 2000-2007 - EU glass packaging recycling targets vs. glass packaging achieved recycling rates in Greece, 1998-2007

Glass packaging recycling in Greece demonstrated a slight increase between 1999 and 2003. The 2004 peak was a one-year occurrence, after which the recycled amounts began decreasing. The reduced waste generation in 2006 did not allow this

decrease to be apparent in the recycling rate, but the trend continued also during the next year and resulted in the 2007 rate being the lowest of the decade. Greece, nevertheless, easily attained the EU target for the first policy period. The rate, however, during the first milestone year (2005) is very low compared to the 2001 rates of the other countries; Greece is limited to a 24% at the same time when the lowest figure at the end of the first policy period was about 50% (Finland) with all other group members being above 75% or even 80%.

10.2.3.3. Metal

The following section will present the developments regarding the metal packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

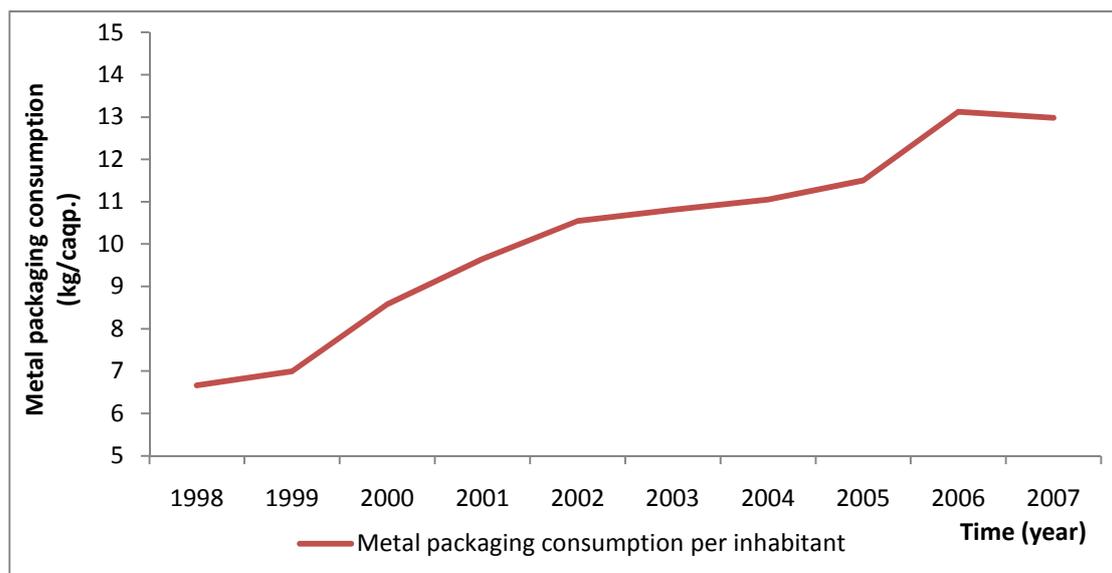
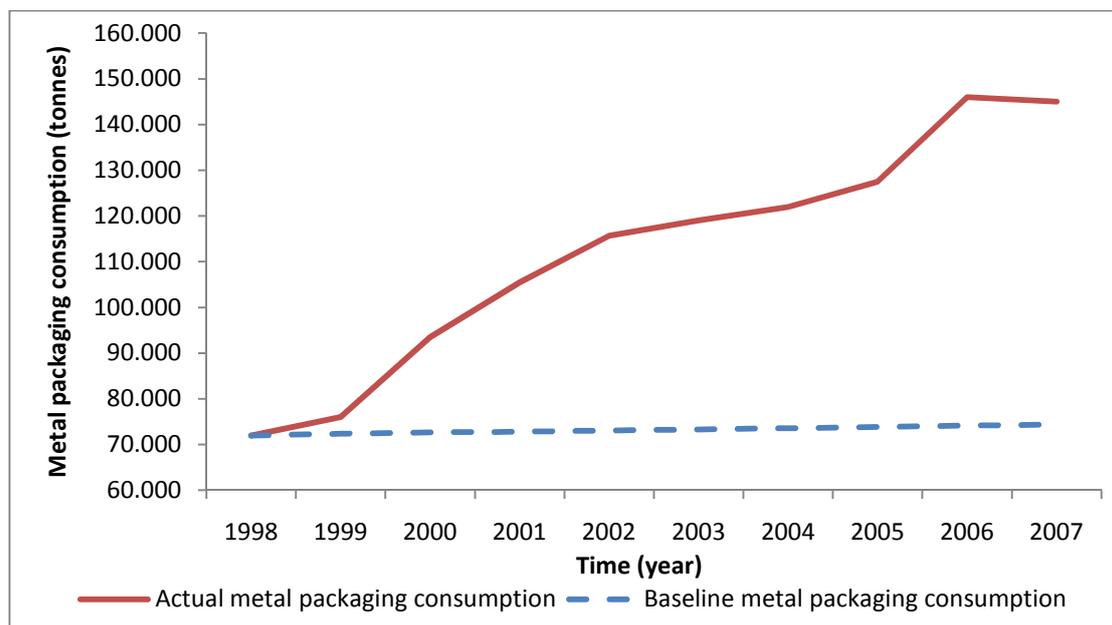


Fig. 110-111: Actual vs. baseline metal packaging consumption in Greece, 1998-2007 - Metal packaging consumption per inhabitant in Greece, 1998-2007

The metal packaging consumption in Greece doubled between 1998 and 2007, having demonstrated a continuous growth almost throughout the decade. The 95% increase of the per capita consumption is an extremely high figure, much larger than any change recorded in any material category so far in this report. Such a drastic increase is expected to result also in a rise of the intensity of use; the higher by 16% IU in 2007 compared to 2000 comes, therefore, as no surprise.

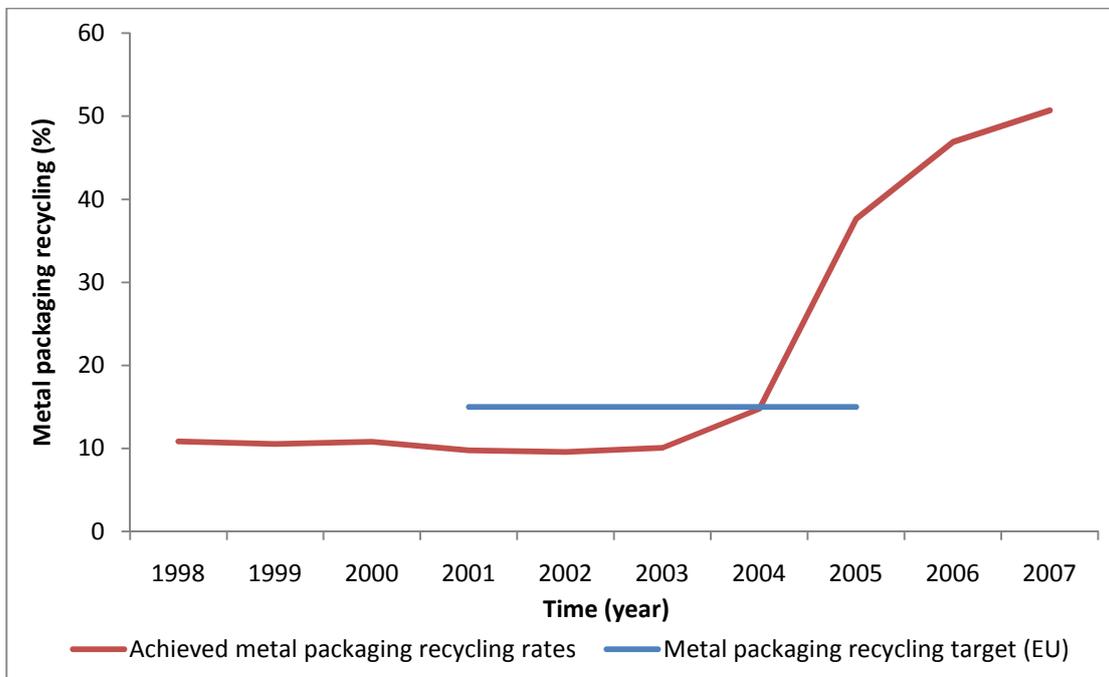
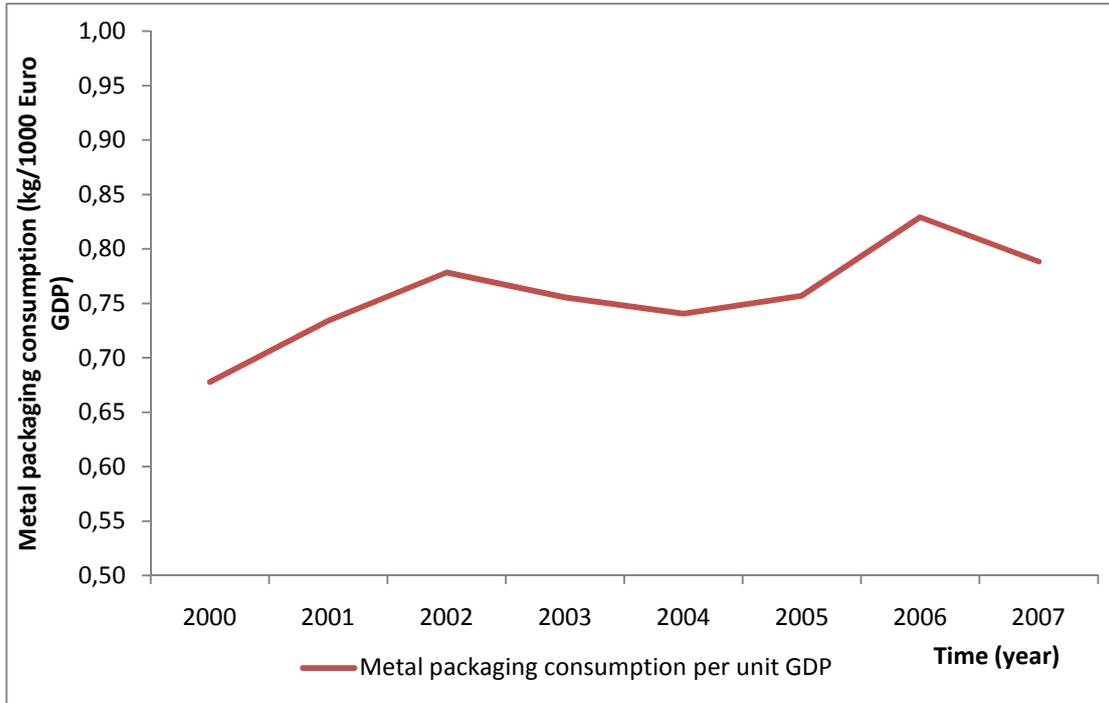


Fig. 112-113: Metal packaging consumption per unit GDP in Greece, 2000-2007 - EU metal packaging recycling targets vs. metal packaging achieved recycling rates in Greece, 1998-2007

Metal packaging recycling appears to be a field where a considerable effort for improvement has been made. The absolute amount recycled grew by 840% between 1998 and 2007 (310% between 2004 and 2007 alone), resulting in an almost five-fold increase of the metal packaging recycling rate in spite of the aforementioned doubling in waste generation. Despite being below the target at the year of its introduction, Greece attained it by more than twenty percentage points in 2005. Leaving this considerable improvement aside, however, it should be mentioned that the Greek rate for 2005 (37.6%) fell quite behind the 2001 rates of the other countries examined, being relatively close only to those of Denmark (40%) and Finland (42%).

10.2.3.4. Plastic

The following section will present the developments regarding the plastic packaging consumption (absolute and per capita), intensity of use and recycling against the targets set during the period 1998-2007.

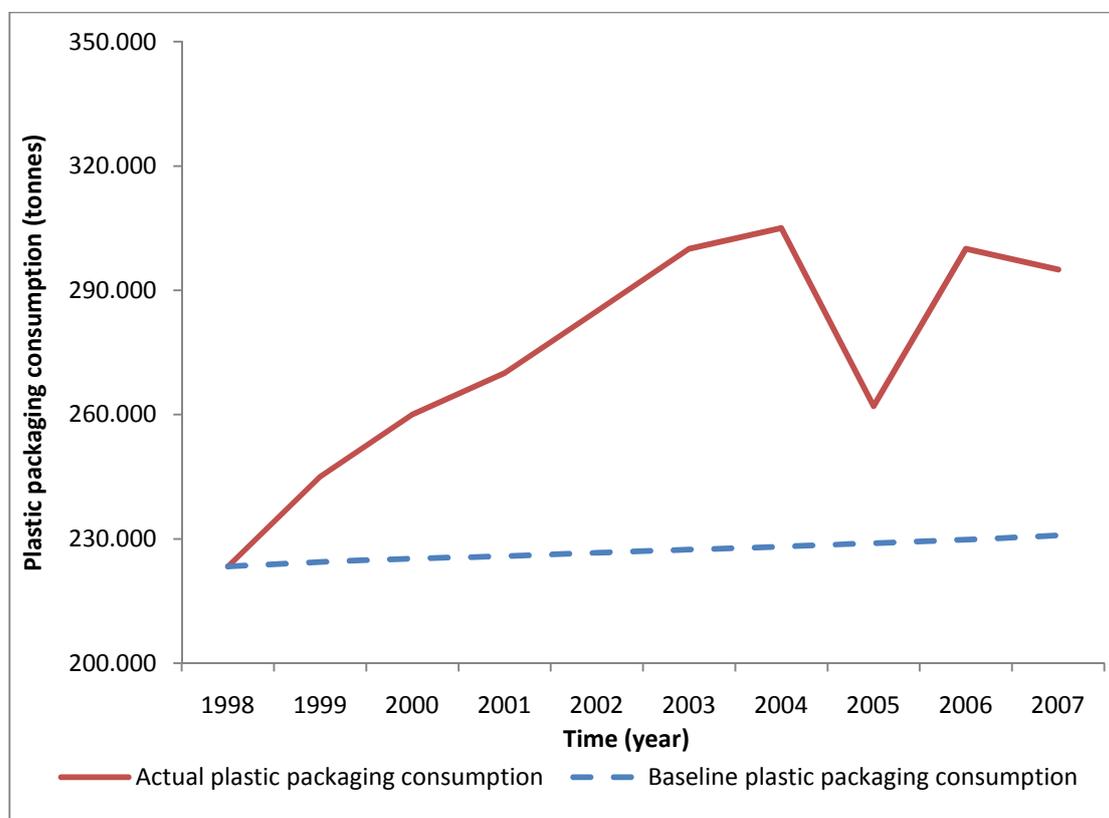


Fig. 114: Actual vs. baseline plastic packaging consumption in Greece, 1998-2007

The plastic packaging consumption was increased significantly during the period 1998-2004, showing signs of stabilization after that point. The overall rise throughout the decade exceeded 71 ktonnes and the actual plastic packaging consumption was higher than the baseline by close to 65 ktonnes in 2007. The per capita consumption grew during the same period by almost 28%, with this figure being one of the highest increases among the countries examined (surpassed only by Sweden and Norway). The intensity of use, on the other hand, was reduced by 15% between 2000 and 2007, a reduction that constituted the second best performance in this category.

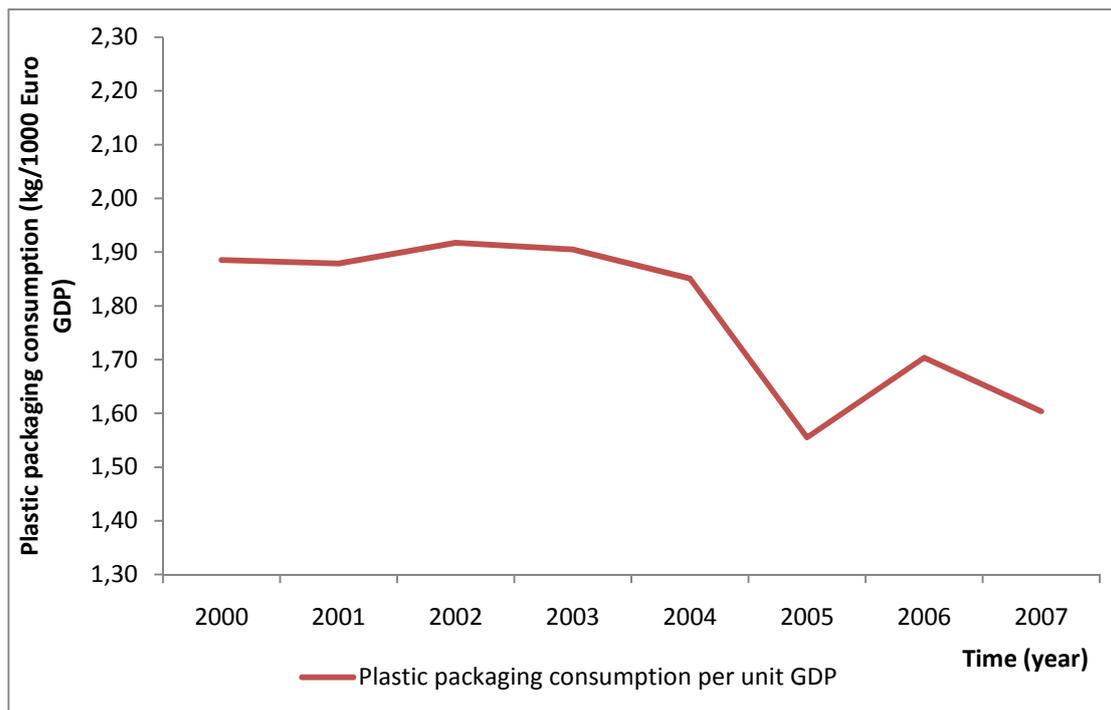
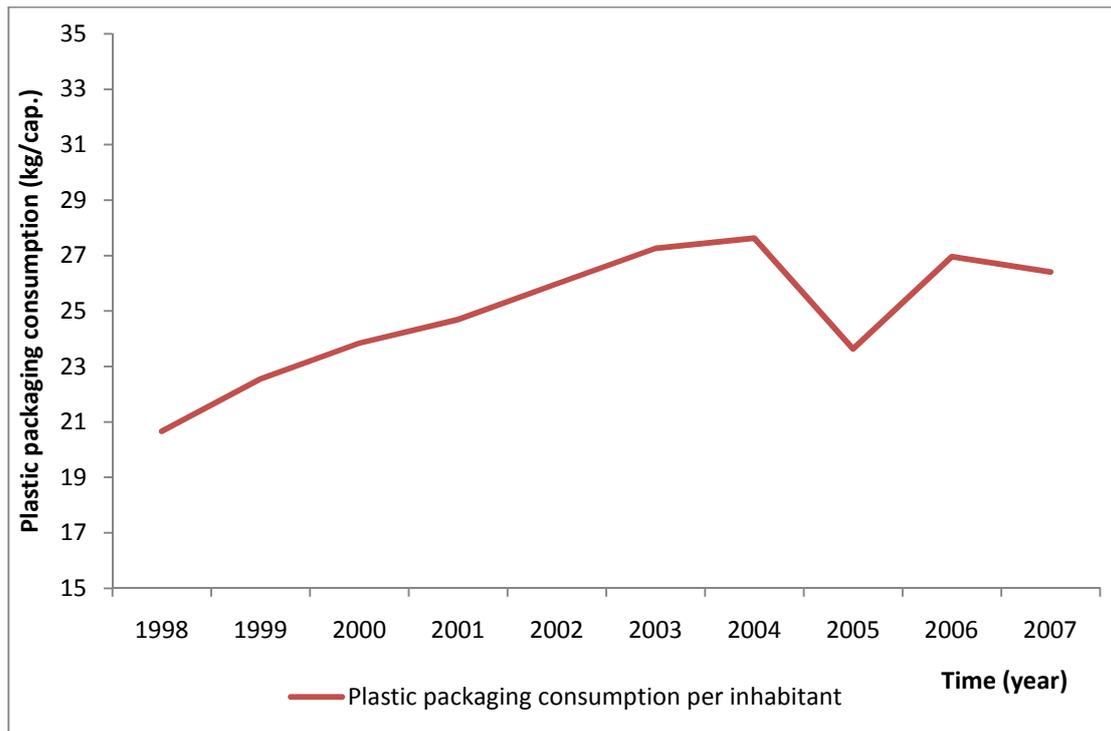


Fig. 115-116: Plastic packaging consumption per inhabitant in Greece, 1998-2007 - Plastic packaging consumption per unit GDP in Greece, 2000-2007

The situation with regard to plastic packaging recycling was generally unchanged – both in terms of absolute quantities and of recycling rates- between 1998 and 2003 (Fig. 117). The very low rate began increasing considerably after this point and it more than quadrupled (from 3% to almost 14%) during the years up to 2007. It should be mentioned that the recycled plastic packaging amount had to rise by 350% so as to

compensate also for the higher demand for this material. Despite this significant effort, however, the first stage target was not attained; the Greek performance at the end of the first policy period (2005) is the worst among all the countries examined when compared with the respective year for them (2001).

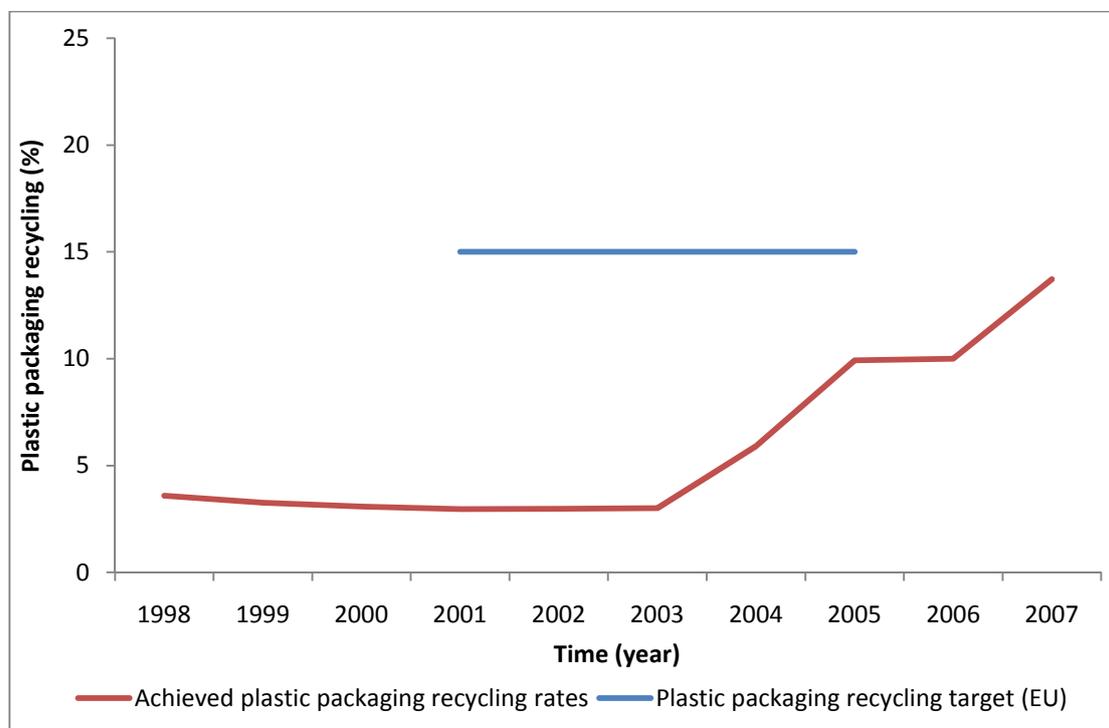


Fig. 117: EU plastic packaging recycling targets vs. plastic packaging achieved recycling rates in Greece, 1998-2007

10.2.4. Packaging materials shares

Fig. 118 demonstrates the development of the share of each packaging material in the overall packaging per capita consumption between 1998 and 2007. It can be seen that the paper & board packaging's share has been maintained rather stable throughout the period examined, while the same is generally true also in the case of plastic packaging. Significant changes appear to have taken place in glass and metal packaging, however; the share of the former has decreased from 20% to 15% between 1998 and 2007, while that of the latter grew from 7% to 13% during the same period. The difference between the developments in these two cases is that while the metal packaging growth is spread throughout the decade, the glass packaging share was reduced only during the last two years as a result of the large consumption drop recorded in 2006. Signs of glass packaging being substituted by metal are, nevertheless, present in this graph, but the reliability of the glass packaging waste generation data should make our approach towards this statement rather cautious.

Considering both the consumption levels and the intensity of use for each material, as presented above, it is observed that a weak dematerialization process took place for paper & board and plastic packaging between 1998 and 2007, accompanied by strong

dematerialization in the case of glass packaging –with the same data reliability concerns still present- and a materialization process in the case of metal.

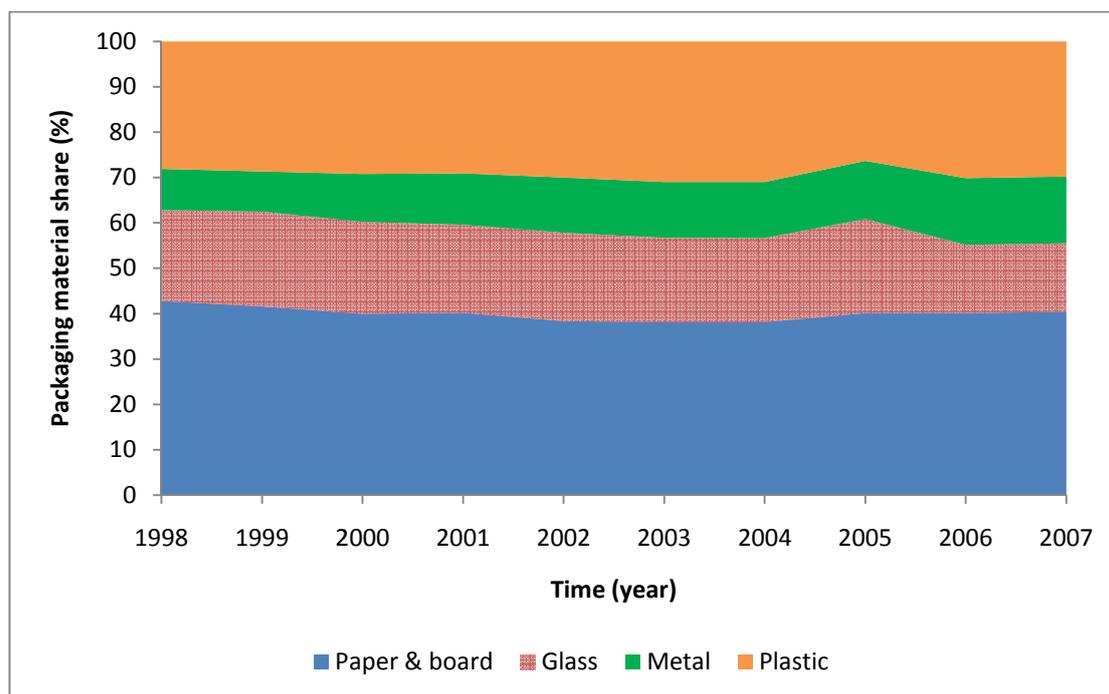


Fig. 118: The development of the share of each packaging material in the overall per capita packaging consumption in Greece, 1998-2007

10.3. Discussion

This section was devoted in the previous chapters to the effort to identify the effect of the various policy measures implemented by each country on the results achieved. Greece, however, is a different case, since no actual policy initiatives have been promoted despite the existence of the 2001 framework law that could become the starting point for the designing of a Greek packaging policies package. No attribution, therefore, of the results presented above can be made to specific policy measures; what will be attempted instead is to offer some recommendations -based on the experiences of the countries examined so far- about the actions that should be considered by the Greek policy makers in order to establish a functioning packaging waste management system. Such a system would be able to help the country attain the targets set by the Packaging Directive and, hopefully, achieve results even better than those required.

The producer responsibility scheme that was introduced with the 2001 framework law should be organized properly, based on the Finnish and Swedish experiences. NOAMPOP, which -as mentioned above- has still to become operational, should be established now as the coordinating government agency with the role of supervising the system, setting policy priorities and targets and designing the implementation of policy measures; data processing and EU-reporting responsibilities should also be assumed by it. The possibility of creating an unlimited number of licensed alternative management systems should be discarded in favor of focusing on only one system

covering the entire country. This system should be based on HeRRCo, the owner and operator of the largest alternative management system currently operational in Greece. HeRRCo would assume the role of PYR or REPA within this proposed EPR scheme as the primarily privately owned actor who is coordinating the recovery activities. A number of material companies should be established, operating under the supervision of HeRRCo; all operators that handle packaging and have an annual turnover above a specified threshold should join HeRRCo, with the packaging fillers and importers paying fees relative to the amounts and types of packaging that they put on the market in order to finance the system.

Introducing such a scheme would already bring about a number of changes. First of all, every party obliged to assume responsibility of its packaging would be made to do so through specific participation rules that would be strictly implemented by the coordinating organizations (HeRRCo and -in cases of persistent non-compliance- NOAMPOP). By obligating participating companies to keep inventories of the packaging they introduce to the market and to report all quantities under a common format used by all members, data collection would become much more organized - compared to nowadays-, thus allowing the compilation of more accurate and reliable figures and enabling policy makers to determine what the actual situation is and what measures should be taken. Creating a self-financed system (participants' fees, income from recycling activities) would alleviate the need to seek governmental and EU funding for packaging management activities (as it is done today), a feature of significant importance within the context of the Greek economic meltdown that has made government spending rare in every field. Even more importantly, economic operators, who now find no costs attached to their packaging use, would be burdened with charges and a very probable side-effect would be the implementation of plans aiming at the reduction of packaging waste generation –at least on a “low-hanging fruits” level initially-.

One of the foremost priorities of the proposed EPR scheme –apart from ensuring that all obliged companies actually participate in it- should be the expansion of the packaging waste collection capabilities. There are a number of conditions that make the introduction of a well-functioning household waste collection system relatively easy. The Greek population is primarily urban, with the metropolitan area of the capital (Athens and the surrounding areas in the Attiki region) holding about half of the country's eleven million inhabitants. The second largest city (Thessaloniki) adds about one more million people to the urban population, while a number of smaller cities with a population above 100,000 exist. Moreover, the Greek cities -apart from having the largest share of the population concentrated within them- are very densely populated, eliminating to a large extent problems that sparse suburban populations pose in the North (e.g. Sweden). HeRRCo's “RECYCLING” system's “blue bins” network can be used as the basis of the collection infrastructure needed. A combination of centrally located collection points (e.g. in neighborhood squares) with a network of dedicated recycling bins would be ideal for the Greek urban environment

and conditions. Relying only on centralized collection points would have a negative effect on the citizens' participation, since their environmental awareness is not strong enough to encourage making the extra effort needed in order to transport the waste to such points. On the other hand, the municipal waste collection systems offer a network of collection bins located in close proximity to almost every house in urban areas; recyclable waste collection bins can be added to the same points in this network, making the new system equally accessible to the population. In this way, common problems faced by the "RECYCLING" system, such as the disposal of ordinary waste in the blue bins because of a lack of ordinary bins nearby or the lack of blue bins in areas where there is population willing to participate in recycling activities, would be avoided. It would be also necessary to accompany the building of such a collection infrastructure with extended information campaigns aiming to convince the population of the importance of the recycling activities and to offer all necessary practical information, especially to certain portions of the population (e.g. immigrants, the elderly, etc.) among which such activities currently have no penetration whatsoever.

Apart from the household packaging waste, the collection of waste from the trade and industry sectors should also be better organized. HeRRCo has been undertaking initiatives for the collection from special points where large amounts of packaging waste are generated (e.g. hotels); such initiatives should be expanded to cover as many points as possible, establishing –for example- separate collection systems of the material companies for packaging waste from businesses (HoReCa, retailers, etc.). Another issue falling under the same category would be that of the increased packaging waste generation in areas that accommodate large numbers of tourists for 3-4 months annually, while having small populations during the rest of the year. Such areas exist both in mainland Greece and in the islands and it would be advisable that a revised packaging waste collection system be extended to these regions during the "peak" months; especially for the islands, the trucks that return empty to the mainland after having transported products could offer the solution for the collected amounts' transportation. Moreover, operators in the industry sector (factories, large warehouses, etc.) should become obliged to separate their packaging waste (primarily paper & board and plastic transport packaging) and take care of the collection activities necessary. The current system covering lubricants packaging could be kept operational on an individual level, since it is already established and well-functioning.

About 50% of the household waste generated is currently landfilled in Greece, while most of the rest (about 40% of the total amount) is disposed of in illegal dumping sites; an immediate ban on the landfilling of recyclables is not realistically feasible at this point, since the infrastructure necessary for the recovery of all the packaging waste generated is not present and the illegal dumping problem is far from solved yet, although it should definitely be implemented at some point in the future. Until then, however, it would be beneficial to introduce higher charges for the landfilling of waste in order to encourage local authorities to participate actively in

efforts that would remove recyclables from the general waste stream, thus reducing its volume and, consequently, their landfilling costs. Such an initiative should be combined with the elimination of the illegal dumping phenomenon, as it offers a way out of paying charges; in the case that these would be raised, such an option would become increasingly appealing. Charges or bans regarding the landfilling of combustible waste, as imposed in other countries encountered in this report, have currently no implementation potential in Greece, since there is no infrastructure for the recovery of energy out of waste.

All the elements of a new approach towards packaging waste management proposed thus far revolve around the issues of the collection and recovery of packaging materials. Given, however, that the top priority in the waste hierarchy is the minimization of the amounts of waste generated, initiatives aiming at this point should also be promoted. A category of packaging products upon which the attention of policy makers is focused in most of the countries examined in this report is beverage containers; no organized initiatives in this field have existed in Greece so far. It has been demonstrated that this segment of the packaging market has a great potential for the introduction of reusable packaging; reusable beverage packaging should become a priority also in the Greek case. A means for achieving this goal would be the introduction of a beverage packaging taxation scheme structured in such a way that would promote reusable packaging over recyclable. Such an initiative should be combined with the introduction of a deposit system for beverage containers, with Dansk Retursystem being a fine example of an organization controlling the deposit and collection systems in the beverage market, covering both reusable and recyclable packaging.

On a more general level, packaging waste minimization measures should be introduced. It is the author's opinion that, considering the Greek business practices and the weaknesses of the state when regulatory action is required, instruments such as voluntary agreements or the introduction of quantitative targets are not well-suited for Greece. There is a greater possibility of success if financial instruments are preferred; the Danish paradigm with the introduction of the LCA-based packaging taxation could be seen as the starting point for a similar scheme in Greece. It has been the norm for companies operating in Greece to pass extra charges directly to consumers (and even create windfall profits out of such occurrences); the current financial crisis, however, in combination with the already high prices of most products, has decreased the purchasing power of the population and many products are tending to become price elastic. A tendency has appeared recently among Greek companies to absorb new or increased taxes and charges themselves in fear of seeing their sales diminishing. This situation suggests that if a packaging taxation scheme was to be introduced under the present circumstances, it would have a potential for actually driving companies towards changes in their packaging use; if such a system had been introduced in more prosperous times for the population (e.g. the late '90s) it is almost certain that the charges would be simply passed on to the consumers and no

significant actions would be undertaken on behalf of the companies in order to improve their practices. Another potential solution would be the introduction of packaging waste minimization targets coupled with the packaging taxation levels; if the economic operators failed to attain the targets set, then the packaging tax would be raised making packaging use even more expensive for them.

The paragraphs above describe only some aspects of a possible new packaging policies package for Greece. In the author's opinion, however, a change in the behavior and habits of the average Greek citizen is equally important to any specific measure. The population has to be convinced about the importance of reduced material use, should be informed of the ways they can contribute to such efforts and the levels of environmental awareness in general should be raised; since environmental NGOs are not adequately represented or respected within the Greek society, the state itself should set as its foremost priority the "environmental re-education" of its citizens. Without great changes in mentality and behavior, the effectiveness of any policy measure –no matter how well thought of- will still be uncertain.

11. Conclusions

The present chapter will present the conclusions reached through the research process described thus far. These conclusions are divided into various categories, each focusing on a specific aspect of the packaging waste management issue. In addition to this, some recommendations for future research projects will be offered, along with some potential shortcomings of this work.

11.1. Targets attainment - Level of targets

The attainment of the targets set by the Commission should be examined at two points in time: in 2001, when the first policy period of the Packaging Directive expired, and in 2007, which was the last year before the expiration of the second policy period and the latest year for which national reports were made available in time to be used in this project.

The target levels prescribed for the first policy period were generally quite easy to attain for the Nordic countries. The fact that these targets could not be characterized as “ambitious” meant that in most cases of both overall packaging and specific material categories the recycling and total recovery levels reached by 1998-99 were already high enough so as to exceed (by a wide margin in several cases) the 2001 goals. It is worth mentioning in this context that the country that presented the poorest results among the group members during this early stage (Finland) was still able to come very close to (or even exceed) the higher recycling and total recovery targets for overall packaging, while the rest of the participants achieved much better results. Plastic packaging has been the exception in this situation, with its recycling targets remaining unattained by Denmark and Finland (although not by much), with Sweden being only slightly better.

The fact that the data that would give us the complete picture for the second policy period were not available at the time when this project was concluded leaves some questions unanswered. Generally, the higher level of the targets did not allow the countries to exceed even the higher overall packaging recycling goal as easily as in the previous period; all Nordic countries were in 2007 within the “recycling rate bracket” (55%-80%) prescribed by the Directive. The goals for most of the materials were attained already at this point with greater ease than the overall targets, albeit for two notable exceptions: Denmark stayed only marginally higher than the paper & board packaging recycling target, while Sweden fell below the goal for metal packaging recycling. Plastic packaging, on the other hand, appears again as the material category posing the greatest difficulties for the national packaging waste management systems, with Finland and Denmark still falling short of the 2008 recycling target. It is worth mentioning that the rates achieved in 2001 were sufficient so as to ensure that the 2008 targets would be attained in most countries; Finland was the only Nordic country that needed to make extra efforts in order to improve its rates in almost all categories.

The fact that this particular group of countries faced a relatively limited challenge in reaching the levels prescribed by the Commission leads to an obvious question: “Could the EU targets be more ambitious?”. The national packaging waste management policy frameworks set -in more than a few occasions- targets that were higher than the required, thus seeming to point towards a positive answer; considering also that these targets were usually attained, we can quite safely say that the potential of the Nordic countries was much greater than what the EU was able to exploit, especially during the earlier part of the 1998-2007 period. When the 2007 results are taken into account, this potential appears to have been decreased, although opportunities for further improvements still exist. Not much space for higher recycling rates can be found, for example, in the case of glass packaging, but higher targets would probably be beneficial in some countries with regard to paper & board and metal packaging and to all countries when plastic packaging is considered. Two things, however, should be kept in mind about the EU targets: the first is the anxiety of the EU policy makers not to impose barriers to trade and create market distortions by raising the targets too much; the second is the need to set goals that can bring about improvements to countries with advanced recovery infrastructures without being unrealistic for countries where such means are still not developed. These parameters seem to suggest that the EU targets will always be a result of compromises rather than of a focus strictly on the highest material efficiency benefits possible; the opinion of the author is that the road towards further improvements can be paved by more ambitious national policies, trying to set the bar higher than where the Commission prescribes. Countries such as the Nordic ones, where considerable experience in packaging waste management policies is available, should be the forerunners in introducing such ambitious goals and, even more importantly, goals that the EU is lacking altogether, namely in the field of minimization/prevention.

11.2. A final evaluation of the Nordic countries

Selecting one of the participating Nordic countries as the “packaging material efficiency champion” within this group is not as straightforward a process as one might expect; each country has its own strengths and shortcomings and none seems to have an undeniable lead in all categories compared to its counterparts.

Denmark can be seen as having an advantage since it is the only Nordic country that managed to reach the highest level of the waste hierarchy by reducing -even at a very limited degree- its per capita packaging consumption between 1998 and 2007. Even this “minimization success story”, however, is not flawless: the overall reduction was a result of significant consumption declines concerning only two of the basic packaging materials (glass and metal), while considerable increases were recorded in paper & board and plastic packaging waste generation. Moreover, Denmark may have been able to demonstrate a slight reduction in packaging consumption but it is still by far the most packaging-consuming group member; much higher reduction rates are needed if it is to fall to the packaging waste generation

levels of Sweden and, given the nature of the reasons that promote its high packaging consumption, this could prove to be a very difficult task.

Finland stands in the other end of the Nordic packaging consumption spectrum, limiting its annual per capita waste generation to slightly over 90 kg. Although this can be definitely seen as a success, partially stemming from the very substantial reuse efforts made (73% packaging reuse rate in 2007), some concerns still exist. One of them is that this seemingly excellent Finnish figure is partly a result of the choice not to include wooden packaging in the amounts presented; Finland uses large quantities of this material that would drastically change its packaging waste generation figures if included in the calculations (although it would still record the lowest figure among the group members). The second reason for concerns comes from the increasing packaging waste generation. The above 10% increase between 1998 and 2007 is alarming and it is made even more so when the fact that the packaging reuse rate was raised from 66% to 73% during the same period is considered.

Sweden and Norway –especially the latter- appear to be the worst performers with respect to packaging waste minimization. Both of them have to demonstrate significant increases of their packaging waste generations, which were not particularly low to begin with. Norway has been the only Nordic country to present a higher than 20% increase during the period at hand combined with a packaging IU rise in all categories, a somewhat surprising development given the fact that it has a seemingly well-structured effort to reduce packaging waste generation in place.

Moving to lower levels of the waste hierarchy, an observation that can be made is that Denmark is not as successful in promoting packaging recycling as it has been in packaging waste minimization. The Danish overall packaging recycling rate has been only slightly increased between 2001 and 2007, primarily as a result of the decreased recycling rate of the most prominent packaging material, namely paper & board. This can be largely attributed to the fact that Denmark does not make any efforts to collect and recycle this kind of packaging from households, relying instead only to the results brought about by the voluntary agreement with the industry. This arrangement seems to have reached its limitations and not expanding the recycling efforts to sales packaging appears to hold Denmark back in this field. The situation is much better in the cases of glass and metal packaging, while even plastic packaging recycling (also relying heavily on the voluntary agreement) has been significantly improved despite still being relatively lower than that of other group members. Denmark also appears to be the best example of avoiding the final disposal of packaging waste, since its extensive waste-to-energy infrastructure is utilized in order to ensure that only minimal amounts of packaging are not recovered in one way or another.

Finland has managed to demonstrate a very good recycling rate in 2007 but what is of greater importance is the improvements made within a limited time span (2001-2007). The recycling increases in almost all material categories have been very significant; despite falling back in most categories in 2001 and increasing its

packaging consumption in the meantime, Finland managed to become the forerunner or come close to them in overall, paper & board and metal packaging recycling; significant room for improvements still exists in glass and plastic packaging though.

Sweden and Norway both achieve better results in packaging recycling compared to their efforts in the minimization field. Their overall packaging recycling rates have been very similar in 2001 and 2007, although Sweden improved its own slightly more in the meantime. Norway's efforts have been more successful in paper & board and metal packaging, while Sweden has the group lead in plastic packaging recycling as well as in overall packaging. Their paths are diverging when the total recovery is considered, with Norway being able to come close to the Danish rates, while Sweden is the weakest group member in this respect.

The fact that the only country that has succeeded in somewhat reducing its packaging waste generation during the period at hand is Denmark is enough to give it the label of "an interesting (possible) success story". Further steps, however, should be made in its case with regard to higher and more widespread consumption reductions and to an increased focus in sales packaging recycling. Finland appears as a noteworthy example of extensively applied reuse practices, although these have not been entirely able to limit its consumption growth, and of strong efforts to improve some originally poor recycling rates. Finally, Norway is showing two very different faces in this project: an extremely poor minimization record is combined with a solid recycling/total recovery effort as demonstrated by the fact that it was the only country having attained all EU targets already in 2007; arduous efforts have to be made, however, in order to promote advancements in the higher levels of the waste hierarchy, without which the good recovery record loses a large part of its significance.

11.3. Packaging waste management policy measures

Chapter 2 offered a brief description of the various measures included in the three broad categories of waste management policy instruments (administrative, economic and informative). As expected, the first two categories included the policies most implemented in the Nordic countries, with the informative instruments being used primarily in the role of policy supplements.

The majority of the group members (with the exception of Denmark) chose to structure their packaging waste management systems around the introduction of producer responsibility schemes. Several differences exist among the various EPR systems: the Swedish is transferring the responsibility for the collection and recovery to producers, while the Finnish is limited to the recovery processes; the Norwegian system is based on voluntary agreements, while the others are results of government regulations. Despite these variations, however, the schemes have a common core in requiring from the parties responsible to use as little packaging as possible and to take care of the recovery activities when the packaging they put in the market becomes discarded. The Nordic EPR schemes appear to be quite functional and well-

established, facing a reduced amount of free-riding problems and covering the large majority of the packaging introduced into the national markets. Although they are, however, the key policy initiative in three Nordic countries, it is quite difficult to determine what their actual influence is. The reason for this is that these schemes are implemented in tandem with a multitude of policy measures promoting specific goals. When, for example, an EPR scheme coexists with a recyclable waste landfilling ban, it is difficult to exactly determine the extent of each measure's influence on the achieved recycling rates. This does not mean of course that the role of the EPR schemes can be overlooked; it would be more accurate to say that producer responsibility systems can bring good results when combined with policy measures focused on specific aspects of the waste management issue.

The Nordic countries that chose the EPR route have employed a variety of measures along with their main initiative. Administrative instruments appear to be less preferred; the most prominent example of their use is the introduction of quantifiable packaging minimization targets in Finland, which proved to be ineffective probably due to an inappropriate structure of the target. Other than that, the only case of a major administrative instrument implemented in these three countries is found in Sweden, where a landfilling ban on sorted combustible waste was introduced in 2002. Economic instruments, on the other hand, are the norm in their cases. Landfilling waste taxes in all of them, incineration taxes in Sweden and Norway, beverage containers taxation systems in Finland and Norway and deposit systems in all three have been supplementing their EPR schemes. Several successful cases can be found among them: the beverage containers taxation has largely promoted the penetration of reusable packaging in the beverage market, the deposit systems ensure very high return rates for reusable and recyclable packaging and the introduction of the landfilling taxation in Sweden proved to be a turning point in a period of declining packaging waste recycling rates.

The case of Denmark is worthy of a separate mention, since it is differentiated from the other group members because of the absence of an EPR scheme. The Danish policy makers have heavily relied on economic instruments; taxation is imposed on waste disposal, beverage containers and –a uniquely Danish feature- on all packaging entering the market. In addition to these, a deposit system is in place, which was revised and became mandatory after the termination of a one-way beverage packaging ban. The choice to essentially make packaging more expensive can be considered to have been successful to a certain extent; the combined influence of the packaging and beverage packaging taxation schemes and of the deposit system appears to have been critical both in achieving the large reductions in metal and glass packaging waste generation –while also controlling the increase of the plastic packaging consumption- and in increasing the recycling rates in three of the main packaging material categories. In this context, Denmark may prove that the best way to improve our packaging waste management practices is to attach the proper cost to packaging, while financially motivating consumers to be actively involved in the effort.

One more category of administrative instruments exists, present in all countries regardless of the implementation or not of the EPR principle, namely the national targets. Several cases appear throughout this project that indicate the importance of setting them at the proper levels in order to provide incentives for improvements. Apart from the aforementioned failure of the Finnish minimization goals, an indication of the importance of proper target-setting comes from Sweden; the Swedish policy makers maintained their goals at relatively low levels for paper & board, metal and plastic packaging recycling for the first policy period of the Directive despite having already achieved much higher rates. This choice can be deemed responsible for the large decreases in packaging recycling during the early years of the decade examined, since no proper incentives were offered for sustained strong recycling efforts. The high glass packaging recycling target of the same period, on the other hand, contributed in this material being the only one whose recycling rate did not decline. Moreover, several other cases are recorded in Finland and Denmark where low recycling targets coincide with a stability of the recycling rates, while their increase (or the introduction of ambitious goals straight from the beginning) is followed by immediate improvements.

Considering the focus of the various policy initiatives encountered on the different stages of the packaging chain, the major conclusion is undoubtedly the lack of efforts revolving around the “packaging making” step, as demonstrated by the rising packaging consumptions. The two examples of policies in this area were found in Denmark, whose packaging taxation is aiming at bringing about changes in packaging designing, and in Finland, where the quantifiable packaging minimization targets were meant to promote similar changes. Despite the clear mention of the producers’ responsibility to minimize their packaging use as much as possible in all national policy frameworks, no results are to be expected without the use of economic instruments or of ambitious and well-structured targets whose attainment will be linked with the threat of strict regulations or economic costs for the producers. The situation in the Nordic countries is of course a reflection of the shortcomings of the EU Packaging Directive; this European initiative has been criticized for its focus on recycling and total recovery, without devoting anything more than wishful thinking to packaging minimization. The stages of the packaging chain below “packaging making” are, on the other hand, covered to a satisfying extent with a multitude of measures aiming at promoting product reuse and material recycling and/or waste incineration over final disposal. It should be noted that a significant number of these measures are focused on the beverage packaging sector, which appears to offer many opportunities for material efficiency improvements.

11.4. Data quality

While establishing the obligation for EU member states to annually submit their packaging data to the Commission in a uniform manner has undoubtedly been a large step forward, the varying national practices employed in order to compile these datasets are creating several uncertainties. A large number of differences have been

found when the way each Nordic country collects and processes its packaging data is compared to those of the group counterparts; some of these differences concern the following issues:

- Packaging definitions and items considered to constitute packaging,
- Extent of the packaging market covered by the statistics,
- Selection of data sources for the acquirement of packaging consumption and collection/recovery figures,
- Ways of acquiring the data from the sources selected (e.g. inventories, questionnaires, etc.),
- Assumptions made in several phases of packaging management (e.g. samples taken in order to measure the share of a specific packaging material in the mixed waste of a certain area and subsequent extrapolation of the results),
- Ways of accounting for significant packaging quantities that are not officially registered (e.g. private imports of alcoholic beverages).

The fact that such different practices can be found in so many points of the packaging data collection process is creating questions about the validity of the figures reported by the countries and presented in this project. As mentioned in Chapter 3, it is much “safer” to consider these figures as indications of trends in packaging consumption and recovery and as signs of the strengths and shortcomings of the national policy frameworks, rather than as undeniably reliable figures demonstrating the actual situation in every country and being able to be directly compared with each other. The Packaging Directive has left many issues open to interpretation by the national governments resulting in the establishment of differing national practices; it is only logical to assume that only a new EU initiative can resolve the statistics compatibility/comparability problem. The Commission should specifically declare which items should be considered to constitute packaging, where should the consumption and collection/recovery data come from and how should they be acquired and processed. Until this happens, the comparisons between the results achieved by different member states will always come across the limitations related to the aforementioned issues and no concrete opinions will be possible to be offered regarding the actual state of affairs and the progress made in packaging waste management in the EU.

11.5. Research limitations – Future research recommendations

There are two additional components that could significantly improve the quality of this research project but were not included in it due to time limitations. The first would be an energy analysis of the packaging consumption in the Nordic countries; a much more comprehensive overview of the results of the various policy initiatives implemented in the Nordic countries would be offered by determining the energy requirements throughout the life-cycles of the packaging materials (energy production, material production, transportation, waste treatment), since the issue of energy use is equally critical with that of material use that was handled by this report.

The second improvement is the inclusion of a cost effectiveness analysis; determining the actual costs required in order to bring about the aforementioned changes in packaging waste consumption and recovery is a challenging task but the results of such an analysis would offer very useful insights into the Nordic packaging waste management policy field.

Future research focusing in the geographical area of the Nordic countries could initially revolve around the aforementioned issues. It is of course needless to say that the developments in other European regions would be of equal interest and, therefore, could constitute the topic of similar future projects (e.g. concerning the 3 major EU nations – Germany/France/Great Britain, the European South – Portugal/Spain/Italy/Greece, or the newer members of the EU in Central and Eastern Europe). Much more work, however, remains to be done in the Nordic countries. Researchers with a knowledge of the national languages and able to work on-site could provide new information on the national policy frameworks, expand the period examined to the years prior to the introduction of the Directive, establish contacts with stakeholders from all related fields and possibly answer a variety of interesting questions (e.g. what is the actual influence of the financial instruments employed in Denmark, what is the relation between material substitution and reduced consumption in the same country, what are the practices implemented in order to promote packaging reusability in Finland, how is the failure of the Norwegian minimization efforts explained, etc.). Last, but not least, research opportunities exist in the field of integrated packaging-product environmental impact determination and on policies addressing this aspect of packaging waste management.

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