

# Diverting waste from landfill

Effectiveness of waste-management policies in the European Union

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# Contents

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<b>Acknowledgements .....</b>	<b>5</b>
<b>Executive summary .....</b>	<b>7</b>
Impact of EU policy .....	7
Successful national policies.....	8
Summary of national strategies.....	10
<b>1 Background.....</b>	<b>12</b>
1.1 Why study policies on diverting waste from landfill? .....	12
1.2 EEA and policy effectiveness evaluations .....	13
1.3 Aims of the present study .....	13
<b>2 Waste management in the EU-27 .....</b>	<b>15</b>
2.1 Development of municipal waste generation .....	16
2.2 Development of municipal waste management.....	17
2.3 Drivers of change in waste generation and waste management .....	19
<b>3 Methodological considerations.....</b>	<b>21</b>
3.1 Introduction .....	21
3.2 Indicator-based analysis .....	21
3.3 Interviews with key stakeholders.....	25
<b>4 Estonia.....</b>	<b>26</b>
4.1 Waste management situation.....	26
4.2 Waste policy objectives .....	26
4.3 Institutional context .....	27
4.4 Policy instruments.....	27
4.5 Observations on effectiveness.....	28
<b>5 Finland.....</b>	<b>30</b>
5.1 Waste management situation.....	30
5.2 Waste policy objectives .....	30
5.3 Institutional context .....	31
5.4 Policy instruments .....	31
5.5 Observations on effectiveness.....	32
<b>6 Flemish Region of Belgium.....</b>	<b>34</b>
6.1 Waste management situation.....	34
6.2 Waste policy objectives .....	34
6.3 Institutional context .....	34
6.4 Policy instruments .....	35
6.5 Observations on effectiveness.....	36
<b>7 Germany .....</b>	<b>38</b>
7.1 Waste management situation.....	38
7.2 Waste policy objectives .....	38
7.3 Institutional context .....	39
7.4 Policy instruments .....	39
7.5 Observations on effectiveness.....	40

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<b>8</b>	<b>Hungary</b> .....	<b>42</b>
8.1	Waste management situation .....	42
8.2	Waste policy objectives .....	42
8.3	Institutional context .....	43
8.4	Policy instruments .....	43
8.5	Observations on effectiveness .....	44
<b>9</b>	<b>Italy</b> .....	<b>46</b>
9.1	Waste management situation .....	46
9.2	Waste policy objectives .....	46
9.3	Institutional context .....	47
9.4	Policy instruments .....	47
9.5	Observations on effectiveness .....	48
<b>10</b>	<b>Comparative assessment and conclusions</b> .....	<b>50</b>
10.1	Impact of EU policy .....	50
10.2	Influence of renewable energy policies .....	51
10.3	Generation of biodegradable municipal waste .....	52
10.4	Landfilling of biodegradable municipal waste (Landfill Directive target) .....	53
10.5	Treatment capacity .....	53
10.6	Separate collection of biodegradable municipal waste fractions .....	57
10.7	Importance of markets for compost and other recycled materials.....	58
10.8	Landfill taxes and gate fees .....	59
10.9	Regional responsibilities and cooperation .....	60
10.10	Public acceptance.....	61
<b>11</b>	<b>References</b> .....	<b>62</b>
<b>12</b>	<b>Glossary of abbreviations and definitions</b> .....	<b>64</b>

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# Executive summary

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Issued in 1999, the Landfill Directive was a milestone in EU waste policy. It marked a decisive shift from landfill towards the EU's new waste hierarchy, which prioritises waste prevention, followed by re-use, recycling and recovery, and seeks to avoid landfilling wherever feasible.

The rationale was clear: besides concerns about landfill capacity in some countries, European policy-makers were compelled to act because of growing awareness of landfill's environmental impact, notably emissions of methane and other gases, and pollution of groundwater, surface water and soil. On that basis, the Landfill Directive set targets for progressively reducing the amount of biodegradable municipal waste landfilled in the period to 2016.

A decade on from the Landfill Directive's enactment seems a fitting time to review progress and extract key lessons for policy-makers in Europe and elsewhere. Through individual and comparative analyses of waste management in five countries and one sub-national region (Estonia, Finland, the Flemish Region of Belgium, Germany, Hungary and Italy), as well as an econometric analysis of the EU-25 Member States, this report seeks to answer a number of important questions, including:

- To what extent has waste management practice changed in the last decade?
- How much of the change was due to the Landfill Directive (and other EU instruments)?
- What measures and institutional arrangements did countries introduce?
- Which measures and arrangements proved most effective in different national and regional contexts?

The report's key findings are summarised below.

## Impact of EU policy

Determining the extent to which EU policies have effected change in national waste management practices is a complex task. The process of diverting biodegradable municipal waste from landfill commenced at different times in the countries and region studied and has proceeded at varying speeds. In addition, urbanisation and population density are obviously important socio-economic drivers for diverting waste from landfill. Nonetheless, this report's findings are clear: the Landfill Directive has been effective, advancing the closure of landfills and increasing the use of alternative waste management options.

### *The Landfill Directive: a flexible framework*

The Landfill Directive's success is based on two core factors. First, its combination of long-term and intermediate targets has provided a good framework for countries to landfill less biodegradable municipal waste. In particular, the targets have helped governments and the European Commission measure progress and keep attention on the core issues. Second, the directive's flexibility has been an important asset, affording Member States the space to try out alternative policies, adjust measures to match national and regional realities (including existing waste management practices, institutional structures and environmental conditions), and adapt policies in the light of experience.

Evidently, the Landfill Directive has had the greatest impact in locations where the process of shifting away from landfill was not already under way. As such, it has been a strong driver of change in Estonia, Italy and Hungary and had less impact in Germany and the Flemish Region, where implementation of diversion policies started before the directive's adoption. Likewise, countries' progress towards the directive's targets varies according to the maturity of their diversion strategies; although all the areas studied are making progress, the Flemish Region and Germany are a considerable distance ahead and already comfortably meet the 2016 target for landfilling biodegradable municipal waste.

There is no evidence that the Landfill Directive has lessened municipal waste generation. Per capita generation of biodegradable municipal waste likewise remained pretty stable over the period 1995–2006. However, the econometric analysis of the EU-25 States revealed some decoupling of waste generation from income. It also indicated that general national waste strategies had little effect on municipal waste generation; reducing waste generation demands specifically targeted policies.

### *Other EU instruments*

Besides the Landfill Directive, other EU instruments have helped reduce landfilling. In some countries, notably Estonia and Hungary, the introduction of separate collection schemes for biodegradable packaging waste (paper, cardboard and wood packaging) pursuant to the Packaging Directive (1994) has helped initiate the diversion of biodegradable waste from landfill. This may be because this was the first directive to introduce obligatory recycling targets for selected materials and packaging is a very visible waste stream for citizens.

The Renewable Energy Directive (2001/77/EC) obliges EU Member States to set national indicative targets for the amount of gross electricity consumption to be supplied from renewable sources by 2010. Because incineration of biodegradable municipal waste with energy recovery is considered a renewable energy source, the directive provides an additional incentive to divert biodegradable waste from landfill.

### **Successful national policies**

Unsurprisingly, given the Landfill Directive's flexibility and the heterogeneity of national and regional conditions, there is significant variance in the methods used by countries and even within countries. Member States use a variety of strategies to divert biodegradable municipal waste from landfill. Often such strategies are embedded in programmes addressing municipal waste or also cover biodegradable waste from other sources, such as industry.

In general terms, diverting waste from landfill has relied on combinations of policies aimed at households, waste companies and producers. And countries have progressed or plan to progress further towards the Landfill Directive targets by strengthening several alternative waste treatment paths, rather than focusing on just one.

The strategies usually include a combination of recycling, incineration, and/or mechanical-biological treatment.

### *Landfill capacity*

Closing landfills is an important driver for adopting new waste treatment options. The number of landfills in the countries and region studied decreased significantly in the last 10–15 years, mostly through the closure of dumpsites and other low standard sites. Although this probably implies a reduction in total landfill capacity, data on current waste generation and landfill rates indicate that existing capacity in most countries is sufficient for many years to come.

### *Incineration*

Incineration capacity has increased significantly as governments have tightened emissions standards, although the rate of growth has varied widely in the areas studied. In Germany and the Flemish Region of Belgium, dedicated incineration capacity now accounts for around 35 % of municipal waste generated. In other areas, however, several factors have slowed the shift to incineration. These include public opposition, largely based on worries about the environmental and health impacts of emissions, and — in the case of Finland — difficulties integrating waste incineration into existing power and heating systems. For these reasons, incineration capacity stands at around 15 % of municipal waste in Italy and less than 10 % in Finland and Hungary.

It is interesting to note, however, that after trying alternatives both Estonia and Finland are now planning to extend incineration capacity in order to meet the Landfill Directive's diversion targets. Both are situated in the colder parts of Europe and energy recovery is an important aspect of their decisions.

### *Separate collection of biodegradable municipal waste fractions*

Separate collection of biodegradable municipal waste fractions (mainly paper and cardboard, packaging waste, and food and garden waste) is increasingly used to divert biodegradable waste from landfill. Again, the countries and region studied showed considerable variation in the amounts of waste collected separately. Whereas separately collected municipal waste fractions total more than 200 kilograms per capita in the Flemish Region each year, they are only about 20 kilograms in Hungary (but are growing steadily).

*Mechanical-biological treatment*

Mechanical-biological treatment is used as an alternative option to incineration to treat mixed municipal waste in Estonia, the Flemish Region, Germany and Italy. Mechanical-biological treatment is a pre-treatment method, whereby mixed household waste is mechanically separated into a high caloric refuse-derived fuel product and a residue, which is first digested or composted and then sent for landfilling or to dedicated incinerators. Capacity for mechanical-biological treatment has doubled or tripled in some countries, with Italy having by far the largest treatment capacity at 240 kilograms per capita. The countries studied that use this treatment option all use or are planning to use dedicated incineration and co-incineration of the refuse-derived fuel produced to generate energy.

*Composting*

Since 1999, capacity at composting and anaerobic digestion plants has increased manifold in Finland, Germany, Hungary and Italy. Germany has the largest composting capacity per capita, followed by Italy, Finland and the Flemish Region; capacity in Hungary and Estonia is considerably lower. Since 1999, capacity has increased by five times in Finland and Hungary, and tripled in Italy. It rose by 50 % in Germany in four years. Separate collection schemes have struggled to keep up with the increased processing capacity. Compost plants in Estonia, Germany, Hungary and Italy operate at 50 % of their capacity or less.

*Markets for compost and other recycled materials*

The countries and region studied stressed that if composting is to play a role in diverting waste from landfill then a well-functioning market for compost is needed. This in turn necessitates that the products of biological treatment of biowaste are of good quality. This report finds that the quality of the compost derived from separately collected biodegradable waste is not always sufficient.

National quality standards for compost have been set in Finland, the Flemish Region, Germany and Italy, and seem to have been effective in making compost quality adequate for agricultural use, wholesale and private gardening. In addition, in its Green paper on the management of biowaste in the EU (2008), the European Commission sets out proposals for improving biowaste management in the EU, including EU-wide regulation of compost quality. Home composting is gradually increasing in most of the countries, and evidence suggests that there is potential to expand this treatment option.

*Landfill costs and economic instruments*

To comply with the provisions of the Landfill Directive, countries have introduced various measures to increase the cost of landfilling. In Estonia gate fees rose by 700 % in the decade to 2006, while in Finland the increase was around 300 %. This corresponds to annual gate fee increases of 23 % and 14 % respectively. Gate fees rose by a more modest 40 % in the Flemish Region over the decade (equivalent to 3 % annually), albeit from a much higher base.

The increasing gate fees mainly result from rising technical standards for landfills and implementation of the principle that gate fees should cover all costs involved in the setting up, operating and closing landfills. In addition, Estonia, Finland, the Flemish Region and Italy use landfill taxes to discourage landfilling of waste. This study finds that to be effective landfill tax rates should be relatively high, although in Estonia rapid increases to a relatively low landfill tax have achieved a similar effect.

Economic instruments such as user charges for managing municipal waste (e.g. 'pay-as-you-throw' schemes), landfill taxes and product charges can play a significant role in diverting waste from landfill if they are designed in such a way that they regulate the behaviour of households, waste companies and producers effectively.

*Regional responsibilities and cooperation*

When governments and competent waste management authorities set waste management objectives and targets these must be clearly defined. Governments also need to designate clearly the institutions and actors responsible for meeting them.

Cooperation between municipalities or larger geographical units such as provinces or districts plays an important role in ensuring that necessary financial and human capacity is available to develop alternatives to landfill.

*Public acceptance and communication*

An often overlooked problem in waste recycling is the lack of acceptance of waste-derived products among potential users. In Finland and Hungary there seems to be a basic aversion to using fertilisers made of waste, so the problem is not the quality of the compost but its image. Overcoming this problem will necessitate securing good compost quality, as well as comprehensive communication campaigns and stakeholder dialogues.

Lack of public acceptance is also very often an obstacle for the introduction of waste incineration. Germany and the Flemish Region have tackled incineration's poor reputation in the past by setting ambitious emission standards. In Italy, public acceptance of waste incineration may increase with the implementation of the national guidelines on best available techniques for waste incineration.

Policy measures and instruments that the public traditionally regards positively, for example separate collection of waste paper, can be further strengthened. In addition, regular communication activities are important to keep households and others aware and active in separating waste and participating in home composting schemes.

### *Quality of data on biodegradable municipal waste*

The lack of a harmonised method to measure or estimate the amount of biodegradable municipal waste makes it difficult to compare data from different countries. Whereas the amount of separately collected biodegradable waste fractions (mainly biowaste, paper and cardboard) can be measured directly, the share of biodegradable municipal waste in the mixed municipal waste has to be estimated.

The information from the countries and region reveals different methodologies and assumptions. For example, the estimated share of biodegradable municipal waste in municipal waste varies from 52 % to 83 %. Planners and authorities need good waste statistics to implement appropriate policy measures and monitor the progress. A European guideline harmonising the estimation of biodegradable municipal waste amounts would thus facilitate more effective and comparable monitoring of progress towards the Landfill Directive's diversion targets.

## **Summary of national strategies**

### *Estonia and Hungary*

In Estonia and Hungary the waste diversion strategies have focused on establishing treatment capacity and setting up schemes for separate collection. Such schemes largely cover packaging waste, with those targeting biowaste at an early stage of development. Hungary has consistently landfilled approximately 80 % of municipal waste. This constancy is partly because improvements in material recovery and mechanical-biological treatment capacities were counterbalanced by temporarily reduced

incineration capacity while the single incinerator was under reconstruction for several years.

In both Estonia and Hungary official stakeholders, including the ministries of environment, generally believe that the Landfill Directive targets cannot be met without waste incineration. According to the data of Eurostat, Estonia has managed to achieve a considerable reduction of municipal waste landfilled from 95 % in 2000 to around 60 % in 2006. In 2005, the reported recovery rate was 24 %. It appears, however, that a further 16 % of the generated waste is disposed of, exported or undergoes some other treatment.

### *Finland*

In the 1990s the Finnish strategy for diverting biodegradable waste from landfills focused mainly on recycling, including composting and anaerobic digestion. Problems arose, however, because the Finnish climate created technical problems for composting plants. Moreover, regulations that made municipalities responsible for providing municipal waste treatment capacity did not specify which kind of treatment should be used. As a result, several municipalities fulfilled their obligations by expanding landfill capacity.

From 2000 to 2005 Finland's focus shifted towards co-incineration but the introduction of stricter emission standards pursuant to the EU Waste Incineration Directive made the use of municipal waste fractions unattractive for operators of co-incineration plants. Over the same period landfilling of municipal waste has remained constant at around 60 %. The new waste plan from 2008 focuses more on dedicated incineration plants combined with co-incineration.

### *Flemish Region of Belgium*

The strategy in the Flemish Region has been to increase separate collection, promote home composting and make maximum use of existing incineration capacity. Many policy instruments were introduced, mostly between 1990 and 1999. The national waste plan is a powerful instrument because once approved by the government its provisions apply to all public authorities. Other prominent measures include voluntary agreements with municipalities, communication activities (especially on separate collection and home composting), a rising landfill tax, and a ban on landfill and incineration of certain waste streams such as unsorted household waste. By 2006 the Flemish Region had reduced landfilling to around 1 % of total household waste generation.

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*Germany*

The German strategy on biodegradable waste has focused on separate collection and recycling of secondary raw materials (paper and biowaste), mechanical-biological treatment, dedicated incineration with energy recovery of mixed household waste and banning the landfill of waste with organic content of more than 3 %. Separate collection schemes have been successful in achieving very high recycling rates.

A landfill ban was adopted in 1993 but due to several loopholes it was not implemented properly. The loopholes were closed with the Waste Landfilling Ordinance (2001), which confirmed the deadline of 1 June 2005 for implementing the landfill ban and included special provisions for landfilling residues from mechanical-biological treatment. Since the deadline, the amount of municipal waste landfilled has fallen to 1 %.

*Italy*

Based on the national strategy for biodegradable waste, the Italian regions have developed programmes for diverting waste from landfills. The regions have chosen different approaches; the northern ones use more incineration and southern ones more mechanical-biological treatment. Separate collection, especially of biodegradable fractions of municipal waste but also of packaging waste, also plays a major role. Every 'optimal management area' (or province) has to meet a set of national targets for landfilling biodegradable municipal waste. These are defined in kilograms per inhabitant in order to improve monitoring at the local level. As a result, Italy has continuously decreased its landfilling of municipal waste so that about half was diverted in 2006. However, there is a considerable difference between the performance of the northern regions and the southern and central regions of the country.

# 1 Background

## 1.1 Why study policies on diverting waste from landfill?

Diverting waste from landfill is an important element in EU policy on improving the use of resources and reducing the environmental impacts of waste management. In particular, in pursuance of Directive 1999/31/EC on landfill of waste (hereafter referred to as the Landfill Directive), Member States are obliged to set up national strategies for reducing the amount of biodegradable municipal waste (BMW) going to landfill (Box 1.1).

The Waste Framework Directive was revised and the new directive (2008/98/EC) issued in November 2008. Several of the new provisions in the directive aim to reduce landfilling. Key issues are the introduction of quantitative targets on recycling of selected waste materials from households and other origins, and of construction and demolition waste. It provided for the development of waste prevention and decoupling objectives for 2020. Furthermore, it reclassified waste-to-energy incineration as a recovery operation provided that waste-to-energy plants meet certain efficiency standards.

The European Commission has published a green paper on the management of biowaste in the EU (EC, 2008b). It sets out several options to improve biowaste management, including standards for composts, specific biowaste prevention measures and tighter targets for biodegradable municipal waste sent to landfill.

Greenhouse gas emissions are also becoming more and more relevant in waste management planning. Landfilled biodegradable waste produces methane many years after the waste has been deposited. Countries with high dependence on landfill can take positive action against climate change by landfilling less biodegradable waste. Likewise, in countries that have very low landfill rates, waste recycling and energy recovery can help avoid greenhouse gas emissions from the production of virgin material or energy (EEA, 2008a). Effective waste management, including high levels of recycling and possibly incineration with energy recovery, can partly offset the emissions released when the raw materials and products were extracted and manufactured. If the recovery rate is sufficiently high then the waste management sector could help achieve the Kyoto targets. In 2005, waste management contributed 2.6 % of

### Box 1.1 Main provisions of the Landfill Directive

According to the Directive 1999/31/EC on landfill of waste, Member States must reduce the amount of biodegradable municipal waste going to landfill

- to 75 % of the total amount of biodegradable municipal waste generated in 1995 by 2006;
- to 50 % of 1995 levels by 2009;
- to 35 % of 1995 levels by 2016.

Member States who landfilled more than 80 % of their municipal waste in 1995 can apply for a prolongation of the time limits not exceeding four years. Some Member States (Bulgaria, the Czech Republic, Estonia, Greece, Ireland, Latvia, Lithuania, Poland, Romania, Slovakia and the United Kingdom) have made use of this option and have special derogation periods.

The directive also prohibits landfilling of certain waste types (such as waste tyres and liquid waste) and introduces classes of landfill and a system for landfill permits. With these measures and with the general provision that only waste that has been subject to treatment, including sorting, can be landfilled, the Landfill Directive is expected to have a major effect on the design of future waste management systems.

total greenhouse gas emissions in the EU-15 (EEA, 2007c).

Finally, Directive 2001/77/EC on the promotion of electricity produced from renewable energy sources in the internal electricity market, may stimulate waste incineration with energy recovery. The biodegradable fraction of industrial and municipal waste is defined in the directive as a renewable, non-fossil energy source. Production of electricity from incineration of municipal waste contributes to meeting the EU renewable energy target of 12 % of total energy supply by 2010. Individual targets have been set for each Member State. According to the European Commission's 2008 integrated climate change and energy package (EC, 2008a) and the proposed directive on renewable energy sources (EC, 2008c), Member States are expected to define ambitious new targets for generating electricity and heat from waste to help achieve the EU's goal of generating 20 % of energy from renewable sources by 2020.

Various combinations of policy measures can be used to achieve EU targets on diverting biowaste from landfill. Countries with different socio-economic characteristics and geographical conditions may have different approaches. This study presents the main characteristics of the different routes chosen by selected Member States, the effectiveness of policy instruments applied and also some information at the pan-European level.

## 1.2 EEA and policy effectiveness evaluations

The Sixth Environment Action Programme of the European Community (EP/EC, 2002) highlights the need to undertake 'ex post' evaluation of the effectiveness of existing measures in meeting their environmental objectives'. Such evaluations require a sound understanding of policy instruments and the mechanisms that lead to their observed effects. This means that it is essential to know what measures have been implemented in response to a given directive, their effects and the national context in which they are supposed to operate.

For a number of years, the European Parliament has clearly expressed its wish for the EEA to provide information on the implementation of policies in the Member States and to analyse the effectiveness of past EU policies. The Parliament is particularly interested in information and analysis on the implementation of EU legislation in the Member States.

The European Commission also needs information on the extent to which directives and measures are working in Member States. Reporting by Member States on the implementation of directives seldom covers the effectiveness of the instruments used by the countries. The EEA can help to fill this knowledge gap.

EEA member countries, including all the 27 Member States of the EU, face increasing demands to identify successful and unsuccessful policy interventions and the conditions that framed them. This is particularly the case for the 12 Member States that joined since 2004, who face a significant challenge to implement EU directives as soon as possible, while avoiding the mistakes and problems that the EU-15 Member States encountered.

The EEA report, *Reporting on environmental measures – are we being effective?* (EEA, 2001), concluded that little is known about the extent to which past environmental policies and instruments have affected the environment.

Since then, the EEA published three studies on policy effectiveness (EEA, 2005a; EEA, 2005b; EEA, 2008b). These helped build capacity in undertaking such evaluations and the required methodologies, and provided the European Parliament, the Commission and EEA member countries with analyses of the effectiveness of policy instruments in certain areas and countries.

## 1.3 Aims of the present study

This study analyses the effectiveness of national policies on diverting total municipal waste and biodegradable municipal waste from landfill pursuant to the Landfill Directive and other relevant directives. This includes an analysis of whether the Landfill Directive has been a driver for implementing national policies to divert waste from landfill.

Waste policies must be seen in the broader life-cycle perspective of resource use, consumption and production; prevention and recycling of waste are important elements in this life-cycle. There are different routes to divert waste from landfill, including prevention and recycling, other material and energy recovery, and pre-treatment. Not all of them are used by all Member States. In this study we focus on why specific sets of measures were chosen and evaluate which measures worked well and why, and explore success factors and reasons for unsatisfactory results.

The report analyses the effectiveness of policies, i.e. if and how they achieved their objectives and produced outcomes. It does not address either cost-effectiveness or cost-benefit analysis of the same policies. This is mainly because of the lack of detailed information on economic and financial aspects of landfill and waste management in most EU Member States. Landfill and incineration gate fees were taken into account, however, as relevant factors influencing the effectiveness of waste management systems. The effects of applied economic instruments are also included in the analysis.

The study does not aim to evaluate Member States' legal implementation of the Landfill Directive formally. Rather, it assesses the functioning of policy packages and instruments that have been introduced pursuant to the directive and other measures in order to divert waste from landfill. Moreover, the study will not examine the extent to which Member States have actually implemented the more technical requirements for landfills.

Chapter 2 of the study includes, to the extent possible, information on waste management in the 27 EU Member States that must implement the Landfill Directive. In order to gain deeper insights on the effectiveness of national waste policies related to the Landfill Directive, five countries and one sub-national region were analysed in more detail in subsequent chapters. The results of the analysis are considered useful for all 32 EEA member countries and EEA cooperating countries, however, and are probably also of value outside Europe. Countries not covered in the detailed analysis of this study are encouraged to make use of the developed methodology.

In-depth evaluations were conducted for Estonia, Finland, the Flemish Region of Belgium, Germany, Hungary and Italy. The criteria for selecting these countries and region were:

- ensuring that a variety of biodegradable municipal waste and municipal waste management strategies were evaluated;
- ensuring the inclusion of both new and old Member States and large and smaller ones;
- ensuring a diversity of demographic and geographical conditions.

The detailed evaluation of the five countries and one region is presented in a series of background papers that also set out all information sources (ETC/RWM, 2008a–f).

In addition, a quantitative analysis of socio-economic and technical factors influencing generation and management of municipal waste was carried out for the EU-25 Member States (ETC/RWM, 2008h). That paper comprises an econometric analysis of the main drivers of municipal waste generation, the choice of waste management options and the role of economic factors and policies. It addresses the EU-25 Member States, with insights specific to the EU-15 and the EU-10 Member States presented separately. The results are set out in Section 2.3 of the present report.

There is no fixed time-frame for the individual country evaluations. Instead, the analysis of each country or region begins when it started to introduce policies to reduce dependency on landfill. In Germany and the Flemish Region of Belgium it was in the 1980s, whereas the process in Finland and Italy started in the early- and mid-1990s. In the newer Member States, Estonia and Hungary, policies were mostly implemented to fulfil the requirements of the *acquis communautaire* of the EU, which began in the mid-1990s.

Following the individual analysis of the five countries and one region set out in Chapters 4–9, Chapter 10 provides a cross-cutting comparative analysis of the countries and region and the report conclusions.

### **Box 1.2 Waste streams considered in this study**

Municipal waste means waste from households and other waste which, because of its nature or composition, is similar to waste from households (cf. the Landfill Directive). Some of this waste is biodegradable, e.g. paper and cardboard, food waste and garden waste.

Biodegradable waste means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard (cf. the Landfill Directive). In this report, only the biodegradable waste included in municipal waste is addressed.

Biowaste means biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants (cf. the Waste Framework Directive (2008/98/EC)).



## 2 Waste management in the EU-27

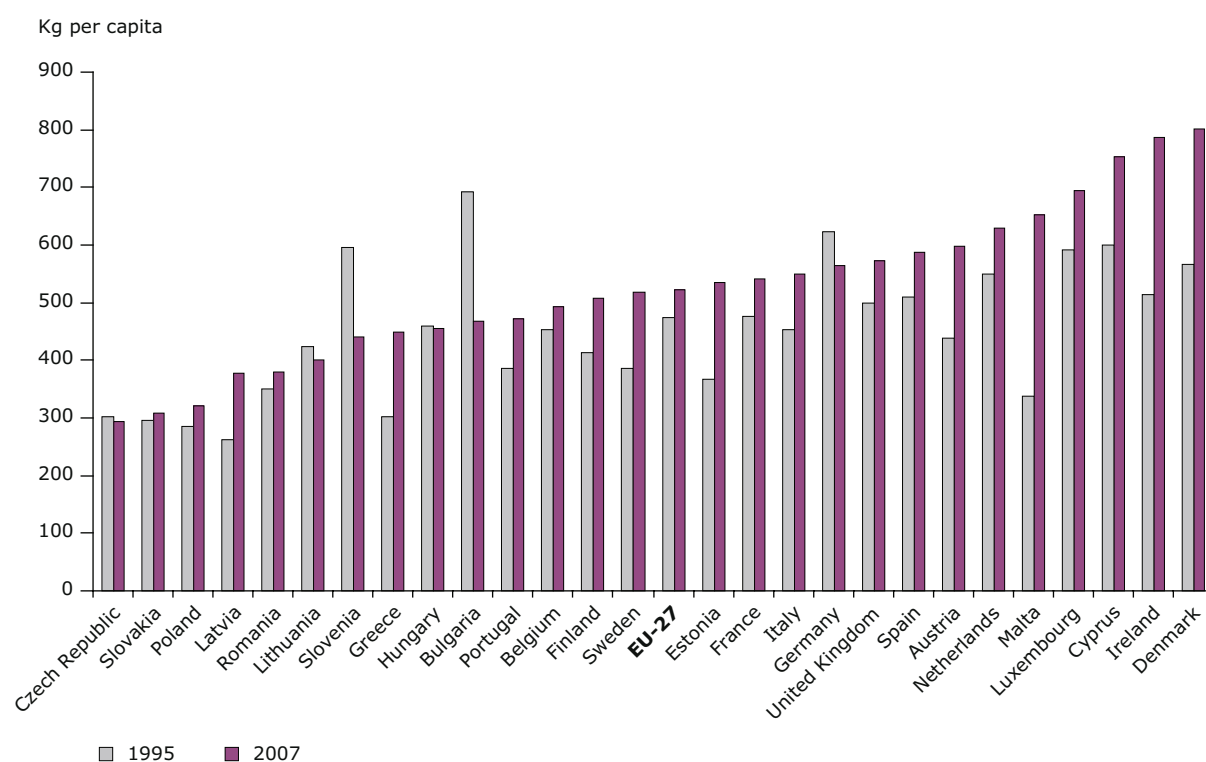
The Sixth Environment Action Programme (2002–2012) sets out the EU's key environmental objectives. One of the overall goals is to decouple resource use and waste generation from the rate of the economic growth. The programme also targets a significant, overall reduction in the volumes of waste generated through waste prevention initiatives and a significant reduction in the quantity of waste going to disposal. It further encourages reuse and aims to reduce the level of hazard, giving preference to recovery and especially recycling, making waste disposal as safe as possible, and ensuring that waste for disposal is treated as close as possible to its source.

According to the new Waste Framework Directive (2008/98/EC), the European Commission will propose

measures to support waste prevention activities, e.g. by setting prevention and decoupling objectives for 2020. Also by 2020, at least 50 % of waste materials such as paper, glass, metals and plastic from households and possibly from other origins must be recycled or prepared for re-use. The minimum target set for construction and demolition waste is 70 % by 2020.

In the next two sections of this chapter, we present the development of waste generation, landfilling and incineration from 1995 to 2007 using Eurostat Structural Indicators <sup>(1)</sup>. As reported data on recovery and recycling were not available for all Member States, an indication of the EU recovery level is given by assuming that waste neither

**Figure 2.1** Generation of municipal waste in the EU-27, 1995 and 2007



**Source:** Eurostat Structural Indicators.

<sup>(1)</sup> Eurostat is the Statistical Office of the European Communities.

landfilled nor incinerated is recovered. However, the actual recovery rate might be lower if countries use other treatment options extensively such as mechanical-biological treatment (MBT), which cannot be regarded as recovery per se.

The last section of this chapter describes the findings of the study on drivers of municipal waste generation, landfilling and incineration over the period 1995–2005 for 25 Member States.

## 2.1 Development of municipal waste generation

On average (unweighted), the European citizen generated 10 % more waste in 2007 than in 1995 (Eurostat). The waste volume grew even faster (11.5 %) in the EU-15 Member States. As Figure 2.1 illustrates, these aggregated figures mask considerable differences between Member States. Whereas the Czech Republic generated less than 300 kilograms of municipal waste per inhabitant, Denmark exceeds 800 kilograms per capita. Some Member States have experienced exceptionally high growth rates over the last eleven years and others have experienced a considerable decrease.

Interestingly, although ten of the EU-12 Member States have enjoyed relatively rapid economic growth over the period, municipal waste generation has fallen or increased by less than 2 % in five of those countries. There are several possible reasons for the decrease: some biowaste may have been reused as animal feed, some combustible waste may have been used as fuel in individual households due to increasing coal prices (EEA, 2007b). Furthermore, the gradual introduction of weighbridges at the landfills has provided more reliable information. Previously, the amounts of municipal waste were estimated according to the volume, which may have led to an overestimation of the mass.

In 18 Member States, however, growth in waste generation was above average, with the highest rate of increase (93 %) occurring in Malta.

Member States have difficulties in preventing the generation of municipal waste, mainly because of increased consumption. Nonetheless, a recent study shows that there is potential for preventing biowaste from households, especially in wealthier parts of Europe (Ventour, 2008). The study presented in Box 2.1 shows that British

### Box 2.1 The food we waste

A study published by the UK Waste and Resources Action Programme (WRAP) shows that roughly one-third of the food bought in Britain each year, or 6.7 million tonnes, is thrown away. Of this waste, 4.1 million tonnes are 'avoidable', i.e. it is food that is no longer wanted or it has been allowed to go past its best. It corresponds to 70 kilograms waste per person. The study also finds that about 1 million tonnes of the waste, or around 15 kilograms per person, comprises products unopened or whole when thrown away.

UK consumers spend EUR 12.6 billion on food that is thrown away each year but could have been used if stored or managed better — corresponding to EUR 530 per household. The table below shows the main groups of avoidable food waste and their associated costs.

Avoidable food waste	Tonnage (1 000 tonnes)	Cost (million EUR)
Fresh fruit, vegetables and salad	1 405	3 070
Bakery	782	1 807
Mixed foods (for example home-made)	666	2 742
Meat and fish	279	1 857
Dairy products	187	708
Other	560	2 338

The study also reveals that people's age does not seem to affect the amount of food waste that they produce. However, single-person households produce more food waste on average than those with two or more persons.

**Source:** Ventour (2008) and exchange rates from the European Central Bank (May 2008).

households throw away 70 kilograms food waste per person every year that could in principle have been avoided. Although these results may not be directly transferable to other countries, they do provide an indication of how much waste could have been avoided through better planning in households. Communication and awareness raising campaigns may be needed to address this issue.

## 2.2 Development of municipal waste management

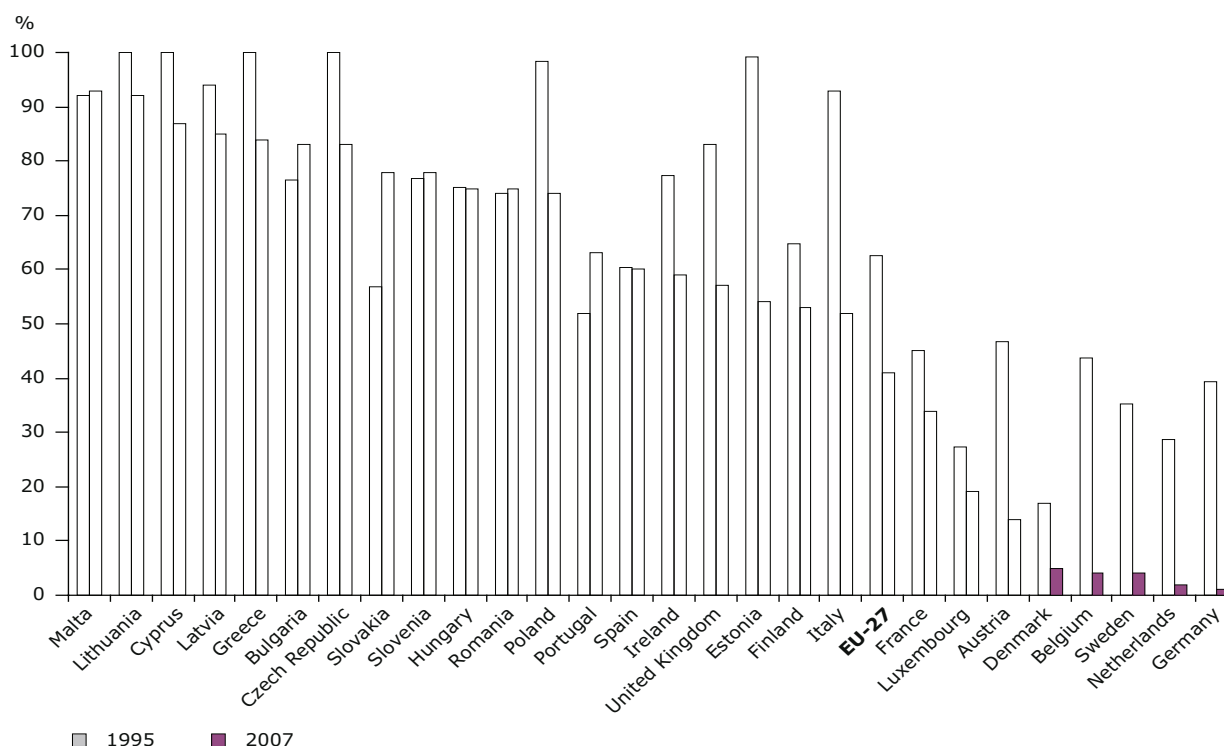
Landfilling municipal waste has been the predominant option in the EU-27 Member States for several years but this is changing. In 1995, 62 % of municipal waste was landfilled on average and in 2007 this had fallen to 42 %. However, waste management practises vary greatly among the Member States. Figure 2.2 shows that eight EU-15 Member States landfilled less than 40 % of the municipal waste in 2007, while seven EU-12 Member States landfilled 80 % or more. The figures also show that several countries have realised considerable reductions in landfilling over the period.

Data on incineration present almost the inverse image (Figure 2.3). Thirteen countries had either no incineration or incinerated less than 10 % of their municipal waste in 2007. Eight EU-15 Member States incinerated more than 20 % of municipal waste. The figures from Eurostat do not indicate whether incineration takes place with or without energy recovery. According to the International Energy Agency, however, all eight countries produce energy from municipal waste incineration, although with different rates of efficiency (IEA, 2005).

According to recently published data, 22 % of municipal waste generated in 2007 has been recycled and 17 % composted (Eurostat, 2009).

A new study has analysed the waste generated by selected waste streams in the EU-27 in 2004 and estimated the potential for recovery (Alwast *et al.*, 2008) <sup>(2)</sup> (Table 2.1). The amount of biodegradable waste generated totalled 87.9 million tonnes. Around 67 % of this waste was from municipal sources and the remaining 33 % was from the food industry and services. Thirty-seven per cent of biodegradable waste was recovered but the picture varied across the EU and the authors concluded that the countries' recovery potential was between 31 % and 98 %.

**Figure 2.2 Percentage of municipal waste that is landfilled in the EU-27, 1995 and 2007**



**Source:** Calculated using Eurostat Structural Indicators.

<sup>(2)</sup> Alwast *et al.* (2008) used available waste generation data from national statistics according to the European Waste Catalogue (EWC) and the EWC-Stat categorisation.

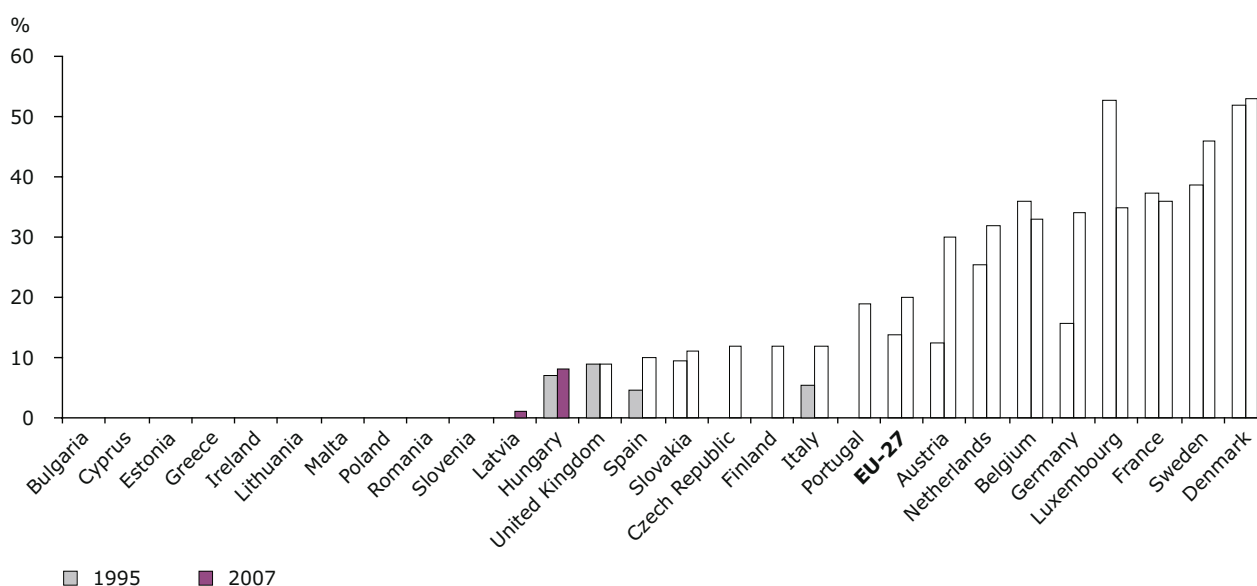
**Table 2.1 Generation and recovery of selected waste streams in the EU, 2004**

	Total		Share from municipal sources	From municipal sources	
	Waste generation	Recovery		Waste generation	Recovery
	Million tonnes	%	%	Kilograms per capita	Kilograms per capita
Biodegradable waste	87.9	37	67	120	44
Waste paper	79.5	56	44	71	40
Waste wood *	70.5	65	n/a	n/a	n/a
Textiles	12.1	32	50	12	4

**Note:** \* From wood working industry, construction and demolition, packaging and bulky waste.

**Source:** Alwast *et al.* 2008.

**Figure 2.3 Percentage of municipal waste that is incinerated in the EU-27, 1995 and 2007**



**Source:** Calculated using Eurostat Structural Indicators.

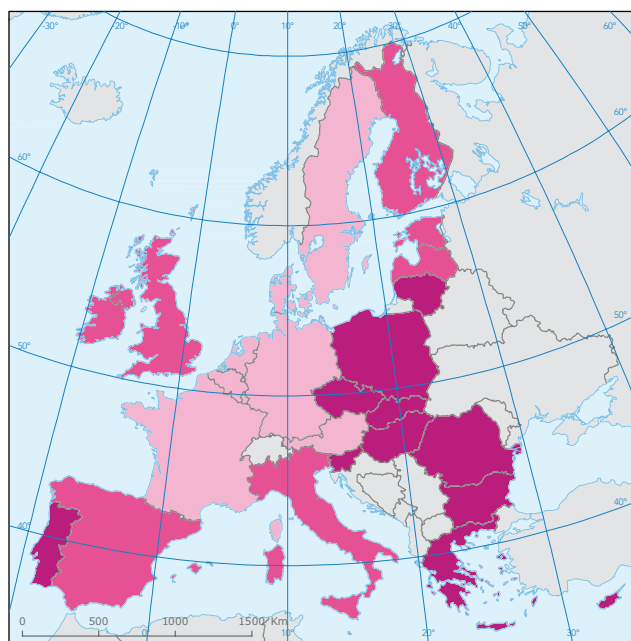
Broadly speaking, Member States can be categorised under three waste management 'groupings', clustered according to their strategies for diverting municipal waste away from landfill and their relative shares of landfilling, material recovery (mainly recycling and composting) and incineration (EEA, 2007a).

The first grouping comprises countries that maintain high levels of both material recovery and incineration, and have relatively low landfill levels. Countries in this group generally introduced several policy instruments early, often before the adoption of Directive 94/62/EC on packaging and packaging waste (hereinafter referred to as 'the Packaging Directive') and the Landfill Directive.

The second grouping brings together countries with high material recovery rates and medium levels of incineration, and with a medium dependence on landfill. In general countries in this grouping introduced policy instruments after adopting the Packaging Directive in 1994 and the Landfill Directive in 1999.

The third grouping contains those countries whose material recovery and incineration levels are both low and whose dependence on landfill is relatively high. This group comprises the majority of the EU-12 Member States in the process of implementing EU regulations and several, but not all Member States with a 4-year derogation from the Landfill Directive (i.e. Bulgaria, the Czech Republic, Greece, Lithuania,

**Figure 2.4 Three country groupings defined by diversion strategy**



**Three country groupings defined by diversion strategy**

- 1: Incineration > 25 % and material recovery > 25 %
- 2: Incineration < 25 % and material recovery > 25 %
- 3: Incineration < 25 % and material recovery < 25 %
- Outside data coverage

**Source:** Based on data for 2006, Eurostat Structural Indicators.

Poland, Romania, Slovakia and the United Kingdom) or from the Packaging Directive (Greece and Portugal).

The geographical distribution of the three groupings is shown in Figure 2.4.

## 2.3 Drivers of change in waste generation and waste management

Like policies, economic and demographic factors play an important role in the generation and management of municipal waste. This section presents the results of an econometric analysis conducted for the EU-25 Member States covering the years 1995–2005 (ETC/RWM, 2008h; Mazzanti and Zoboli, 2008). This analysis can help determine the framework conditions and factors

that influence waste generation, management and disposal and therefore must be taken into account when designing waste policies.

### 2.3.1 Waste generation

First, the analysis finds no absolute decoupling of municipal solid waste (MSW) generation and consumption per capita. Contrary to earlier analyses on the subject, however, there is now evidence of a relative decoupling, i.e. MSW generation is growing more slowly than income. The new Member States seem to have experienced a larger relative decoupling.

In addition, the analysis suggests that high population density and urbanisation result in more waste generation and that richer and more services-oriented economies produce more municipal waste. However, insufficient coverage of waste collection systems, such as in rural Estonia, can have a significant impact on the accuracy of data on the amount of waste collected.

Income growth, urbanisation and an expanding service sector can all lead to more MSW generation. Environmentally responsible behaviour by firms and households, the adoption of waste recovery/reuse innovations and waste prevention policies may be among the drivers that can reverse MSW growth in the future.

As for policies, the implementation of the Landfill Directive appears not to have provided incentives to reduce MSW generation. There is likewise no evidence that more general national waste strategies have had a significant effect on MSW generation. Policies more specifically targeted to waste prevention seem to be necessary to achieve further waste reductions as economies grow.

### 2.3.2 Diversion from landfill

Whereas MSW generation increased in the EU with growing incomes, albeit at a slower rate, the analysis identified a significant absolute decoupling of MSW landfilled and income, i.e. incomes rose while less MSW was landfilled. For the EU as a whole, this process of diverting waste from landfill started around 1995–1997, although some countries, such as the Flemish Region of Belgium and Germany, had already started earlier. This is discussed in the country chapters within this report, which in some cases include pre-1995 data.

Increased urbanisation and rising population densities appear to be socio-economic factors driving the diversion of waste from landfill. In

densely populated areas the value of land is generally higher, making it more costly to use areas for landfill and increasing the incentive to invest in separate collection schemes, which can be operated more efficiently than in areas with low population density.

Policies also appear to have a significant effect on the diversion of waste from landfill. Policy variables, both specifically linked to EU directives or to waste strategies at national level seem to be very relevant in explaining the landfill diversion practice in EU Member States.

### 2.3.3 *Incineration*

Evidence from EU-15 Member States (the new Member States are not considered due to negligible

amounts of incinerated waste) shows a positive relationship between consumption growth per capita and incinerated MSW. We should expect a similar development for the new Member States in the future if emission standards are enforced strictly. However, the trend is nevertheless expected to stabilize eventually.

The analysis also shows that research and development expenditures as a proportion of GDP — a country-specific indicator of technological investment and capacity — correlates positively with the level of incinerated waste. This evidence suggests that it will be relevant to investigate the role of EU (environmental) innovation policies, which may link directly (through 'waste directives') and indirectly to the development of enhanced, more effective and more efficient waste treatment options.

## 3 Methodological considerations

### 3.1 Introduction

The study analyses the diversion of waste from landfill pursuant to the Landfill Directive and other relevant waste directives, such as the Packaging Directive. The study combines an indicator-based methodology to evaluate information on policy changes and other pertinent factors, and interviews with key stakeholders in each of the geographical areas studied.

### 3.2 Indicator-based analysis

Landfill levels can be influenced not only by waste policies, but also by many other factors in the waste system, e.g. developments in waste generation, waste collection, recycling, and incineration. These developments may favour or hinder the diversion of waste from landfills that is the aim of landfill policy. The analysis of these favouring or hindering factors should help identify and single out the specific role of landfill policy change compared to the influence of the various other relevant factors.

The evaluation of the effectiveness of landfill policy in the present report uses the methodology set out in a recent working paper by ETC/RWM (2008g). In this methodology the causal link between a variety of favouring and hindering factors (explanatory variables) and the diversion of waste from landfill (the dependent variable) is analysed. Hindering and favouring factors are measured by relevant indicators representing the state and the change of the waste system at the time of policy implementation. These factors are described in more detail below and summarised in Table 3.1. The reference indicator used to represent the dependent variable (diversion of waste from landfill) is the amount of biodegradable municipal waste landfilled compared to the 1995 levels, for which the Landfill Directive introduced specific targets.

As the ETC/RWM study notes, country data are currently inadequate to conduct a rigorous econometric modelling exercise. The analysis of the influence of the various factors on diversion

to landfill is therefore conducted using a mixed qualitative and quantitative methodology.

The favouring and hindering factors and the waste diversion indicator are analysed for all five countries and one sub-national region. These factors are used in the comparative analysis (Chapter 10) for deriving cross-country conclusions on the effectiveness of waste policies related to the Landfill Directive. Where relevant, some of the factors are also described in more detail in the chapters presenting the situation in the specific countries/region (Chapters 4–9). In addition to the favouring and hindering factors, those chapters include a discursive review of landfill policies in the five countries and one region.

The methodology employing favouring and hindering factors and the evaluation of each country/region are presented in detail in a series of background papers (ETC/RWM, 2008a-h). Individual country/region papers present the objectives, the policy instruments introduced to meet these objectives and the waste management scene at the time of the transposition of the Landfill Directive. Further, these papers include an evaluation of the implemented policy and of the Landfill Directive being a driver for landfill diversion according to the methodology employing hindering and favouring factors. All background papers are available from <http://waste.eionet.europa.eu/publications>.

#### 3.2.1 *Factors favouring and hindering the effectiveness of landfill diversion policy*

A policy for diverting waste from landfills can fully succeed only if the waste management system is able to receive and manage the resulting waste flows. In particular, the 'maturity' of the system, i.e. the existence of separate collection schemes and recovery capacity, and its responsiveness to landfill diversion policy, can impact the effectiveness and the time-frame of landfill policy. If the system is not ready to manage the diverted waste flows, landfill policy cannot be effective and can even lead to unintended effects (e.g. illegal dumping and export

**Table 3.1 Factors influencing the effectiveness of a policy of diverting biodegradable municipal waste from landfill**

Favouring/hindering factors	Influence on diversion	Justification of the +/- sign
<b>Factors related to BMW landfill policy</b>		
Landfill Directive 1999/31/EC transposed	+	Legal framework in place
Landfill tariffs/gate fees for BMW or MSW (excl. VAT and landfill tax)	+	High cost of landfill favours other treatment options
Landfill tax on BMW (or MSW)	+	High cost of landfill favours other treatment options
Prohibition of untreated waste in landfill	+	Prohibition favours separate collection and pre-treatment which discourages landfill and favours other treatment options
Selective ban on BMW	+	Quantity limitation by law sets up minimum diversion criteria
<b>Factors related to waste production and collection</b>		
BMW generation per capita	-	High waste production requires many management options
Separate collection for BMW, split into the following fractions (if possible):	+	Separate collection of biodegradable waste fractions is a basic requirement for recycling
<ul style="list-style-type: none"> <li>• paper and cardboard (incl. newspapers etc.)</li> <li>• kitchen, garden and wood waste</li> <li>• BMW in residual waste</li> </ul>		
'Full cost' collection tariffs or charges (excl. VAT and taxes)	+	Appropriate tariffs increase capacity to invest in separate collection and recovery/recycling
<b>Factors related to the landfill sector</b>		
Share of MSW landfilled (Eurostat Structural Indicator)	+	High pressure on capacity favours other treatment options
Landfill residual capacity (non-hazardous waste)	-	High residual landfill capacities discourages diversion
Land per capita	-	Higher land availability makes land a less scarce resource and decreases the cost of landfills
<b>Factors related to the incineration sector</b>		
Share of MSW incinerated (Eurostat Structural Indicator) makes diversion more difficult	-	Low incineration rate
Dedicated incineration capacity for MSW (available)	+	Available incineration capacity makes diversion easier
Other incineration capacity (e.g. cement kilns, power plants, etc.)	+	Other incineration capacity makes diversion easier, but requires capacity for refuse-derived fuel (RDF)
Incineration gate fees for MSW (excl. VAT and incineration tax)	-	Higher fees discourage incineration
National policies on renewable energy sources	+	Progressive targets for renewable energy sources policies stimulate energy from MSW
<b>Factors related to the material recycling and recovery sector</b>		
Packaging and packaging waste policy	+	Diversion of biodegradable fraction of packaging waste contributes to BMW diversion from landfills
MBT capacity	+	Available MBT capacity favours diversion
Compost capacity (i.e. input of biowaste)	+	Available compost capacity favours diversion

**Note:** Positive influence = + (factor favouring diversion); negative influence = - (factor hindering diversion).



of untreated waste). If the system is responsive because the needed capacity is available or created through rapid investment then landfill policy can be successful.

Therefore, the effectiveness analysis of landfill diversion policy should take into consideration:

- the features of the 'active' landfill diversion policy;
- the factors — in both the landfill sector and the other parts of the waste system — that favour and hinder diverting waste from landfill.

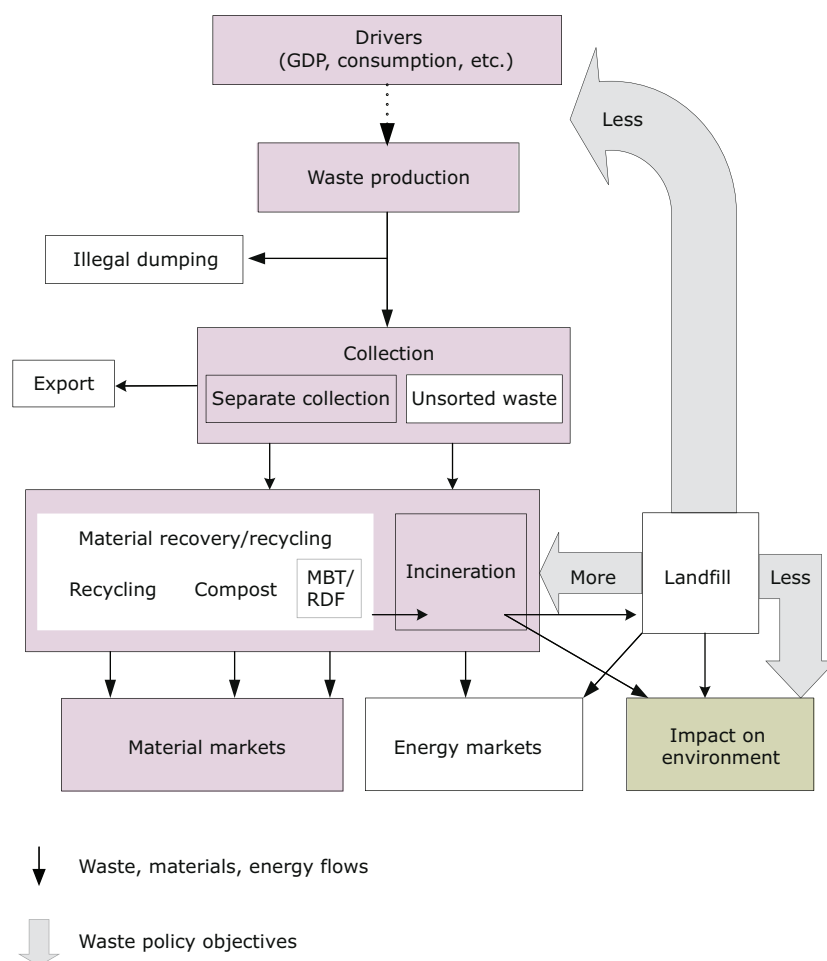
Some of these factors and their propensity to hinder or favour successful and effective waste diversion are discussed below with reference to the waste system parts depicted in Figure 3.1. These factors

(waste generation, collection, recycling, incineration and landfilling) have been represented using quantitative indicators in the six country studies (ETC/RWM, 2008a–f). In the present report, some of these findings are discussed in the comparative assessment (Chapter 10). Policy instruments such as landfill taxes, landfill bans and waste collection charges are also discussed in each of the country chapters of this report.

### 3.2.2 Waste generation factors that influence diversion from landfill

Waste generation dictates the scale of the waste management system and waste composition can influence the choice of management and recovery options. Both have important implications for the effectiveness of landfill policy and both are driven by economic and social variables.

**Figure 3.1 A simplified sketch of a waste management system and the objectives of landfill policy**



**Note:** MBT — Mechanical-biological treatment; RDF — Refuse-derived fuel.

A policy aiming to divert waste from landfill may be more difficult in countries where waste generation is still increasing because of the need to create new options and larger waste management capacities. Land use constraints can limit the expansion of landfill capacity; however, regardless of the rate of waste generation, structural features (e.g. population density) can also be important.

Any progress in waste prevention can indirectly help the effectiveness of a landfill diversion policy by slowing down the inflow of waste into the system, whereas the composition of waste can influence policy effectiveness in complex and unpredictable ways.

### ***3.2.3 Waste collection factors that influence diversion from landfill***

The characteristics of a waste collection system can be critical to the amount and type of waste flows directed either to landfill or to recovery options (incineration, material recovery, recycling). Well-developed separate collection schemes can make waste diversion from landfill more effective.

Charges for collecting and treating municipal waste can also be designed to favour separate collection. The cost of waste collection services to waste producers can influence waste prevention, especially if the producers pay the 'full cost' of the service either via 'pay-as-you-throw' schemes or other user charges. Furthermore, the higher the cost of landfill (fees and taxes), the higher the incentive (net benefit) to invest in separate collection that can feed recovery and recycling options.

### ***3.2.4 Landfill capacity and cost factors that influence diversion from landfill***

Constraints and bans on the types of waste that may be landfilled (defined by waste streams and composition), technical-environmental requirements for landfills and public opposition to landfill can be important catalysts for diverting waste from landfill. Furthermore, because few countries have programmes of landfill expansion, residual landfill capacity can be important in determining the rate of diversion. Low residual capacity can accelerate the diversion process and vice versa.

Countries with a high share of total waste landfilled probably have low residual capacity (if the technical requirements of landfill policy constrain expansion), which would make a policy of diversion easier. On the other hand, in such countries there can be a strong lock-in to the dominant technology, as well

as other difficulties establishing alternative waste management options.

In many countries, landfill is still a relatively cheap disposal option. However as residual capacity becomes scarcer and technical-environmental requirements increase, gate fees are bound to rise. Specific (environmentally motivated) landfill taxes can also increase the cost relative to other waste management options. The Landfill Directive's bans and limitations on specific waste streams could free residual capacity and thereby lower the cost for other waste streams but could also make the operation of many small landfills economically unsustainable.

### ***3.2.5 Waste incineration factors that influence diversion from landfill***

The use of incineration varies greatly from country to country. Incineration capacity can be important in determining the volume of waste diverted from landfill to incineration. Limited incineration capacity can constrain diversion, while expanding capacity requires investment.

If a very large share of total waste is incinerated then there will be limited scope for further expanding incineration, particularly because some fractions of total waste composition are not suitable for energy recovery. Nonetheless, lock-in to the dominant technology may mean that incineration continues to be preferred to recycling.

The Waste Incineration Directive (2000/76/EC) raised the technical and environmental standards for incineration and is therefore expected to increase costs. These high costs could in turn hinder diversion from landfill. On the other hand, because incinerators can generate power, high energy prices can incentivize expanding capacity and redirecting waste flows to incineration. The renewable energy policies and high renewable energy source targets that Member States are currently designing could create similar incentives because co-incineration of separately collected biowaste is recognised as a renewable energy source.

### ***3.2.6 Material recovery and recycling factors that influence diversion from landfill***

Diversion of waste from landfill and, to some extent, from incineration depends to an important degree on availability of separate waste collection schemes, development of the industrial recovery and recycling chain and implementation of national policies for each waste stream. These options and policies can influence the effectiveness of landfill diversion policy positively.

However, if these sectors and policies are already very advanced or at saturation level (e.g. all packaging policy targets have been achieved), then there will be limited scope for further diverting of waste from landfill to the recovery and recycling sectors. Thus, their influence on the overall effectiveness of the system might cease to be favourable.

Table 3.1 presents a summary of the factors identified in as hindering or favouring diversion from landfill. For each factor an appropriate indicator was selected (as detailed in ETC/RWM, 2008g). Some of the findings on the impacts of the different factors are presented in the country chapters (Chapters 4–9) and the comparative analysis (Chapter 10).

### 3.3 Interviews with key stakeholders

Issues such as institutional context and public acceptance of a particular instrument play an important role in determining policy effectiveness. In order to explore these, four to six interviews were conducted in each country.

Examining the actions that occur in a policy area can provide a better understanding of why policy instruments were selected and why they have functioned as they have. The interviews explored the internal logic of the instruments and the policy

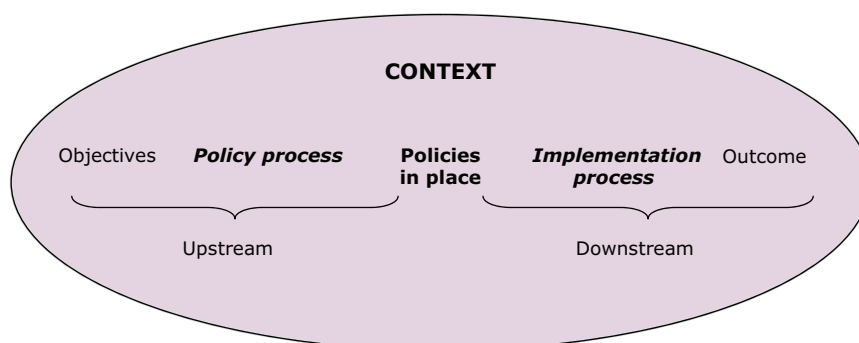
and implementation processes surrounding them. In this way the information from the interviews supplements the indicator-based analysis.

One way of analysing the process of policy design and implementation is to review the course of actions taken regarding the policy process and objectives (upstream from the policy in place in Figure 3.2) and regarding the implementation of the policy and the outcomes (downstream from the policy in place in Figure 3.2). By describing changes in waste management in terms of a series of actions over time it is possible to focus on the real actions and therefore choices made by authorities and other stakeholders, thus going beyond declarations of intent.

The context includes country-specific features of physical geography, demography, socio-economics, political and administrative organisation and tradition. What works well in one country might not work well in another context.

The interviewees were selected by following the course of action upstream and downstream from the enactment of a policy, identifying authorities and other stakeholders responsible for crucial actions and choices. The interviewees include staff in public administration, waste management companies, industry representatives and research institutions.

**Figure 3.2 Policy effectiveness – from objectives to outcome**



## 4 Estonia

### Box 4.1 Main elements and effectiveness of the Estonian strategy

- The Estonian waste strategy has focused on setting up schemes and building capacity for separate collection. These schemes largely cover packaging waste, whereas others addressing collection of biowaste are in an early stage.
- The national Waste Management Plan sets targets for the diversion of BMW from landfills and the Waste Act (2004) introduced a ban on landfilling untreated waste. In most counties this has not yet been implemented, however, due to lack of alternative waste treatment capacity.
- Estonia introduced a pollution charge for municipal waste disposal in 1990. Although low compared to other European landfill tax rates, it has increased considerably over recent years.
- According to Eurostat data, Estonia has significantly reduced municipal waste landfilled, from 95 % in 2000 to around 60 % in 2006. In 2005, the recovery rate was 24 %, and it appears that a further 16 % of generated waste is disposed of, exported or undergoes some other treatment (ETC/RWM, 2008a).
- The Ministry of Environment estimates that around 20 % of all households, mainly in rural areas, lacked access to waste collection schemes in 2006.

### 4.1 Waste management situation

Private consumption in Estonia has been growing at a pace similar to or faster than GDP (9.3 % in 2002 and 15.4 % in 2006) and this has put significant upwards pressure on waste generation. Generation of municipal waste (and thus BMW which accounts for 65 % of municipal waste in Estonia) fluctuated in the period 1995–2001 and has since increased.

Until 1999 virtually all waste was landfilled in Estonia. Since 2000, however, an increasing share of BMW has been diverted and by 2006 the landfill share had been reduced to 60 % (Eurostat Structural Indicators) (Figure 4.1). Some recycling schemes have been in operation for many years and work well because they are now firmly rooted in society, e.g. deposit schemes for glass and plastic and separate collection of paper.

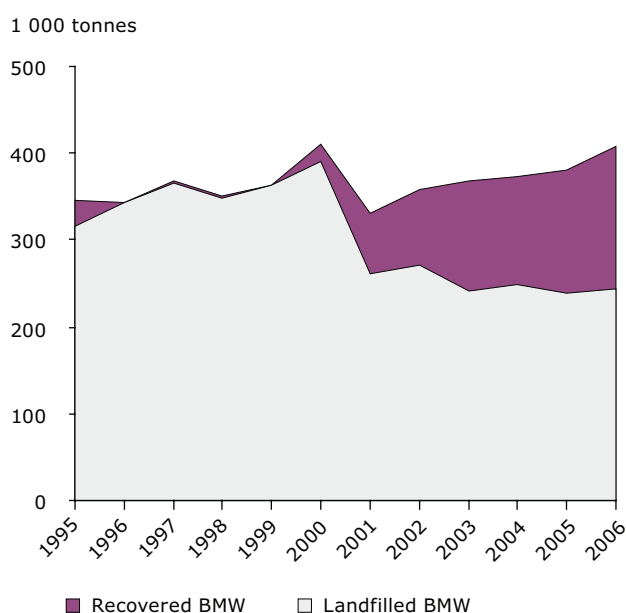
### 4.2 Waste policy objectives

The overall priorities for improving waste management in Estonia were laid down in the

National Environmental Strategy in 1995. These are to prevent waste generation; to reduce generated waste volumes and hazardous substances contained in waste; and to increase quantities of recycled waste. The strategy set two benchmarks for municipal waste: recycling half of generated waste and stabilising waste generation at 250–300 kilograms per person between 2000 and 2010.

The National Waste Management Plan 2003–2007 focused on transposing EU waste legislation. Estonia became an EU Member State in 2004. The Plan includes targets for various waste streams, as well as defining the organisation and institutions of waste management. In addition, it details the costs of waste management and associated investments. Targets on landfilling BMW are defined as a percentage of the total municipal waste that is landfilled. Although this approach is different from that of the Landfill Directive, which sets targets in relation to the BMW produced in 1995, the national targets are designed to guarantee implementation of the directive. Estonia set its targets four years later than those prescribed in the Landfill Directive using the provision granted to countries that put

**Figure 4.1 Management of biodegradable municipal waste in Estonia**



**Note:** BMW calculated from data on MSW under the assumption that BMW accounts for 65 % of MSW.

**Source:** Eurostat Structural Indicators and ETC/RWM, 2008a.

more than 80 % of their collected municipal waste to landfill in 1995. The targets are stricter than those in the Landfill Directive, however, and will remain realistic only if the planned incineration of municipal waste is implemented in coming years.

Rapid economic growth has made the prevention targets in the National Environmental Strategy impossible to achieve. The target in the National Waste Management Plan was therefore revised and now aims to stabilise municipal waste generation per person at the 2005–2006 level. The recovery target has also been lowered to 30–40 %. Other aims of the Plan include stimulating efficient waste separation in the industrial and service sector, providing guidance on sorting municipal waste in households and providing municipal waste collection services to all households and businesses.

Targets for the period 2004–2010 require that at least 50 % of packaging waste be recovered and at least 25 % recycled. In addition, at least 15 % of the total mass of each packaging material must be recycled. After 2010, the targets increase to 60 % recovery and 45 % recycling, with at least 15 % of each packaging material recycled.

### 4.3 Institutional context

The Ministry of Environment is responsible for developing and implementing the National Waste Management Plan and all other waste management policies. The Ministry has 15 structural units at county level. These county environmental authorities are responsible for issuing permits and also, until recently, for county-level waste management planning. The county environmental authorities therefore play a key role in implementing waste legislation and relevant action programmes at county level.

Municipalities are in charge of organising the collection, transport and disposal of municipal waste. In 2007, an amendment to the Waste Act (2004) suspended county-level waste management planning. This move aimed to give more responsibilities to the municipalities and stimulate them to pool their resources and strengthen their human and financial capacities for better waste management activities. For example, it is compulsory for municipalities to elaborate waste management plans but they can do so in coordination with other municipalities to form a regional waste management plan.

### 4.4 Policy instruments

A pollution charge for municipal waste disposal — sometimes referred to as a landfill tax — was introduced in 1990. The charge is paid by landfill operators and 75 % of the revenue goes to the local budget of the waste generating municipality and 25 % to the state budget. Until 2005, the rate was very low at EUR 0.10–0.20 per tonne. In 2006 it rose to EUR 7.8 per tonne and it will increase to EUR 10 per tonne in 2009. So even though the charge is still low compared to other countries' landfill tax, the increase of the charge has been considerable. Moreover, the rate is twice as high (and will be three times as high from 2009) for landfills that do not comply with the Landfill Directive.

Since 1991, municipalities have been able to collect a charge from households and industry for managing municipal waste. The charge covers all waste management costs and waste pollution charges, and can be adjusted for inflation.

The Waste Act (2004) introduced a ban on landfilling untreated waste (including mixed municipal waste). However, until 1 January 2008 it only applied to landfills in counties that had an established facility for treating municipal waste.

In reality, only the landfills in the Harju County (in Tallinn area) met this requirement.

In April 2007, the city of Tallinn started collecting biodegradable kitchen waste separately. Buildings with more than five apartments must have a separate container, as must offices producing more than 25 kilograms of BMW per week. The city regulation was adopted to help meet the Estonian targets on BMW. In the first few months implementation was poor but it is expected to improve over time. There has not been any tradition in this type of separate collection and uptake is therefore expected to be slow. Public awareness campaigns are needed to bring about a change in mentality.

#### 4.5 Observations on effectiveness

The National Waste Management Plan aims to provide all households and other waste producers with a municipal waste management service. The Waste Act (1998) obliged municipalities to organise waste collection systems but it was not very efficient. A lack of concrete rules and time schedules meant that most municipalities did not organise collection systems. The Waste Act (2004) was much more explicit in this respect, including a special chapter about procedures. The obligation to establish a collection scheme has attracted much criticism from both the general population and municipalities but the Ministry of Environment maintains a firm stand on this part of the new legislation.

The Ministry of Environment estimates that 20 % of all households (10 % in towns and up to 80 % in some rural areas) did not have regular waste collection in 2006. These households dealt with waste by either bringing it to containers in other dwellings or public containers, burning it at home or dumping it illegally in forests. There is a particular problem with the summer houses and small enterprises around Tallinn, as they are not covered by a collection system. Waste from these premises often ends in the forest. Furthermore, approximately 60–80 % of households do not have access to a separate collection scheme for garden waste. Improvements in collection systems may result in increasing waste generation figures, which in this case would be a positive sign in terms of pressures on the environment because the waste would then be managed properly instead of being burnt at home or ending up in forests.

Estonia has a relatively large number of municipalities (227). Of these 33 are urban and

194 are rural. The total number is higher than in countries of similar size, implying that the average number of inhabitants per municipality is relatively low. As a result, municipalities are fragmented and often lack the human and financial capacities to deal with their waste management responsibilities.

The pollution charge for municipal waste disposal is one of the most important and controversial waste policy instruments in Estonia. Policy-makers at the Ministry of Environment and the Estonian Waste Management Association were not in favour of the instrument, instead supporting the introduction of a local waste management tax in 2003. That was not possible, however, because introducing a new tax was and still is contrary to the government's economic programme.

When the pollution charge was introduced at the beginning of 1990 it was collected by the state. After 2004, it was decided to return 75 % of the revenue from the charge to the municipalities where the waste is collected, partially to secure a steady source of funding for the waste management activities of local authorities. Unfortunately, this creates a disincentive for starting large-scale recovery operations because municipalities would lose revenues when reducing landfilling. Another drawback of the charge is that it is relatively rigid and cannot be adjusted by municipalities. On the positive side, it channels significant amounts of money to the Environmental Investment Centre, which funds environmental projects, including ones addressing waste. The amount of revenue raised from the disposal charge differs significantly between municipalities and depends on several factors such as waste generation per capita and the extent of organised waste collection among the population as a whole.

The closing of old landfills, which was quite successful, was also funded partially through the Environmental Investment Centre and the pollution charge. Encouragingly, the charge is planned to increase in the years until 2010–2011, making recycling and recovery operations more attractive and making it easier for Estonia to reach its recycling targets. The fact that the charge is twice as high for old, non-compliant landfills creates an additional pressure to close them. Fly-tipping (i.e. illegal dumping of waste) is a side-effect of such closures although fly-tipping primarily arises because many municipalities have not yet fully met their legal obligation to join the systems of organised waste collection

and transport. In fact, the old, small, uncontrolled landfills themselves constituted fly-tipping and dumping sites from an environmental point of view.

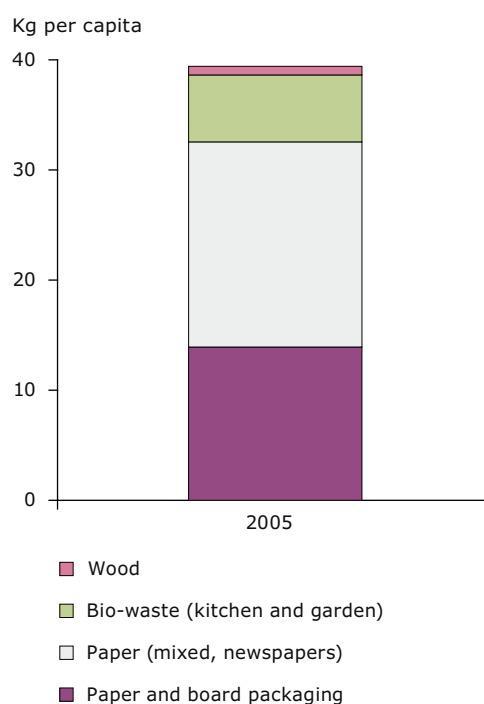
Until early 2007 tenders for waste collection and transportation systems could not be organised for areas with more than 10 000 inhabitants. This inflated prices for such services because there were no economies of scale. The ceiling has been increased to 30 000 inhabitants, which should make collection cheaper.

Because of the relatively cold climate, Estonian authorities look favourably on the production of heat from waste incineration, and the construction of three incineration facilities is currently being considered. Incineration of waste could replace heat produced from oil shale, which would also have a net positive environmental effect. This is because part of waste-generated fuel can be considered as renewable fuel (unlike oil shale). It would also decrease the dependency on Russian gas imports. It is therefore probable that one or more of the incineration projects that are currently under consideration will be implemented.

Estonia does not have a long history of collecting biodegradable waste fractions separately, apart from waste paper collection. Available figures show that in 2005 paper and cardboard was by far the largest stream collected separately, accounting for 19 kilograms of paper waste and 14 kilograms of cardboard packaging per capita. The total amount of biodegradable waste collected was just below 40 kilograms per capita and is shown in Figure 4.2.

The recycling rate of packaging is increasing as a result of policies on packaging and packaging waste and is therefore perceived to be one of the strongest factors favouring diversion of municipal waste from landfill.

**Figure 4.2** Separate collection of biodegradable waste fractions in Estonia



Source: ETC/RWM, 2008a.

## 5 Finland

### Box 5.1 Main elements and effectiveness of the Finnish strategy

- In the 1990s the Finnish strategy for diverting biodegradable waste away from landfills focused mainly on recycling, including composting and anaerobic digestion. Unfortunately, the Finnish climate and the different composition of biodegradable municipal waste compared to other EU Member States led to technical problems for composting plants.
- Municipalities are responsible only for ensuring that sufficient capacity is available for treating municipal waste but not for guaranteeing capacity for particular types of treatment. As a result, municipalities can fulfil their responsibility by providing landfill capacity.
- From 2000 to 2005 the focus shifted towards co-incineration but when co-incineration plants were required to meet the stricter emission standards set by the EU Waste Incineration Directive, the use of municipal waste fractions became economically unattractive. The new Waste Plan 2008 focuses more on dedicated incineration plants combined with co-incineration.
- In 2000–2005 landfilling of municipal waste has remained nearly constant at around 60 %.

### 5.1 Waste management situation

The total generation of biodegradable municipal waste fell in 2001 and has stayed relatively stable notwithstanding a slight increase in 2004. Finland has landfilled around 60 % of its biodegradable municipal waste since 1995 (Figure 5.1). Before the Landfill Directive was implemented, landfilling was relatively cheap. In the sparsely populated parts of the country, land is inexpensive and suitable locations for landfills are not difficult to find. This situation has changed since 2007 when Finnish landfills were required to meet the technical requirements in the Landfill Directive — two years before the 2009 deadline.

Incineration gained a bad reputation in the 1970s so when the Finnish EPA in 1991 suggested a combination of incineration and biological treatment, politicians were not in favour. Instead, they decided to promote waste prevention and recycling.

Currently, around 35 % of biodegradable municipal waste is recycled and some 2–5 % is incinerated. There has been a slight increase in separate collection since 2002 at the expense of incineration.

### 5.2 Waste policy objectives

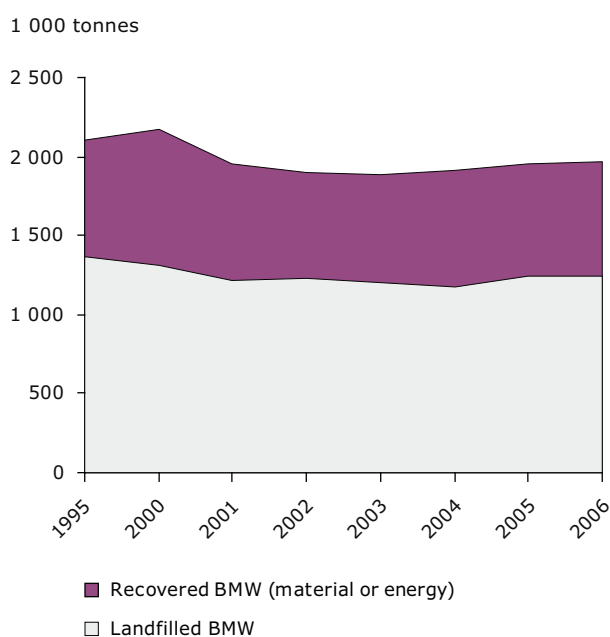
In 1998 Finland drafted its first Waste Plan, which defined a set of targets to be met in 2005. The Ministry of the Environment revised the Plan in 2002. Both the original and revised Plans set high targets for recovering waste.

The Waste Plan 2002 also set a target on preventing waste generation. Specifically, it provided that the amount of municipal waste generated in 2005 should be at least 15 % lower than the level that would have been anticipated based on the volume of waste in 1994 and real growth in GDP.

For biodegradable waste the Waste Plan 1998 targeted 75 % recovery through composting and anaerobic digestion by 2005. In the Waste Plan 2002, however, the target was changed so that by 2010 municipal waste could only be landfilled if at least 80 % of the organic matter in the waste had been removed. In other words, the target was to landfill a maximum of 20 % of the biodegradable waste generated. For waste paper the Waste Plan 1998 set a target of 75 % recovery and this target was increased to 80 % recovery, to be achieved by 2005, in the Waste Plan 2002.



**Figure 5.1 Management of biodegradable municipal waste in Finland**



**Source:** Statistics Finland, 2007.

The national strategy for reducing biodegradable waste going to landfills 2006–2016, which was issued in 2004, sets BMW generation targets for 2006, 2009 and 2016 measured by weight. The strategy also specifies that an additional 600 000 tonnes of treatment capacity at regional level is needed by 2009 and 900 000 tonnes by 2016.

In April 2008 the government adopted a new Waste Plan, which aims to reduce landfilling of municipal waste to around 20 % by 2016. By the same deadline, municipal waste generation should be stabilised at 2000 levels. Half of this should be recycled and 30 % should be incinerated. The plan also aims to increase composting and production of biogas from organic wastes (Ends Europe, 2008).

### 5.3 Institutional context

Finland has 416 municipalities, which are self-governing units with considerable local autonomy, including the right to levy taxes. For many years Finland has had a special system for collecting municipal waste. According to the Waste Act (1993), municipalities are responsible for organising municipal waste collection and have two options for doing so. They can either outsource the collection to private companies or require that waste producers, including

households, select a waste collector and pay the collector directly for both collection and treatment. In the latter case, the municipality sets the conditions, including a maximum price for collection, and the waste producers have no contractual link with the municipality. Nonetheless, responsibility for municipal waste remains with the municipality. Until 1 June 2007, municipalities were also responsible for organising the management of household-like waste from enterprises but that responsibility has been transferred to the enterprises so they are now free to contract a waste collector.

Because many municipalities are small, fragmented and sparsely populated, policy-makers realised in 1993 that municipalities would manage waste better if they united to form inter-municipal companies. By 2000, 65 % of municipalities (covering 80 % of Finland's population) cooperated in such companies. There is no legal obligation to cooperate but it enables municipalities to establish treatment capacity that would otherwise be more costly and take advantage of economies of scale.

The Ministry of the Environment draws up a national waste plan and presents targets and the possible measures. The municipalities are not obliged to develop local waste management plans that transform the national plan into local conditions and this may weaken political and administrative commitment. The only 'decentralised plans' are made by the 13 regional environment centres, which are under the authority of the Ministry of the Environment but these plans are not binding on municipalities. Furthermore, Finnish legislation does not require that municipalities introduce separate collection schemes for BMW.

### 5.4 Policy instruments

Finland joined the EU in 1995. During the preparation for the EU membership Finland was able to take into account both existing and expected EU legislation, for example the EU Landfill Directive, when debating future Finnish waste legislation.

As the overall framework of the EU Landfill Directive was debated and enacted in the period 1993–1999, the Finnish government incorporated the directive's anticipated requirements in new policy instruments on diverting waste from landfills. Thus, several instruments were introduced before the

adoption of the Landfill Directive and even prior to Finland's first Waste Plan in 1998.

The government introduced a landfill tax for municipal landfills in 1996 at a level of EUR 15 per tonne of waste. It has raised it twice since and from 2005 it stands at EUR 30 per tonne. It seems that the tax has helped divert heavier waste streams such as construction and demolition waste but has had less effect on BMW and municipal waste. Compared to landfill tax levels in other Member States, the tax is relatively low.

The government also introduced a producer responsibility system for waste paper in January 1999. For packaging waste, industry is responsible for managing up to 61 % of the waste and municipalities are responsible for the remaining 39 %.

The government enacted a landfill ban for certain waste streams partly as a result of the EU's debate on the Landfill Directive. The ban prohibits landfilling biodegradable waste 'from which the major part of the biodegradable waste has not been collected separately'. The wording is rather vague and does not refer to the aim of removing a minimum of 80 % organic matter before waste is landfilled, which features in the country's Waste Plan 2002. As a result, it leaves room for interpretation of what 'the major part' is. Although, the 2002 Waste Plan provided that more detailed restrictions for the landfill of biodegradable waste would be passed in 2003, this was not implemented till 2006.

**5.5 Observations on effectiveness**

Finland's policies and strategies for diverting biodegradable waste from landfills have shifted focus in recent years. In the 1990s the focus was initially on recycling, including composting and anaerobic digestion, and there was no political support for incineration with energy recovery. This strategy proved problematic because the Finnish climate, combined with a different composition of BMW compared to other EU Member States, caused technical problems at composting plants.

From 2000 to 2005 the focus shifted towards co-incineration (using waste as a fuel substitute in an industrial or power plant). The need for co-incineration plants to meet Waste Incineration Directive standards meant that costs exceeded benefits, however, especially because of the additional expenditures needed to meet the

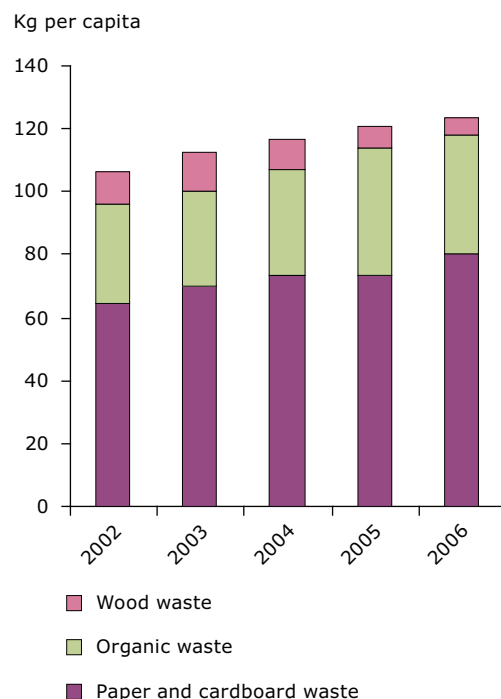
directive's strict emissions standards. This caused a decline in demand for Refuse-Derived Fuel (RDF). Rising energy prices until mid-2008 increased demand for RDF once again and in 2007 the capacity for co-incineration was around 300 000 tonnes of waste. Still, RDF is only partly made of municipal waste.

The Waste Plan from 2008 focusses on establishing dedicated incineration plants combined with co-incineration in about 10 energy production plants. As a result, between 27 % and 42 % of BMW (and municipal waste) will be incinerated with energy recovery in the future. This move should allow Finland to meet the Landfill Directive's 2009 target of landfilling at least 50 % less BMW than was generated in 1995.

Separate collection of biodegradable waste fractions has increased by 18 % since 2002. Seventy-one per cent of paper waste (e.g. newspapers and printed paper) is recycled — among the highest rates in Europe.

Independent of strategy and policy focus, efforts to divert waste from landfill have faced problems due to a lack of clarity in targets and responsibilities for building BMW recovery capacity. Municipalities

**Figure 5.2 Separate collection of biodegradable waste fractions in Finland**



Source: Statistics, Finland 2007.

are responsible only for ensuring that sufficient capacity is available for treating municipal waste, not for guaranteeing capacity for particular types of treatment. As a result, municipalities can fulfil their responsibility by providing landfill capacity.

When municipalities decide to allow households to select their own private waste collectors, it can be difficult for the municipality to monitor the waste streams and to ensure that the necessary treatment capacity is available. Indeed, because enterprises are accountable for managing their household-like waste, in those cases municipalities may only be responsible for the MSW of public utilities, e.g. schools and hospitals.

The shared responsibility for packaging waste has also been difficult to implement because conflict exists between producer organisations and municipalities due to unclear responsibilities.

Where the responsibility for managing a waste stream — including planning, collecting, providing treatment capacity and financing — is very clear

and combined with clear targets for recovery and recycling, it has produced good results in diverting waste from landfills. Good examples are tyres and waste paper.

Where the responsibility has been divided between different actors or when the target in the legislation is worded loosely, as in the prescriptions on permitted amounts of BMW deposited at landfills, it seems as to take much longer time to achieve the desired results. Although Finland drew up national waste plans and set high recovery targets, they were not supported by a clear division of responsibilities and sufficient action. More waste might have been diverted from landfill if the government had introduced a regulation on separate collection or more incentive-based instruments.

Finally, Finnish stakeholders have concluded that the targets in the EU Landfill Directive on diverting biodegradable waste away from landfill will be very difficult to reach without giving an important role to incineration with energy recovery in Finland.

## 6 Flemish Region of Belgium

### Box 6.1 Main elements and effectiveness of the Flemish strategy

- To reduce the amount of residual waste sent to landfill, Flanders promotes separate collection of waste and home composting and aims to make maximum use of existing incineration capacity.
- These measures are implemented pursuant to the Waste Plan, which is a powerful instrument because once approved by the Region's government its provisions apply to all public authorities.
- Other prominent instruments include a set of voluntary agreements with municipalities, communication activities on separate collection and home composting, an increasing landfill tax and a ban on landfilling and incinerating certain waste streams such as unsorted household waste.
- Landfilling of household waste started to decrease in 1996 and by 2006 the Flemish Region had reduced landfilling to around 1 % of total household waste generation.

### 6.1 Waste management situation

The first priority in Flemish waste policy has been to close or improve many local dumping sites created in the early 1960s and 1970s. In an area as densely populated as the Flemish Region, disamenities from dumping sites were considered a major problem and thus of political concern. The Waste Plan 1986 aimed to close and improve landfills, making maximum use of existing incineration capacity and starting the first separate collection of municipal waste. The second plan from 1991 focused on further improving separate collection and preventing waste generation.

Since 1995 the amount of waste landfilled has decreased considerably and it seems that the decline has been matched by a corresponding increase in separate collection of household waste for recycling. The amount of waste incinerated has remained almost constant (Figure 6.1).

### 6.2 Waste policy objectives

The Region's objectives for waste management are:

- to protect public health and the environment from the harmful influence of waste;
- to prevent raw materials becoming waste materials;

- to regulate waste management policy in accordance with the waste hierarchy.

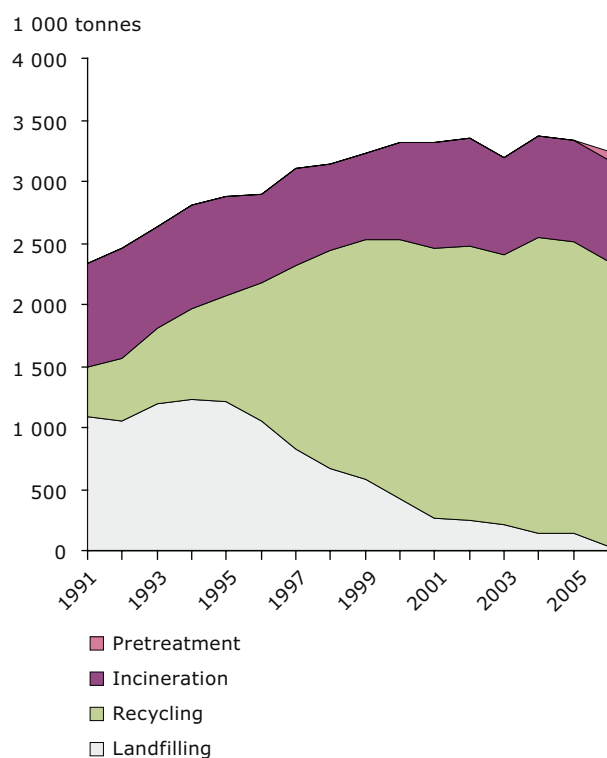
The Waste Plan 1997 included a target for separate collection of household waste and a set of targets on the generation of residual waste. More waste was diverted from landfill than originally expected, however, so these targets were raised in the Waste Plan 2003.

By 2007 the aim was therefore to achieve a separate collection rate of 69 % of household waste and to reduce the average residual waste generation to 150 kilograms per capita between 2003 and 2006. Less stringent targets per capita were set individually for every municipality. For waste paper, in 1998 a target was set to recycle 85 % by 2001.

The Waste Plan 2003 also includes the following target on prevention: 'By 2007, the collected amount of municipal waste should be reduced by 13 % compared to 2000, taking into account an annual autonomous increase of 2 % as a result of the growth in population and economy if no measures are taken' (Parent *et al.*, 2004).

### 6.3 Institutional context

In 1980, the national Belgian Parliament started transferring responsibility for a number

**Figure 6.1 Management of household waste in the Flemish Region of Belgium**

**Note:** Figures on the management of biodegradable waste over the period are not available.

**Source:** Statistics Flemish Region.

of policy areas to the three regions: the Brussels Capital Region, the Flemish Region, and the Walloon Region. The first policy areas to be transferred related to the territory, including certain aspects of environment and water policy (e.g. waste collection and treatment, and environmental enforcement). In 1988 more policy areas followed, including waste policy (except waste transit, import and export, and nuclear waste) and environmental permits. In 1993, responsibility for waste import and export (except nuclear waste, product standard setting and waste transit) was transferred. Thus, the responsibilities of the national government are limited to product standards, nuclear waste and negotiation and implementation of international obligations.

The three regions have widespread political autonomy and each is responsible for implementing waste management legislation and policy. In the Flemish Region, the Public Waste Agency of Flanders (OVAM) is responsible for preparing and implementing waste management legislation and for supervising the achievement of waste management objectives. The regions are responsible for setting

up waste management plans covering all waste generated (household, commercial and hazardous waste).

The Flemish municipal authorities are responsible for collecting and treating all household waste generated within their municipality. This responsibility includes the obligation to draw up regulations for waste collection and management within the framework at the regional level. Since 1980, almost all municipalities cooperate in inter-municipal associations to establish the infrastructure for waste collection and treatment. There are 27 inter-municipal associations on waste.

#### 6.4 Policy instruments

The Flemish Region has introduced a series of policy instruments to reduce landfilling, increase recycling and prevent waste generation through home composting.

The first Flemish Waste Decree (1981, amended 1994) regulates the preparation of waste plans. The provisions of the waste plans apply to the administrative governments of the Flemish Region, the provinces, municipalities and public or private institutions who carry out tasks on environmental policy. Several waste plans followed each other covering usually 4–5 years, the first one covering the years 1986–1990. The main focus of these plans moved from closing and improving landfills, via setting up and improving separate collection towards waste prevention.

Since the 1980s, households and other waste producers have paid a charge to their municipality to finance waste management operations. Costs not covered by the charge are financed by income taxes, producer responsibility systems or subsidies from the Flemish government. To date, virtually all municipalities have introduced 'pay-as-you-throw' schemes in combination with a low flat-rate tax on all households, using a specific obligatory household refuse bag or more complex collection systems with chipped bins that are weighed during collection.

In the late 1980s the Flemish Region had success with a policy of subsidising recycling centres, composting plants and incinerators, which helped stimulate major investments, particularly in small municipalities. As a result, the Region's Ministry of Environment decided to continue with the subsidy policy by developing a voluntary environmental agreement with the municipalities. Those municipalities that sign the environmental agreement

receive a subsidy for waste management measures, which is partly linked to the meeting of certain targets within a time period, as laid down in the environmental agreement. Subsidies are only given for activities that go beyond legal requirements. Since 1992 a series of such agreements have been issued, reflecting the respective objectives and measures laid down in the waste plans for the same time periods.

A waste disposal levy was introduced in 1990, which was relatively low. Between 1993 and 1997, however, the levy for landfilling was raised by 260 % to EUR 54 per tonne. A lower rate applies for incineration without energy recovery of waste and far lower rates apply for incineration with energy recovery. The levy is also differentiated for household and industrial waste. Separately collected recyclable waste streams are exempted from the levy. The revenue from the levy enters the general budget of the Flemish Region, although part of it finances the municipal environmental agreements.

Municipalities can decide whether to collect only garden waste or all biowaste (garden, vegetable and fruit waste). If they choose to collect garden waste only, they must introduce an intensive scheme to promote home composting of biowaste. The Flemish Compost Organisation (VLACO) was established in 1992 as a separate, independent organisation in cooperation between OVAM, the waste inter-municipal associations, private compost producers and some cities. VLACO is responsible for coordinating the implementation of systems to collect and manage kitchen and garden waste, monitoring the quality of the compost and promoting sales. VLACO initiated the Compost Masters Programme, whereby volunteers provide information to neighbours and others on how to compost biowaste. At the same time they act as a link between the municipality and citizens.

Due to land scarcity and the policy of diverting waste from landfill, the Minister of Environment decided in 1993 not to establish new landfill sites. A few years later, the Minister decided to limit incineration capacity. Since 1998, only waste that cannot be prevented, recycled or incinerated may be landfilled.

The Flemish Region's Waste Decree was revised in 1994 to include, among other things, international obligations and a new instrument: the 'duty of acceptance', which provides for producer responsibility, meaning that producers have to take back waste arising from their products. Producer responsibility was implemented for waste paper

because of its large volume and the resulting impact on the municipal waste budgets. The first two producer responsibility agreements have been made with the printed advertisement sector and with the informative press. Both agreements are of financial nature only. Producer responsibility has also been introduced for packaging waste. Producers that put products in single-use packaging on the market are responsible for dealing with the packaging when it becomes waste.

## 6.5 Observations on effectiveness

The Flemish Region has one of Europe's highest recycling rates. In 2004, 71 % of household waste was collected separately and only 4 % was landfilled. Likewise, around 40 % of the population is engaged in composting at home. More than 200 kilograms biodegradable waste per capita is collected separately (Figure 6.2). In general, it seems that most of the targets of the Waste Management Plan 2003–2007 have been met.

Other interesting outcomes of Flemish waste policy are that it has helped bring about broad public acceptance of the need to spend time and money separating and composting waste; that concerns about waste management and littering rank high on the political agenda; and that some of the initiatives are more far-reaching than those seen elsewhere in Europe.

Several policy instruments were introduced very early (before 1993) and most measures were introduced before the Landfill Directive was issued in 1999. Diversion of waste from landfills started in the early 1990s and already in 1995 only 29 % of the BMW generated was landfilled. The Landfill Directive therefore did not play a significant role in catalysing the introduction of these measures.

The Waste Plan is a key policy instrument because once approved by the government its provisions apply to all public authorities. All relevant parties are involved in the process of preparing a Waste Plan. As a result, it is a powerful instrument for the Flemish government to steer the development.

The environmental agreements with municipalities and their quid pro quo nature motivate municipalities to go further than the targets set in the Waste Plan. With more than 80 % of municipalities signing agreements, participation is very high. It has declined since the agreements were first launched, however, because the design of the agreements has become steadily more

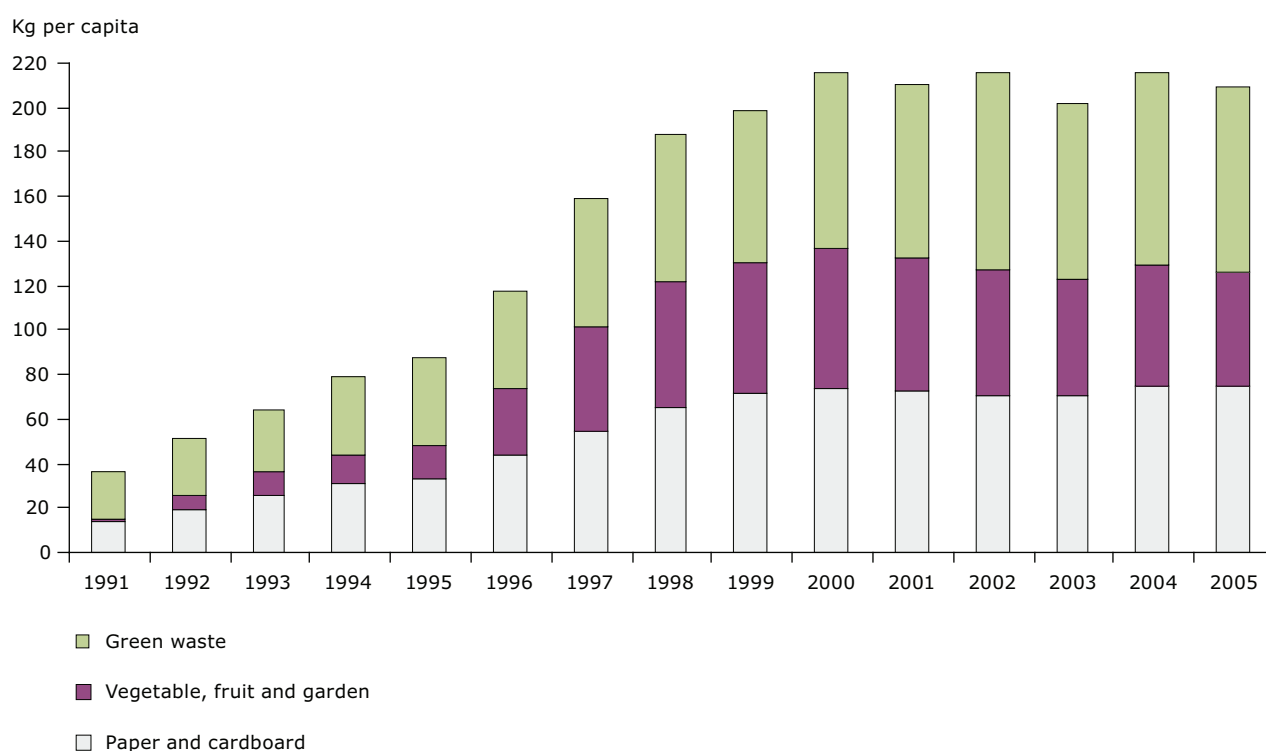
complex, more administration is necessary to document that requirements have been met and the subsidy only partly covers additional costs for the municipalities resulting from the agreements. Still, it is remarkable that a relatively low subsidy, averaging EUR 22 000 per municipality, seems able to motivate municipalities to introduce collection systems and facilities faster than defined in the Waste Plan.

The total cost of managing household waste is important for municipalities (and inter-municipal associations) and many initiatives have therefore been undertaken to reduce or offset costs,

notably the landfill and incineration levies. The Flemish government uses around 40 % of the revenue from the levy to finance the subsidies of the environmental agreements.

Communication that alters citizens' behaviour has played a leading role in achieving high recycling rates. For example, VLACO has observed that it is important to work actively to keep awareness levels high. If information activities are reduced, awareness drops and the quality of separately collected waste fractions worsens. Also, the target for residual waste (measured in kilograms/capita) has been easy to communicate to the public.

**Figure 6.2 Separate collection of biodegradable waste fractions in the Flemish Region of Belgium**



**Note:** Municipalities are required to organise separate collection of either biowaste or garden waste (in combination with home composting of biowaste).

**Source:** Statistics Flemish Region.

# 7 Germany

## Box 7.1 Main elements and effectiveness of the German strategy

- The German strategy focuses on separate collection and recycling of secondary raw materials (paper and biowaste), pre-treatment of mixed household waste in mechanical-biological treatment plants and dedicated incineration with energy recovery of mixed household waste.
- The separate collection schemes have been successful in achieving very high recycling rates.
- A ban on landfilling waste with an organic content of more than 3 % was adopted already in 1993 but due to several loopholes it was not implemented properly. The loopholes were closed with the Waste Landfilling Ordinance (2001), which re-established a deadline of 1 June 2005 for implementing the landfill ban. Special limit values for the organic content of waste that has undergone mechanical-biological treatment were introduced. Since the deadline, the amount of municipal waste landfilled has fallen to 1 %.
- The German federal states have selected different pre-treatment strategies for municipal waste. Some have chosen to reduce the organic content of waste mainly by means of mechanical-biological treatment. Others have focused more on waste incineration in dedicated incinerators.

## 7.1 Waste management situation

In the mid-1960s the national government and the federal states started to analyse waste disposal and disseminated the findings to municipalities, which were responsible for disposing of municipal waste. Due to a substantial increase in industrial production and private consumption, waste generation grew rapidly at the beginning of the 1970s. At that time, waste was primarily disposed of in 50 000 small dumpsites and interest concentrated on them and the need to build appropriate waste management facilities.

In the 1990s Germany was among the first European countries to introduce policies to limit landfilling. Measures included schemes for collecting packaging waste, biowaste and waste paper separately. As a result, by 1995 Germany already recycled a relatively large proportion of municipal waste and landfilled approximately 40 %.

## 7.2 Waste policy objectives

German waste policy follows the EU's waste hierarchy, with prevention as the first priority, followed by material recovery and energy

recovery, depending on which is better for the environment. Objectives for managing municipal waste also focus on avoiding contamination of waste and ensuring treatment and landfilling of waste that is not recovered.

The two main biodegradable municipal waste fractions are paper waste (including packaging paper and cardboard) and biowaste from households and municipal services. The strategy for reducing biodegradable waste going to landfills comprises collecting both fractions separately; recovering paper waste; composting or anaerobic biological treatment of biowaste; and limiting the organic content of landfilled waste.

In 1999, the German government committed itself to recovering all municipal waste completely by 2020, so that landfilling of municipal waste and waste treatment residues will not longer be necessary. This is an ambitious objective and includes, for example, recovering waste incineration residues and further developing treatment technologies such as sorting and MBT.

Except for recycling targets for packaging waste, very few quantitative targets have been set at federal levels. Those that exist generally apply to



paper and cardboard. In addition to the targets of the 2004 Packaging Directive, the paper industry has committed itself to recycle around 80 % of waste paper in a voluntary agreement.

### 7.3 Institutional context

Germany is a federal republic made up of sixteen federal states (Bundesländer). Responsibility for waste management and environmental protection is shared between the national government, the federal states and the local authorities.

The national Ministry of Environment sets priorities, participates in the enactment of laws and oversees strategic planning, information and public relations and defines requirements for waste facilities. Each federal state adopts its own waste management act containing supplementary regulations to the national law, e.g. concerning regional waste management concepts and rules on requirements for disposal. There is no national waste management planning in Germany. Instead, each federal state develops a waste management plan for its area.

According to the producer responsibility principle, which is a core tenet of German waste legislation, the producer of a product generally still has responsibility for the product when it becomes waste. However, this principle has been specified only for some product types such as packaging and waste electric and electronic equipment. For waste generated by households, the Recycling Management and Waste Act assigns responsibility to the local public waste disposal authorities (in most federal states these are the districts and towns). Their responsibility covers collecting and transporting waste, measures to promote waste prevention and recovery, and planning, constructing and operating waste disposal facilities. Municipalities have more practical tasks such as providing sites for waste collection.

### 7.4 Policy instruments

#### 7.4.1 Organic content of waste sent to landfill

One of the key means of diverting waste from landfills is limiting the organic content of landfilled waste. A landfill ban was introduced to achieve this goal. It was introduced in two steps and using three pieces of legislation because the initial statute contained severe loopholes.

The first step was an administrative regulation (TASi) in 1993, which limited the organic content in waste going to landfills to less than 3 % total organic carbon (TOC). Achieving such a low organic content necessitated thermal treatment of the waste. In the debate on the regulation, the most controversial issue was whether biological treatment processes could also be appropriate pre-treatment methods before landfilling. The debate concluded that incineration should be the only pre-treatment method but it was agreed to extend the transition period from 8 to 12 years so the final deadline would be 1 June 2005. The aim was to allow enough time to establish treatment capacity especially in the federal states formerly situated in East Germany. Moreover, it was agreed to permit exemptions in exceptional cases to allow some flexibility. Finally, the Bundesrat (the body at which the federal states are represented) called on the Ministry of Environment to define the criteria for environmentally sound landfilling of residues from mechanical-biological treatment.

Some federal states then expanded their incineration capacity to meet the provisions of the TASi, whereas others invested in MBT as the main pre-treatment method and made use of extensive exemptions from the provisions.

A research programme was set up to investigate MBT as an appropriate pre-treatment method before landfilling and it was concluded that in principle, thermal treatment of municipal waste should be applied to municipal waste, but that MBT might be used as an alternative disposal route provided certain additional criteria were met.

The national government therefore enacted two ordinances in 2001 and 2002: the Waste Landfilling Ordinance aimed to close the loopholes in the 1993 administrative regulation and the Ordinance on Landfills and Long-term Storage transposed the technical parts of the Landfill Directive that were not already implemented in German legislation. The Ordinance on Landfills and Long-term Storage fixed the transition period to 1 June 2005 and allowed landfilling residues of MBT with an organic content above 3 %. In addition, strict technical standards for MBT were introduced, resulting in treatment costs similar to incineration. As a supporting measure, an amendment of the Recycling Management and Waste Act introduced a simplified permit procedure for waste treatment facilities other than landfills in order to enable federal states to establish pre-treatment capacity faster.

### 7.4.2 Separate collection of paper and biowaste

Separate collection of biowaste and paper is also regulated mainly through legislative measures. In 1983 the Federal State of Hesse initiated separate collection of biowaste to divert waste from landfill. Between 1985 and 1993 the number of inhabitants with a collection system for biowaste increased from 400 000 to 7.6 million. Intervention at national level came in 1993 with TASI, which requires the competent waste authorities to set up separate collection schemes for biowaste from households and garden waste from public parks.

According to the Commercial Waste Ordinance, biodegradable waste, as well as other secondary raw materials (e.g. paper) from commercial activities, has to be separated at source and recovered.

Packaging waste is regulated by the Packaging Ordinance (1991), which introduced producer responsibility. In this case, that implies that producers and retailers are obliged to take back used packages and to contribute to their further management. The implementation of this ordinance led to the 'Green dot' system.

In Germany, waste collection charges on households have to cover the full cost of collection and management of waste. Such tariffs vary between municipalities, depending on the waste management situation and the service offered to citizens.

## 7.5 Observations on effectiveness

### 7.5.1 Organic content of landfilled waste

The implementation of the TASI was inadequate for a number of reasons. First, administrative regulations are targeted only at competent authorities and not at bodies outside the administration. Second, the competent authorities in federal states made wide use of permitted exemptions from the landfill ban, which were supposed to be used only in exceptional cases. Finally, the regulation had allowed for a long transition period and by using the exemption rule, the competent authorities even managed to extend the transition period. These loopholes meant that the legislation was legally in place but not fully implemented in practice.

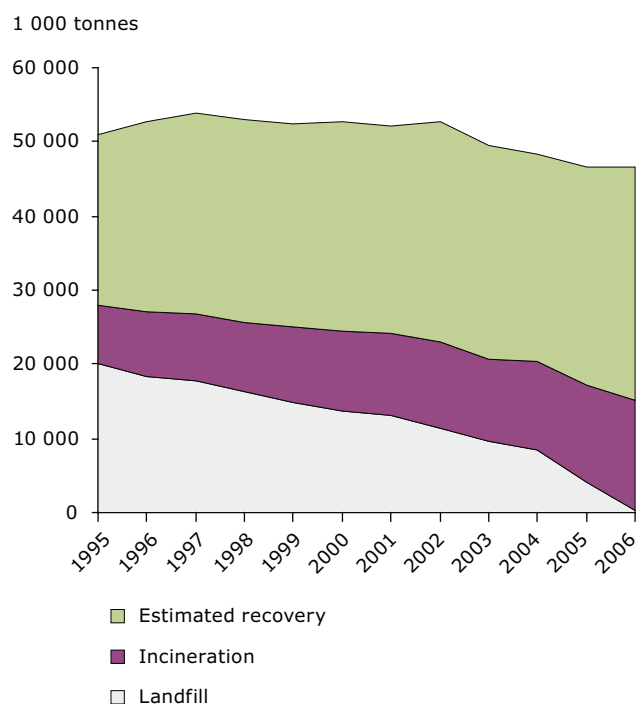
The Waste Landfilling Ordinance (2001) closed these loopholes and allowed MBT as a

pre-treatment method before landfilling. A waste disposal authority in Rhineland-Palatinate challenged the Waste Landfilling Ordinance because it judged its provisions to be too strict in comparison to the Landfill Directive. The German court considering the case sought the opinion of the European Court of Justice (ECJ) on the matter. The ECJ decided that the Ordinance was in compliance with the EU Landfill Directive and that stricter rules could be applied.

Opposition to the acceptance of MBT as a valid pre-treatment method also came from some of the federal states that had complied with the provisions of the TASI and relied only on thermal pre-treatment.

As Figure 7.1 clearly shows, landfilling of (untreated) municipal waste has almost ceased, with only 1 % landfilled in 2006. After its acceptance, MBT capacity has increased from 2 million tonnes in 2000 to nearly 5 million tonnes in 2005. The residues of MBT treatment are different waste fractions, which are then recycled, incinerated or landfilled.

**Figure 7.1 Management of municipal waste in Germany**



**Note:** Recovery is estimated as municipal waste generation minus municipal waste landfilled and incinerated. Recovery therefore includes MBT.

**Source:** Calculated on the basis of Eurostat Structural Indicators.

Commercial waste and residues of waste treatment facilities (sorting plants, MBT plants) also have to be pre-treated before landfilling if they do not comply with the minimum requirements. This has led to a bottleneck of treatment capacity, which has been solved partly through intermediate storage of waste. After a given period of time the waste has to be removed from the storage and treated according to the legal requirements.

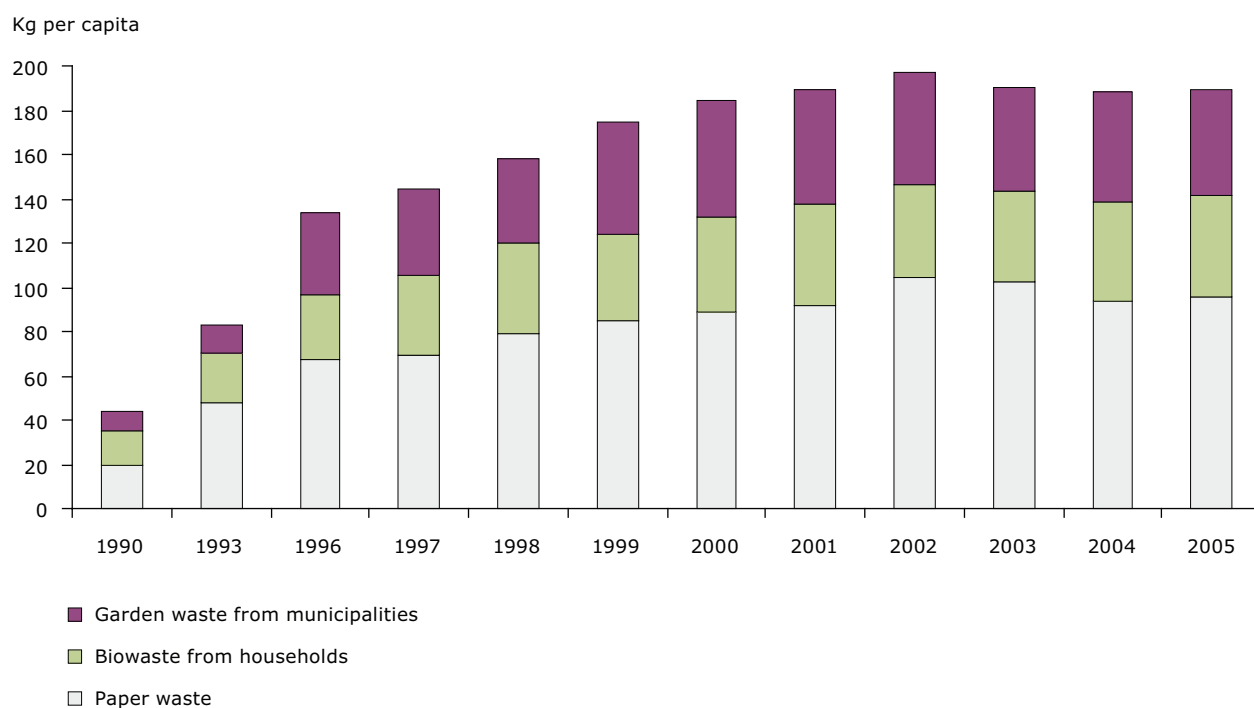
### 7.5.2 Separate collection of paper and biowaste

Separate collection of biodegradable waste has realised a considerable decrease in biodegradable

waste in the residual waste stream. Separately collected paper waste and biowaste show almost the same development: a strong increase from 1990 to 2000, when quantities quadrupled from 2 to 8 million tonnes. Since then saturation has led to relatively stable quantities being collected.

In 2005 around 190 kilograms of biodegradable waste was collected per person, including waste from public parks. Paper is the largest waste stream and it increased from 20 to 96 kilograms per capita between 1990 and 2005. In the same period, the collection of biowaste from households rose by 30 kilograms per capita to 46 kilograms per capita (Figure 7.2).

**Figure 7.2 Separate collection of biodegradable waste fractions in Germany**



**Source:** ETC/RWM (2008d), Biowaste: DESTATIS. Paper: Gallenkemper (1994) for 1990, Bilitewski (2003) for 1997, Destatis 1996–2005 for 1999–2005, all other years are interpolated).

## 8 Hungary

### Box 8.1 Main elements and effectiveness of the Hungarian strategy

- The National Waste Management Plan 2003–2008 sets targets on reducing BMW going to landfill in line with the Landfill Directive, as well as recovery targets for municipal waste. It sets the goal of stabilising municipal waste generated in 2008 at the level in 2000 and provides that municipal waste should not increase by more than half the rate of real GDP growth.
- The Hungarian waste strategy has focused on building capacity and setting up schemes for separate collection, mainly for packaging waste. Recycling is incentivised using charges on products including packaging and advertising material. The product charge system primarily aims to meet recycling targets: the charge is returned to the producer or importer if targets are met. Schemes for collecting biowaste are at an early stage.
- Hungary's landfill rate has remained fairly constant at around 80 % of municipal waste. This is partly due to the fact that improvements in material recovery and mechanical-biological treatment capacities were counterbalanced by temporarily reduced incineration capacity while the single incinerator was rebuilt over several years.
- In order to meet the targets of the Landfill Directive there is a need for additional waste treatment capacity. This is complicated by the generally negative public attitude towards new waste incineration plants and waste-derived products such as compost. The waste strategy therefore also includes mechanical-biological treatment and co-incineration of RDF in existing power-plants.

### 8.1 Waste management situation

Before 1989, municipal waste management was not subject to extensive regulation and focused only on hazardous wastes and collection of municipal waste from households. All municipalities operated one or more landfill sites that were basically waste dumps.

The dominant form of waste management was, and still is, landfilling. According to data from the Ministry of Environment and Water, Hungary landfilled 85 % of its municipal waste in 2004 (Figure 8.1). Recent data published by Eurostat shows that landfilling of municipal waste has decreased to 77 % in 2007 (Eurostat, 2009).

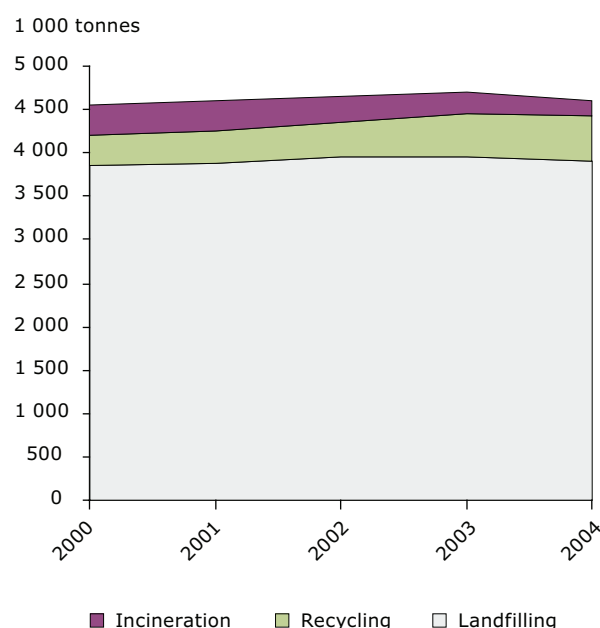
### 8.2 Waste policy objectives

The Waste Management Act (2000) defines the principles and aims of Hungarian waste policy and prescribes that a national waste management plan be developed. The first National

Waste Management Plan (2003–2008) included the Landfill Directive's targets for reducing landfilling of biodegradable municipal waste but the deadlines were originally set two years before those in the directive. When the Waste Management Act was revised in 2007, the targets were transferred to the Act. It was decided, however, to postpone the last two targets to 2009 and 2016 as in the directive. The Act provides that the targets should be met both at local and regional levels.

The National Waste Management Plan also aims to achieve 40 % material or energy recovery of municipal waste by the end of 2008. By 2012, the target is raised to 50 %. As for waste prevention, by the end of 2008 the total amount of waste generated should not exceed the level in 2000. In addition, growth in municipal waste should not exceed 50 % of the growth rate of real GDP.

A government ordinance from 2002 implements the Packaging Directive's targets. Hungary will have to recycle 50 % of packaging waste by 2005

**Figure 8.1 Management of municipal waste in Hungary**

**Note:** The only Hungarian municipal waste incinerator was being rebuilt between December 2002 and December 2005. Since then its capacity has been increased to 420 000 tonnes per year.

**Source:** Hungarian Ministry of Environment and Water, 2004.

and 55 % by 2012. The ordinance is supported by product charges levied on packaging (Section 8.4).

In order to meet the targets, it will be necessary to establish further treatment capacities, including extending the network of existing composting and MBT plants, waste incinerators and waste sorting facilities.

### 8.3 Institutional context

Hungarian environmental policy, including waste management policy, has very strong top-down characteristics. As a result, regulation at regional and local levels has to comply with the national policy.

Hungary set up its Ministry of Environment and Water in 1989 and then started gradually to implement waste management policies, primarily in order to approximate its practice to EU standards and the *acquis communautaire*. Hungary became an EU Member State in 2004. The Ministry of Environment and Water prepares the legislative framework for waste management and draws up the National Waste Management

Plan. The plan is defined in line with the planning periods of the National Environmental Programmes which describe the measures and monitoring necessary to achieve the Hungarian environmental targets. The Ministry issues permits for waste management activities affecting the whole territory of the country.

The regional Inspectorates for Environmental Protection, Nature Conservation and Water Management are responsible for developing regional plans. Inspectorates also review the harmonisation of waste management plans of counties, local authorities and enterprises.

Local authorities are responsible for organising waste management and for drawing up local waste management plans in accordance with the national and regional plans, and spatial planning plans. The regional Inspectorates issue permits with respect to all waste management issues; they also control the plans of local municipalities and approve individual waste management plans. Waste management companies have been established to carry out the collection and treatment of waste and they are usually co-owned by municipalities (so-called 'associations of municipalities for common waste treatment facilities') and private companies.

### 8.4 Policy instruments

A general campaign was launched in 2001 to extend the network of separate waste collection systems gradually. The purpose was to increase the rate of recycling by enhancing access to these free of charge facilities. Metal, plastic, paper, glass waste and (only at waste yards) hazardous waste, such as batteries, are collected via bring systems (a system requiring citizens to bring separately collected waste fractions to public collection points) and civic recycling centres. BMW, mainly garden waste, is usually collected by the waste service provider or via seasonal collections by the municipality (usually in the autumn and spring). The Waste Management Act also requires that by 2005 at least 40 % of the population should have access to separate collection of packaging materials, rising to 60 % by 2009 and 80 % by the end of 2013.

An eco-taxation system of product charges has been in operation since 1995. A product charge is levied on certain products that have an impact on the environment, such as packaging materials including beverage packaging for commercial use,

advertisement brochures and tyres. If a producer or importer meets the recycling or recovery targets, charges are returned. In practice, therefore, the product charge aims to ensure that recycling targets are met. The charge must be paid by the producer (or importer), and can be passed on to the consumers. Exemptions or discounts apply in the case of eco-labelled products. The Ministry of Environment and Water collects a share of the revenue from the charge and earmarks it for waste recovery and other environmental projects.

Since 2003, landfilling of organic wastes has been partially banned. The amount permitted is gradually reducing in line with the interim targets for BMW.

The National Biowaste Programme 2005 includes initiatives for extending separate collection to include garden waste, green waste from public parks, organic kitchen waste and paper by 2008. Other initiatives in the Programme include establishing treatment capacity for BMW and better communication to facilitate wider uptake of separate waste collection.

## 8.5 Observations on effectiveness

According to the Waste Management Act, waste management costs should be based on the polluter pays principle and thus paid by the waste producer. Despite this, charging users of waste collection and treatment services is politically sensitive. In the past, the service was provided by the state, usually free of charge, making people unaware of the actual costs and environmental impacts of their waste production. Many municipalities are not charging residents directly for waste management costs but cover the costs from local taxes. 'Pay-as-you-throw' schemes are only used in a few towns and regions, typically in recreation areas, where the amount of waste generated is higher at weekends or certain seasons.

State officials and non-governmental organisations (NGOs) acknowledge that a dramatic increase in user charges could lead to an increase in illegal waste dumping, despite growing environmental awareness. One option to finance the additional costs of separate collection could be to introduce a producer responsibility system to cover wastes other than packaging.

State and local municipalities only partly provide the financial resources for setting up waste management facilities. Modernisation is extremely

dependent on EU structural funds, however, which cover a significant share of project costs – generally 50 % but up to 85 %. The current 17 regional waste management system projects being planned or installed are estimated to cost EUR 680 million.

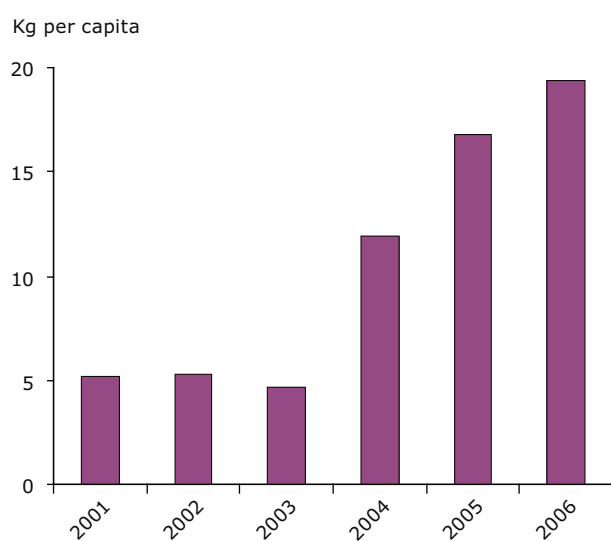
Hungary is close to meeting the 15 % material recycling targets of the Packaging Directive. The 50 % recovery rate target was met for packaging waste in 2005. Of the total amount of packaging placed on the market, 47 % was recycled and 3.4 % incinerated with energy recovery. Access to separate collection facilities was ensured for 50 % of the population in 2006 and further extension of the system is expected until 2012. Hungarians have warmly welcomed the separate collection systems which are often free of charge. Frequently, residents demand that municipalities extend the separate collection service area or increase the capacity of separate waste collection facilities.

Several stakeholders, for example the Ministry of Environment and Water, environmental NGOs and municipalities, have conducted awareness raising campaigns in recent years. These aimed to promote responsible consumption and home composting and may have helped stabilise the amount of waste generated. The intensity of awareness raising campaigns is expected to be enhanced and financed by the Hungarian Environment and Energy Operative Programme from 2007–2013.

Home composting of organic waste is gradually improving and gets more and more popular due to official and NGO-initiated awareness raising campaigns. It is estimated that home composting was around 80 000 tonne (or 8 kilograms per capita) at the end of 2004. The amount of BMW composted at composting plants (on new landfills) is increasing but no figures are yet available to quantify this. The use of compost as fertiliser is challenged by public aversion to waste-derived products.

Separate collection of BMW fractions increased to 20 kg per capita in 2006 (Figure 8.2). The Ministry for Environment and Water expects that separate collection of BMW compounds alone will not achieve the necessary level of diversion of BMW from landfill, although NGOs have disputed this. Presumably, the Ministry will favour extension of incineration (of residues from MBT) capacities instead of composting. Consequently, the main objective is to start co-incineration of MBT residuals at two or three power plants. According to current plans, these facilities will co-incinerate

**Figure 8.2 Separate collection of biodegradable waste in Hungary**



**Source:** ETC/RWM, 2008e and Hungarian Ministry of Environment and Water, 2005.

only fuel derived from MBT and not incinerate unsorted municipal waste.

Identifying appropriate sites for new landfills or waste incinerators is often complicated by local opposition. A draft version of the National Waste Management Plan included a proposal for starting six regional municipal waste incinerators but this was blocked due to the extreme resistance of the public during the consultation processes.

Associations of municipalities often overlap territorially with the planning regions of the National Waste Management Plan. Because the practical implementation of municipal activities differs from the regional planning, this sometimes results in a confusion of institutional responsibilities. Regional Development Councils, which are responsible for regional infrastructural planning in line with the requirements of EU funds, lack professionals and are in need of professional capacity building in order to coordinate the new regional projects better.

## 9 Italy

### Box 9.1 Main elements and effectiveness of the Italian strategy

- The National Strategy for Biodegradable Waste defines targets for landfilling biodegradable municipal waste in kilograms per capita as well as targets for collecting municipal waste separately.
- Based on the Strategy, Italy's regions have developed programmes defining the instruments to use to divert waste from landfills. Separate collection, especially of biodegradable fractions of municipal waste but also of packaging waste, plays a major role. Whereas the programmes of the northern regions focus more on composting and incineration, the southern regions use more mechanical-biological treatment.
- Every 'optimal management area' (or province) has to meet a set of national targets for landfilling biodegradable municipal waste. These targets have been defined in kilograms per inhabitant in order to improve monitoring at the local level.
- Italy has steadily reduced landfilling of municipal waste so that about half was diverted in 2006. There is, however, a considerable difference between the performance of the northern regions and the southern and central regions.

### 9.1 Waste management situation

Italy has traditionally landfilled most of its waste and although schemes for recovering materials such as wood and paper have been rooted in society, Italy still landfilled 82 % of its BMW in 1995 (Figure 9.1). Although Italy could have got a derogation period from the Landfill Directive's targets on landfilling BMW it decided not to do so. BMW generation increased by 20 % in the 10 years until 2005, which makes it more difficult to meet the Landfill Directive targets, as they are based on the reference year 1995. The increase may partly result from economic growth and improved waste statistics.

Italy has steadily increased its separate collection of biodegradable waste fractions. The largest fractions collected are paper, and food and garden waste. There are, however, large differences in the separate collection between northern, central and southern Italy.

### 9.2 Waste policy objectives

Instead of transposing the percentage-based targets set out in the Landfill Directive, Italy adopted targets

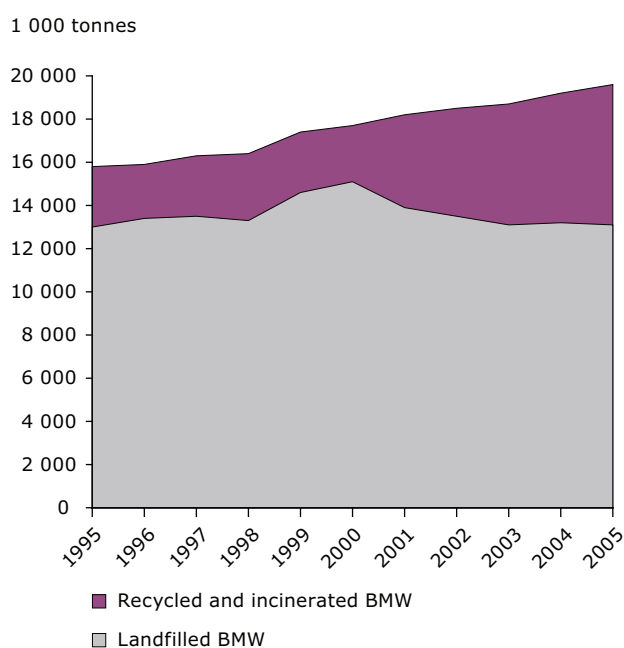
based on the quantity (kilograms) of BMW produced per capita. That decision was based on two core reasons: the lack of reliable data on the quantity of biodegradable municipal waste landfilled in 1995 and the need to implement improved monitoring at the local level. Moreover, every province is supposed to meet these targets and the per capita targets aim to ensure even implementation throughout the country. Targets have been defined for 2008, 2011 and 2018. Italy transposed the Landfill Directive into national law in January 2003, i.e. 18 months after the deadline. As such the targets follow the intervals of the directive with a delay of two years.

Italy also set targets for collecting municipal waste separately. The first set of targets were agreed in 1997 and aimed at 35 % separate collection by 2003. The targets were ambitious in the light of the fact that separate collection at the time was only 10 %. Even though Italy had not yet met the 2003 target, a second set of targets was set in 2006, aiming at a progressive improvement in the separate collection rate, from 40 % in 2007 to 65 % in 2012.

Targets on recycling packaging waste were first introduced in 1997 and then updated in 2006 concurrent with the targets on separate collection.



**Figure 9.1 Management of biodegradable municipal waste 1995–2005**



Source: ETC/RWM, 2008f; and APAT, 2007.

These packaging recycling targets are the same as those in the revised Packaging Directive, except for those relating to plastic and wood, which have higher values than the ones set in the directive. The Italian legislation provides for targets of 26 % for plastic and 35 % for wood, rather than the 22.5 % and 15 % respectively stipulated in the directive.

### 9.3 Institutional context

Italy has four administrative levels: national, regional, provincial and municipal. Each has responsibilities for waste management. The Ministry of Environment outlines the overall waste management strategy by establishing the legislative framework, setting targets at national level and drawing up the National Waste Management Plan. The regions prepare regional waste management plans based on criteria defined in the national legislation and the provinces develop waste management plans in conformity with the regional plans.

The regions issue regulations in compliance with the national legislation and define the 'optimal areas for the management of waste' (ATOs) that are responsible for meeting the targets on landfilling BMW and separate collection of municipal waste. The ATOs are supposed to represent a geographical entity where waste management is

economically feasible and generally correspond to province boundaries. Other countries have a similar approach of joining forces but there it is usually the municipalities themselves who decide if and with whom they cooperate. Every region must also formulate a plan for reducing landfilling of biodegradable waste. The regions define the waste streams to be collected separately and issue permits on constructing new treatment capacity and upgrading existing plants.

The provinces coordinate the municipalities' waste management and identify instruments for separate collection, enhancing implementation of the regional waste management plan. Municipalities are in charge of municipal waste collection and disposal and collect charges for managing waste.

### 9.4 Policy instruments

The framework for waste policy instruments is often introduced at national level leaving the actual implementation of practical measures to the lower levels of administration.

The charge for waste collection and management is based on households' floor space per capita in the vast majority of municipalities. To provide an incentive to prevent waste and increase recycling, some municipalities are developing a new system wherein the waste collection charge also depends on the amount of waste generated per person in the household. The coverage of costs has improved in recent years, with the charge now covering around 90 % of waste management costs.

Italy introduced a landfill tax in 1996. The national regulation defines the upper and lower level of the tax but the regions determine the precise level within these limits. The regions also decide the destination of the tax revenues. The tax has an environmental dimension as regions can spend up to 20 % of the revenue on improving the waste management system, financing regional environmental protection agencies or protecting natural areas.

In 2003, the national Parliament announced that it would introduce a landfill ban for waste with a calorific value exceeding 13 megajoules per tonne but the ban was not enacted until 2006 and took effect in December 2008.

Some Mediterranean soils are undersupplied with organic matter and others are at risk of desertification. Compost can help restore the

organic content and for this reason many regions have introduced individual measures to promote soil restoration of farming areas using organic soil improvers. For instance, the Emilia-Romagna region provides farmers with subsidies of EUR 150–180 per hectare to promote the use of compost. The Italian Composting Association has developed a quality assurance system and label to guarantee good compost quality and some regions have introduced a regional quality label for compost.

The main composted waste fractions originate from domestic food wastes, green wastes from gardens and parks, agro-industry wastes and sewage sludge. The quality of compost that can be sold as a product is prescribed by legislation (legislative decree 217 of 2006), which defines the different typologies of compost, setting precise agronomical parameters, microbiological standards and pollutants limit values. Compost can also be used for organic agriculture if it meets specific standards.

The output of composting plants is primarily marketed:

- by sale via the floriculture sector (mainly mixed with peat and then sold to the public in supermarkets);
- by direct sale to the public (currently only in small quantities);
- by sale to agricultural businesses to cultivate open-field crops.

In order to help develop a market for recycled products, green public procurement regulation requires public bodies and companies to buy goods made of recycled materials to meet at least 30 % of their annual demand.

## 9.5 Observations on effectiveness

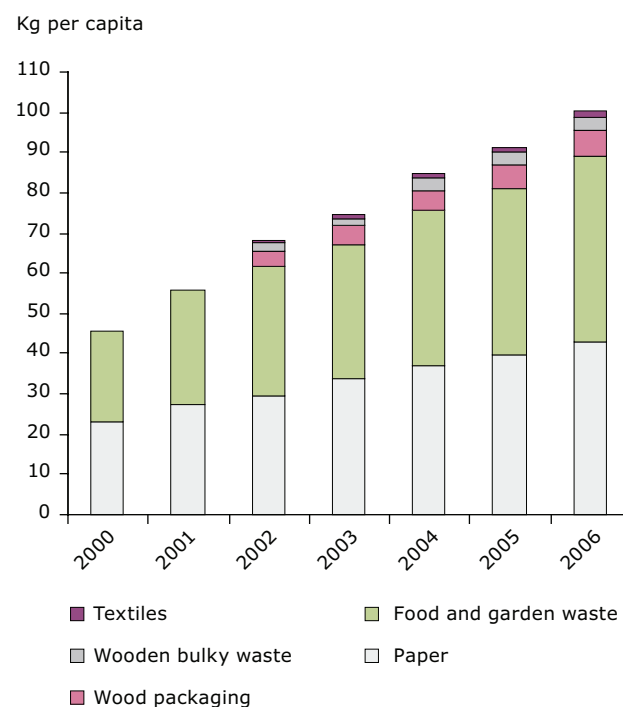
Most of Italy's regions are still far from achieving the 2008 target on diverting biodegradable waste from landfill, particularly in southern and central Italy. Six of the twenty regions have met the 2008 target, and the Lombardy region has already reached the 2018 target and landfills less than 81 kilograms per capita. As about half of the population lives in northern Italy (producing half of the waste generated), the 2008 target has almost been achieved at national level.

Figure 9.2 illustrates that there has been a slow but steady increase in separate collection of

biodegradable fractions of municipal waste since 2000. In the first six years of the decade separate collection doubled to 100 kilograms per capita. The largest fractions collected are paper, and food and garden waste. Still, Figure 9.3 shows that although all three parts of Italy have increased their separate collection, the difference between the north and the two other areas is remarkable. Separate collection was 40 % in the north in 2006, against 10 % in the south and 20 % in central Italy. Moreover, it seems that growth in separate collection has levelled off in the south and centre since 2003.

When comparing the actual development in separate collection with the targets, it appears that the targets were set according to the capacities of the northern regions rather than for the whole country. This is particularly the case for the second set of targets from 2006. Even though Italy had not yet met its 2003 target of 35 % separate collection, policy-makers decided to set more ambitious targets for 2007 that only the northern regions could realistically achieve. In general, kerbside or door-to-door separate collection provided the best results both in terms of amounts collected and the quality of the collected streams.

**Figure 9.2 Separate collection of biodegradable waste in Italy**



**Note:** Figures for the collection of textiles, wooden bulky waste and wood packaging are not available for 2000 and 2001.

**Source:** APAT, 2007; and ISTAT, 2007.

The regions have chosen different strategies to divert municipal waste from landfills. Composting and incineration are more common in the northern regions due to the development and the adoption of integrated waste management strategies. In southern regions efforts have been channelled into building MBT plants and producing Refuse-Derived Fuel in order to overcome dependency on landfill.

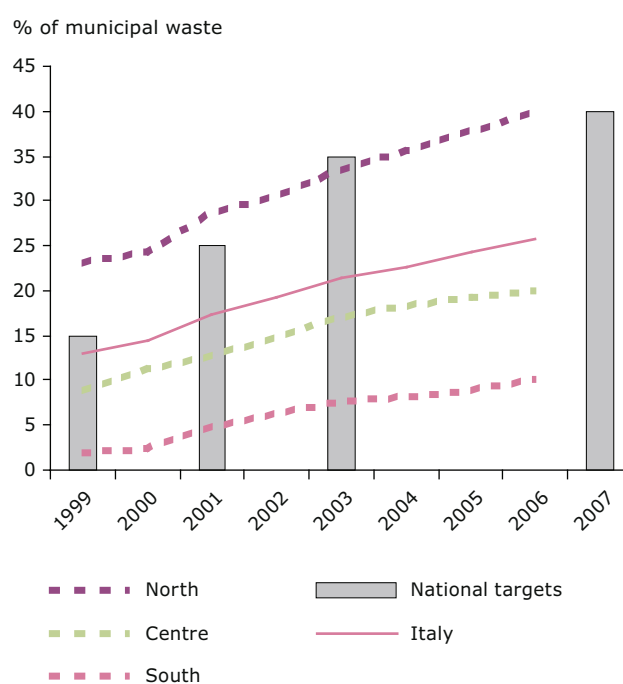
The public has been very critical of the waste management sector, partly because of negative experiences with some old technologies used at certain waste management plants. In some regions investments in new incineration capacity are being planned with little opposition from local people whereas there is strong public opposition to new plants in other regions as illustrated by the case of Naples, where municipal waste mounted up in the streets in 2008. It is therefore very important to adopt strategies (particularly public information campaigns) to create constructive relationships with the public. Public acceptance may also increase following the adoption of national guidelines on best available techniques for waste incineration in 2007.

Implementation of the Packaging Directive has played an important role because it was among the first regulations to introduce separate collection schemes. Italy is close to meeting the Packaging Directive's target of recycling 55 % of packaging in 2008. To manage packaging waste a producer responsibility system for packaging, CONAI, was established in 1997.

The landfill tax has contributed to the diversion of waste from landfill, although the effect may

have been less than hoped because the tax is quite low and may not provide sufficient incentive to choose an alternative to landfilling. Decree 152/2006 foresees an increase of the tax in cases where provinces do not meet the targets on separate collection. There may also be a need to monitor how the revenue from the tax is used to ensure that it realises improvements in the waste management system.

**Figure 9.3 Separate collection of municipal waste in northern, central and southern Italy**



Source: APAT, 2007.

# 10 Comparative assessment and conclusions

This chapter compares the effectiveness of the five countries and one sub-national region in diverting municipal solid waste, particularly BMW, from landfill. The assessment is based on the individual studies outlined in the preceding chapters, combining the indicator-based analysis and interviews with stakeholders described in Chapter 3, and the econometric analysis of EU-25 Member States (ETC/RWM, 2008h).

As outlined below, the analysis reveals that the different circumstances of the five Member States and one region have led to different waste management solutions. In part, this is a result of the flexibility inherent in the Landfill Directive's long-term target (combined with intermediate targets) for reducing the landfill of BMW, which has allowed Member States to try out different options that respond to their particular requirements. Equally, it reflects Member States' need to design waste management systems that build on existing institutional structures and tradition. Viewed together, this suggests that totally harmonising waste management systems across Europe would not be the most appropriate solution.

## 10.1 Impact of EU policy

The Landfill Directive has clearly been a driver for closing landfills and increasing alternative waste management routes such as recycling, composting, mechanical-biological treatment and incineration. But there are clear differences between countries. In Germany and the Flemish Region the diversion of (biodegradable) municipal waste had begun years before the Commission's proposal for a directive in 1997, so the Landfill Directive had less impact here. The directive's impact was greatest in the countries where the process of shifting away from landfilling BMW was not already under way, especially in Estonia, Hungary and Italy where landfilling rates of BMW were at or above 75 % in 1995. For Estonia and Hungary, EU accession in 2004 was the main driver for changing landfill policies and it had a similar effect in Finland in 1995.

The Landfill Directive's targets seem to provide a good framework, allowing countries time to define a strategy and the option to make the most cost-effective investments. It also allows the national governments — and the European Commission — to measure progress and adjust policies if necessary.

The success of the EU measures in guiding policy appears to stem partly from its use of short- and medium-term targets on the way to achieving long-term goals. By contrast, Germany agreed a long-term target in 1993, which banned the landfilling of organic waste 12 years later. Unfortunately, this target seems to have been too distant and as a result some federal states did not maintain it as part of their agenda. More short-term targets might have better retained the attention of both the federal states and the national government.

In the six geographical areas studied, a mixture of regulatory, economic and voluntary instruments was implemented to help fulfil the targets of the Landfill Directive, and in general it appears that a good combination of policy instruments is required to divert waste from landfills effectively. In Finland the measures were initiated a few years before the directive was passed in 1999. In Estonia, Hungary and Italy the majority of the measures were linked to the directive's targets and provisions. Table 10.1 provides an overview of the policy measures implemented.

There is no evidence of the Landfill Directive having prevented waste generation. A previous EEA policy effectiveness study came to a similar conclusion regarding the Packaging Directive's lack of impact on waste production (EEA, 2005a). The conclusion is also supported by the econometric analysis of EU-25 Member States (ETC/RWM, 2008h). That study did reveal a relative decoupling of waste generation from income, however, and confirmed that the Landfill Directive had brought about some diversion of municipal waste from landfill in the European Union.

The Packaging Directive played an important role in raising environmental awareness and introducing

**Table 10.1 Policy measures for managing municipal waste**

	Estonia	Finland	Flemish Region	Germany	Hungary	Italy
User charge for waste collection and management	✓	✓	✓	✓	✓	✓
Environmental product charges					✓	
Landfill tax	✓	✓	✓			✓ (regional)
Incineration tax			✓			
Landfill ban	✓	✓	✓	✓	✓	✓
Separate collection of biowaste	✓	✓	✓	✓	✓	✓ (regional)
Producer responsibility/voluntary agreement for waste paper		✓	✓	✓		
Producer responsibility for packaging waste	✓	✓	✓	✓	✓	✓

separate collection schemes for paper and cardboard, glass, metals, plastics. In some countries, especially Estonia, Hungary and parts of Italy, the introduction of separate collection schemes for biodegradable packaging waste (paper, cardboard and wood packaging) in order to fulfil the Packaging Directive's targets has helped start diverting biodegradable waste away from landfills. This may be because the Packaging Directive was the first directive to introduce obligatory separate collection of selected materials and packaging is a very visible waste stream for citizens.

Several of the countries in this study have met the Landfill Directive's targets on landfilling BMW. The Flemish Region and Germany have already met the 2016 target of landfilling less than 35 % of the amount of BMW generated in 1995. Finland, Hungary and Italy have met the 2006 target of reducing the landfilling of BMW to 75 % of the amount generated in 1995, while Estonia was close to meeting this target in 2005. Bearing in mind that Estonia landfilled more than 80 % of its waste in 1995, it has already made substantial progress.

Unfortunately, the lack of a harmonised method to measure or estimate the amount of biodegradable municipal waste makes it difficult to analyse the effectiveness of EU policy measures. Lack of reliable data also hindered the earlier EEA study on packaging waste policies (EEA, 2005a).

## 10.2 Influence of renewable energy policies

The Directive on the promotion of electricity produced from renewable energy sources (2001/77/EC) sets national indicative targets for the amount of gross electricity consumption to be supplied from renewable sources by 2010. Incineration of biodegradable municipal waste with energy recovery is considered a renewable energy source and the directive may therefore provide an additional incentive to divert biodegradable waste from landfill.

Table 10.2 details renewable energy produced at municipal waste incineration plants.

**Table 10.2 Gross electricity generation from municipal waste in 2004 and 2005, GWh**

	2004	2005	Change 2004–2005 (%)
Finland	304	347	14.1
Belgium	789	850	7.7
Germany	4 232	6 076	43.6
Hungary	52	118	126.9
Italy	2 276	2 619	15.1

Source: International Energy Agency, Statistics, Renewables, 2005.

It shows that in Germany electricity production from municipal waste increased by 44 % from 2004 to 2005. In the same period, waste incineration increased by just 11 %. The reason for the substantial gap between the two figures could be that some incinerators are capable of producing electricity on top of heat if market conditions make it profitable to do so. Hungary's 127 % increase in electricity generation was due to the reopening of the incineration plant in 2005.

### 10.3 Generation of biodegradable municipal waste

Biodegradable substances (biowaste, paper and cardboard, and biodegradable textiles) make up a considerable share of municipal waste – approximately 60–70 % in most countries.

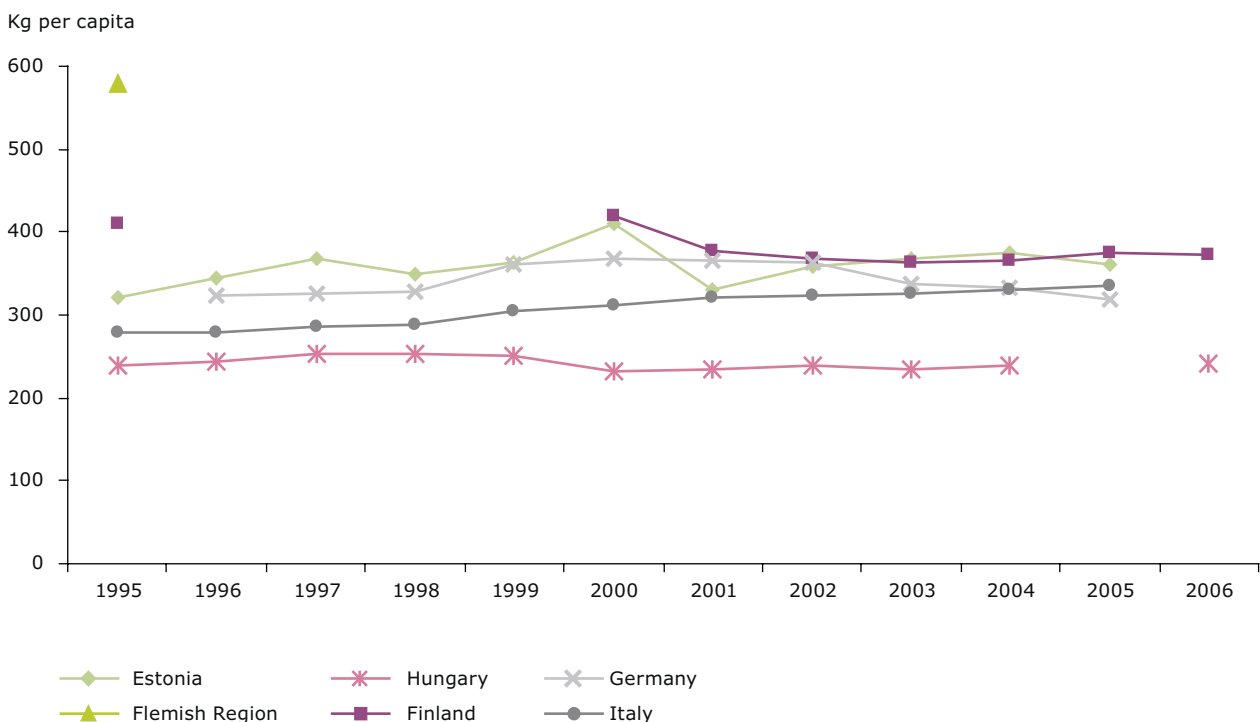
The generation of BMW has been relatively stable over the period 1995–2006 although its production varies between countries and regions (Figure 10.1). Italy experienced an increase in BMW generation of 20 % while Finland saw a decrease of 9 %. An increase in generation of BMW makes it more difficult to reach the diversion targets of the Landfill Directive because the targets are related

to the absolute amount of BMW generated in 1995. The highest generation was in the Flemish Region with 579 kilograms per capita in 1995 but this figure includes biodegradable waste from the food industry and commercial activities corresponding to 375 kilograms per capita. BMW generation in Estonia, Finland, Germany and Italy lies between 320 and 380 kilograms per capita, whereas it is considerably lower in Hungary.

The lack of a harmonised method to measure or estimate the amount of biodegradable municipal waste makes it difficult to compare the data on BMW between different countries. Whereas the amount of separately collected biodegradable waste fractions (mainly biowaste and paper and cardboard waste) can be measured directly, the share of BMW in mixed municipal waste has to be estimated.

The methodology for estimating the generation of BMW, which is derived from the share of BMW in municipal waste, differs across countries. Estonia uses a share of 65 %, Germany 57 %, Italy 62 % and Hungary 52 %. Finland assumes that BMW is 83 % of the total residual, mixed waste. This proportion is much higher than in other Member States. In Finland's case, however, a study by the Helsinki metropolitan area waste company determined that

**Figure 10.1** Generation of biodegradable municipal waste per capita



Source: ETC/RWM, 2008a–f.

BMW accounts for only 69 % of mixed municipal waste in the Helsinki area. A European guideline harmonising the estimation of biodegradable municipal waste amounts would thus facilitate more effective and comparable monitoring of progress towards the Landfill Directive's diversion targets.

#### 10.4 Landfilling of biodegradable municipal waste (Landfill Directive target)

The Flemish Region and Germany have already met the Landfill Directive's 2016 target to landfill not more than 35 % of the amount of BMW generated in 1995. The German landfill ban has clearly proven effective. After the implementation deadline in 2005, BMW landfilled is equivalent to less than 7 % of that generated in 1993 (the reference year for Germany). The Flemish Region's strategy was also very effective: in 2003, BMW equivalent to just 17 % of that generated in 1995 was landfilled. Finland, Hungary and Italy have met the 2006 target of 75 % of 1995 levels but still have some way to go to meet the 2009 target of 50 % (Finland stood at 59 % in 2006; Italy at 67 % in 2005 and Hungary at 75 % in 2006).

Estonia landfilled 60 % of its MSW in 2006. Under the assumption that BMW follows the same management route as municipal waste and that the share of BMW in MSW does not change, Estonia was close to meeting its 2010 Landfill Directive target of reducing landfill of BMW to 75 % of 1995 levels (with the 4-year derogation) in 2005. It was, however, still far from the national target of 45 % also due in 2010. Moreover, the fact that the roughly 20 % of households that lacked access to regular waste collection are rapidly gaining such services may make it more difficult to meet the targets.

Finland has changed its strategy for managing BMW from composting and anaerobic digestion toward a strategy focused on incineration with energy recovery. The situation in Estonia is

evolving in a similar direction; the Estonian government expects that the Landfill Directive targets will not be met without introducing incineration. However, this has not been reflected in policy documents yet.

Table 10.3 shows the development of the diversion indicator (BMW landfilled as percentage of the BMW generated in 1995) for the five countries and one region of this study.

#### 10.5 Treatment capacity

##### 10.5.1 Landfill

Closing outdated landfills is an important driver for adopting new waste treatment options. Over the last 10–15 years the number of landfills in the five countries and one region has decreased markedly. Most of the closures have been dumpsites or other low standard sites. Information on the actual landfill capacity is not available but it seems fair to conclude that capacity has decreased. Despite this, data on current waste generation and landfill rates for municipal waste indicate that the remaining capacity at landfills is sufficient for many years to come.

Diverting waste from landfill depends on the cost and feasibility of alternatives. The appropriate role of dedicated incineration is a matter of public debate in some countries, notably Germany, Hungary and Italy. Federal states and regions that objected to dedicated incineration have, however, accepted the use of MBT with residues co-incinerated in cement kilns and power stations. Composting capacity seems to play an important role in diverting BMW from landfill both in countries where incineration is widely welcomed and those where it is not.

After 16 July 2009, all existing landfills must comply with the provisions of the Landfill Directive. Member States are obliged to close down all landfill sites that do not obtain a permit to operate after that date. As a result, many existing landfills have

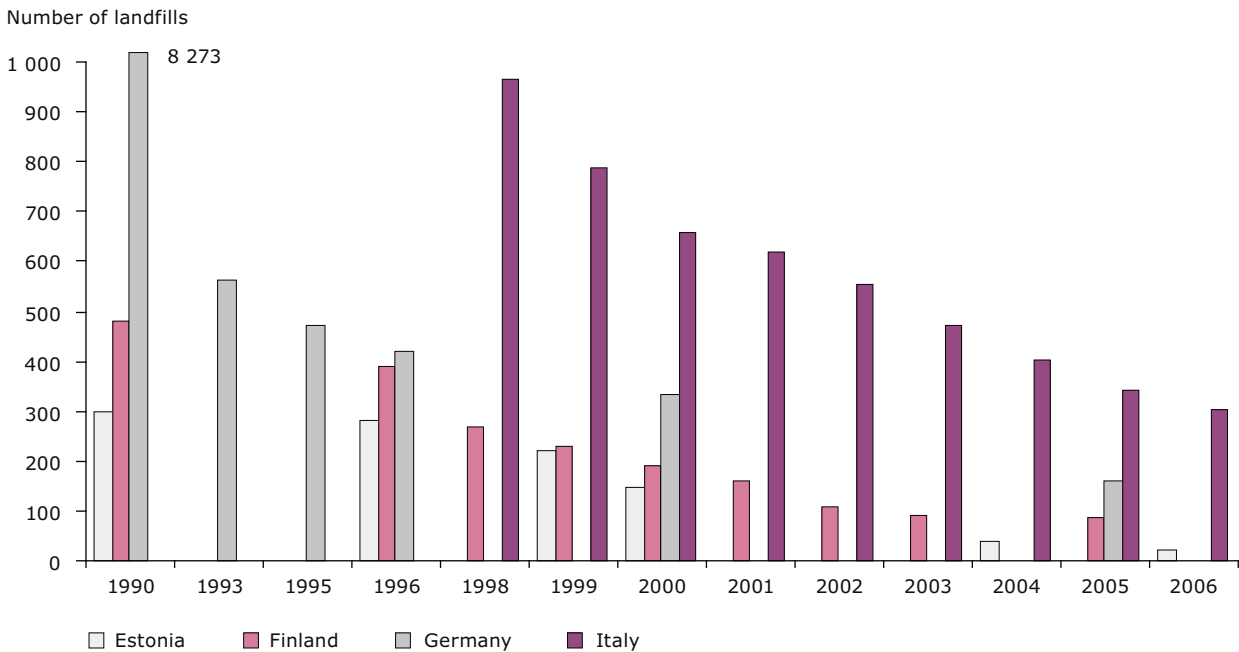
**Table 10.3 Biodegradable municipal waste (BMW) landfilled as a percentage of BMW generated in 1995**

	Estonia	Finland	Flemish Region	Germany	Hungary	Italy
1995	100 %	65 %	29 %	27 % (1999)	75 %	82 %
2005/2006 (latest available data)	77 %	59 %	17 % (2003)	7 %	75 %	67 %

**Note:** In some countries BMW is estimated as a constant share of municipal waste: Estonia 65 %; Hungary 52 %; Italy 62 %.

**Source:** ETC/RWM, 2008a–f.

**Figure 10.2 Development in the number of landfills for non-hazardous municipal waste in four EU Member States**



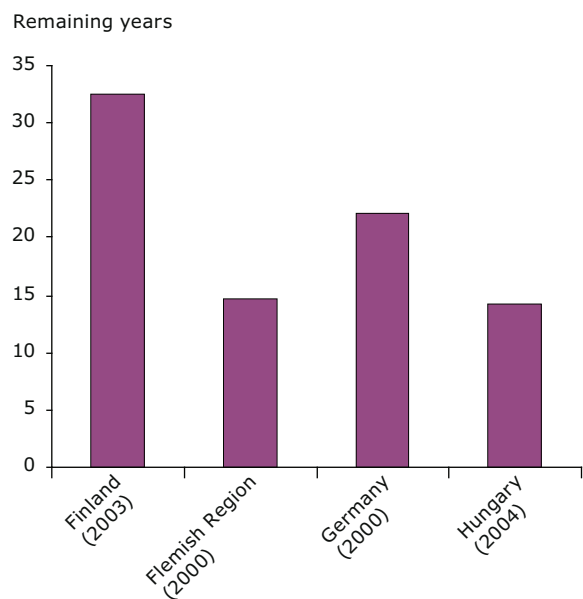
Source: ETC/RWM, 2008a, b, d, f.

already been closed and more sites will follow. Many of these sites were of poor standard and some were even illegal dumpsites. In several countries, however, this trend had already started before the adoption of the Landfill Directive. It is likely that the Landfill Directive will lead to fewer but larger landfills in the future.

The development in the number of landfills in Estonia, Finland, Germany and Italy is shown in Figure 10.2. Germany started closing landfills in western Germany in the 1970s and, after the reunification, in eastern Germany in the early 1990s. In Finland it seems that the EU accession in 1995 and the enactment of the Landfill Directive accelerated the process. The same is true for Estonia where the process started slightly later. In both Italy and Estonia the closure of landfills has been relatively swift.

If we compare countries according to the number of landfills per inhabitant, Estonia and to a lesser degree Finland have many more landfills than Germany and Italy. However, the total area of Germany and Finland is almost the same, so the convenience of having a landfill nearby has played a role in Finland. Where population density is very low, particularly in the northern part of Finland, closure of local landfills would result in higher transport costs and higher associated emissions. Italy has mainly closed landfills

**Figure 10.3 Landfill capacity for municipal waste: remaining years at current landfill rate**



Note: The graph shows how many years the country/region can continue to landfill municipal waste if the share of waste landfilled remains the same as in the year shown in brackets.

Source: ETC/RWM, 2008b, c, d, e.



in the southern regions where there are still a large number.

The number of landfills is not an adequate measure of residual landfill capacity as this depends on a series of factors including the size of the landfills, the height to which waste is disposed of and the density of collected waste. Unfortunately, information about residual capacity is scarce because the waste sector is undergoing major changes, with landfill sites being closed or upgraded to comply with the Landfill Directive.

Based on the available data on residual capacity, Figure 10.3 shows the number of years that a country or region can continue to landfill municipal waste at its current rate in accordance with the Landfill Directive's technical requirements. By these terms, the remaining capacity in Finland is 32 years. In Germany it is 22 years while it is around 15 years in Hungary and the Flemish Region.

### 10.5.2 Incineration

Incineration capacity has increased in Germany and the Flemish Region to around 35 % of municipal waste generated. This is significantly more than in Finland (less than 3 %), Hungary (9 %) and Italy (16 %). It implies that a considerable part of waste diversion from landfills in Germany and the Flemish Region is due to waste incineration (Figure 10.4).

In order to reduce the environmental impacts of waste incineration and improve the image of waste incinerators, Germany adopted an ordinance in 1991 that set high technical standards for waste incineration facilities. In parallel, rules on organic content in waste going to landfills were introduced in 1993 and formulated in such a way that the limits could only be achieved using waste incineration. This led to a 70 % increase in the incineration capacity from 1990 to 2005.

Waste incineration in the Flemish Region had a similar image problem in the 1970s and 1980s when emission levels were much higher. A public campaign was launched to promote incineration in parallel with modernizing incinerators and putting stricter emission limits in place.

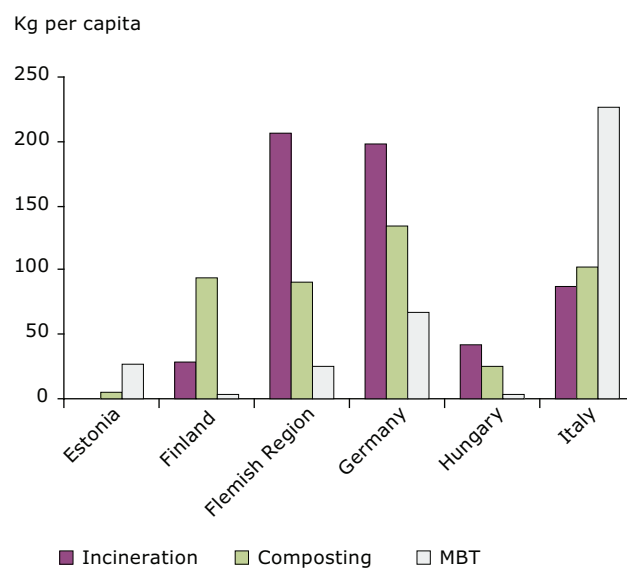
Estonia and Finland are now planning to make greater use of incineration with energy recovery. Both countries are situated in colder parts of Europe but whereas Estonia is seeking to reduce the use of oil shale for energy generation, Finland sees an opportunity to connect new waste incinerators to

paper mills with stable energy demand throughout the year. In comparison, the energy production aspect of waste incineration has so far been less important in Hungary and Italy.

Finland's waste policy in 1991 focused on recycling and prevention, despite advice from the Finnish environmental administration in favour of a combination of incineration and biological treatment. At the end of the 1990s, however, Finland decided to implement co-incineration. Late in the process it was realised that co-incineration plants incinerating waste had to comply with the Waste Incineration Directive and its strict emission standards. The extra cost of meeting these requirements made the use of Refuse-Derived Fuel (RDF) unattractive for co-incineration plants. Energy prices will be important in determining whether the 10 planned co-incineration plants will use waste (predominantly from commerce, industry and construction) as a fuel in the coming five to seven years.

Finland has launched a new planning round regarding dedicated waste incinerators. One new plant has been built next to a hazardous waste incinerator and started operation in late 2007. It is hoped that the hazardous waste plant's good reputation will 'rub off' on the new plant. The new plant is jointly owned by the state, municipalities

**Figure 10.4 Capacities for dedicated incineration, composting and MBT of municipal waste in five countries and one region**



**Note:** Treatment capacities data derive from the years 2005, 2006 or 2007 depending on availability. Composting capacity data for Germany is from 2003.

**Source:** ETC/RWM, 2008b-f.

and private investors. Another new dedicated waste incinerator has been launched recently.

One reason that dedicated waste incineration is not preferred in Finland is that almost every city and town already has district heating based on combined heat and power systems provided by coal or natural gas fired plants. Dedicated incineration capacity is therefore hard to fit into existing heating systems where demand is low in summer and heat coming from waste incinerators would have to compete with the coal- or gas-fuelled combined heat and power plants. Connecting waste incinerators to paper mills with their stable energy demand is considered to be an opportunity in Finland.

Waste management strategies in Italy differ between regions. Thirty of the country's 50 incineration plants are located in the north while only eight are in the south. In 2005 incineration plants operated at 85 % of their capacity treating municipal waste, RDF and other waste fractions. Landfilling is an accepted form of waste treatment in the southern regions, where incinerators are strongly resisted. The public is becoming increasingly vocal in its opposition to many waste management facilities. In response, campaigns are used to raise acceptance of both incineration and MBT plants by providing more detailed information on them.

Hungary has one municipal waste incineration plant in Budapest. It was reopened in 2005 with increased capacity after modernisation to comply with Waste Incineration Directive requirements. At present, there are no municipal waste incineration plants in Estonia but there are plans to build two plants with combined heat and electricity production. In both Hungary and Estonia, energy produced from waste is supposed to partially replace gas imports from Russia. In addition, energy prices have been rising over recent years but future developments are uncertain due to the economic downturn in 2008 and 2009. High energy prices and the chance of greater independence from gas imports from Russia might improve the currently low public acceptance of waste incineration in Hungary. In Estonia energy from waste incineration could partially replace heat produced from oil shale, delivering improved environmental performance.

### 10.5.3 Composting

Composting or anaerobic digestion is used to recover collected biowaste separately from households (kitchen and garden waste) and businesses, often together with comparable waste from the food industry. Separately collected biodegradable waste is typically treated by either composting or anaerobic

digestion, which produces compost that can be used as a soil improver or fertiliser, often subject to quality requirements. In addition, anaerobic digestion produces energy.

Germany has the largest composting capacity, followed by Italy, Finland and the Flemish Region. The capacity in Hungary and Estonia is considerably lower (Figure 10.4). Since 1999, capacity at composting plants has increased manifold in Finland, Hungary, Italy and Germany. Capacity increased by five times in Finland from 20 kilograms to 100 kilograms and in Hungary from 5 kilograms to 25 kilograms per capita. In Italy it tripled from 40 kilograms to 120 kilograms per capita while in Germany it rose by 50 % in four years from around 130 kilograms to nearly 200 kilograms per capita.

Both Hungary and Italy report existing composting sites running at less than half capacity due to a lack of separately collected organic waste. In 2003 Germany also had 50 % free capacity at biological treatment plants; separate collection was 7.3 million tonnes while treatment capacity was around 14 million tonnes. In Estonia the plant at the Tallinn landfill was operating at around 15 % of capacity in 2006 (approximately 4 000 tonnes of 29 000 tonnes). However, Tallinn city only started separate collection of biodegradable kitchen waste in April 2007, so it is hoped that within a few years the plant will be operating at around 50 % of capacity.

### 10.5.4 Mechanical-biological treatment

Mechanical-biological treatment (MBT) is usually used to treat mixed municipal waste. Materials suited for incineration or recycling are separated and biological treatment is then used to reduce the volume and organic content of the remaining fraction. The quality of the biologically treated waste fraction is usually poor and therefore it is landfilled or used as low-quality compost, e.g. as landfill cover.

Italy has by far the largest MBT capacity with 230 kilograms per capita in 2005, which was almost three times higher than in 2000. This meant that 23 % of municipal waste was treated by means of MBT in 2005. Still, only half of the operating capacity was used.

Germany accepted MBT as a pre-treatment method before landfilling in 2001 and capacity correspondingly doubled in the period 2000–2005. The Flemish Region opened its first MBT plant in 2007 with a capacity of 30 kilograms per capita. The capacity in Estonia is similar but is much lower in Hungary and Finland (Figure 10.4).

## 10.6 Separate collection of biodegradable municipal waste fractions

Separate collection of biodegradable municipal waste fractions (mainly paper and cardboard, packaging waste, and food and garden waste) has been increasingly used to divert biodegradable waste from landfill (Figure 10.5). In order to arrive at high rates of separate collection, regular communication activities are particularly important to keep households (and others) aware and active in separating waste and participating in home composting schemes.

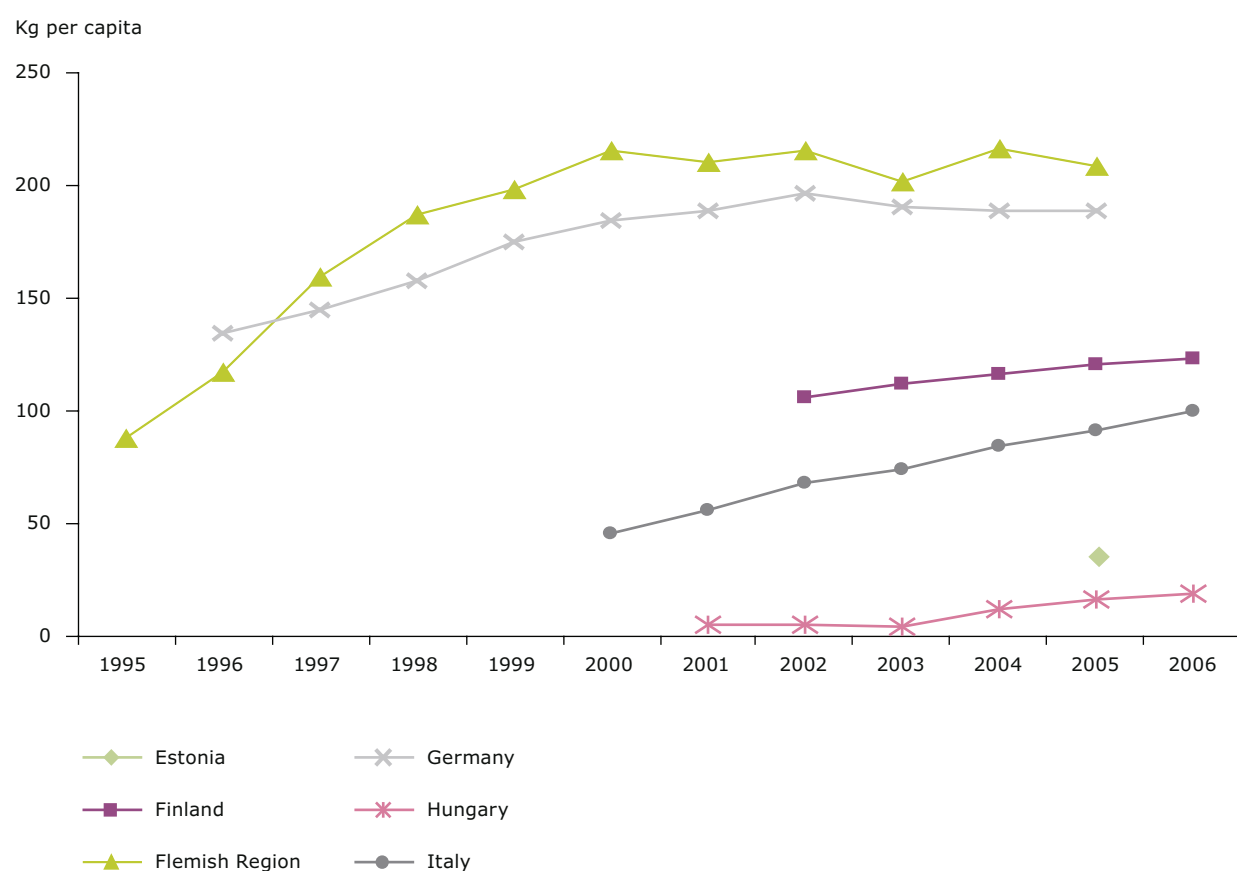
In Germany the province of Hesse initiated separate collection of biowaste to divert waste from landfill as early as 1983. It was successful and spread to the rest of the country over the next ten years. In 2005, the BMW collected separately was 189 kilograms per capita, around half of it biowaste.

In the Flemish Region, a combination of diversion policies (including a waste disposal levy, targets for separate collection binding on all public authorities, 'pay-as-you-throw' schemes and subsidies to stimulate separate collection) produced the highest rate of separate BMW collection in this study at more than 200 kilograms per capita.

Over the last decade, separate collection has developed at varying speeds in different parts of Italy, achieving a high performance in the northern regions, while facing difficulties in the centre and particularly in the south. As the collection of 'dry' recyclables is not sufficient to meet the national targets on separate collection, most regional waste management plans promote separate collection systems for food waste and home composting. Between 2002 and 2005 separate collection increased by 33 % to 91 kilograms per capita.

In Finland separate collection figures for BMW fractions are available from 2002. The collection

**Figure 10.5 Separate collection of biodegradable municipal waste fractions**



**Note:** Figures for Italy 2002–2006 include food and garden waste, paper, textiles, wood packaging and bulky wooden waste.

**Source:** ETC/RWM, 2008a–f.

rate has remained stable at around 25 % of municipal waste generation, corresponding to 121 kilograms per capita in 2005.

In the new Member States separate collection systems are still being established. As a result, approximately 50 % of the population in Hungary has yet to receive access to separate collection systems (of packaging waste), while 60–80 % of the rural population in Estonia do not have access to a waste collection system at all. Separate collection in Hungary was about 20 kilograms per capita in 2005 and around 40 kilograms in Estonia. An important objective has been to improve the coverage of the collection systems in these countries.

The Packaging Directive plays an important role in establishing separate collection systems. The directive was one of the first to set recycling and recovery targets for a specific, and very visible, waste stream and has clearly been a driver for starting separate collection. This seems to be particularly true in Estonia, Finland, Hungary and Italy.

The figures do not include amounts of biodegradable wastes composted privately by citizens. It is difficult to estimate the exact quantities of municipal waste prevented through home composting. About 40 % of households home compost in the Flemish Region which is estimated to reduce annual MSW generation by 25–80 kilograms per capita. In Germany an estimated 3–7 million tonnes of biowaste is home composted each year, which equals 40–85 kilograms per capita. In Estonia home composting has been introduced in the capital and in some rural areas. In Hungary home composting is also being implemented; the 3 200 households currently registered produce around 80 000 tonnes of compost annually or 8 kilograms per capita.

### **10.7 Importance of markets for compost and other recycled materials**

The need for compost to improve soil varies across Europe. The soils of southern EU Member States are facing a particularly destructive decline in organic matter, however, and compost can play an important role in restoring the organic content.

Many studies have stressed the need for a well-functioning market for the products of biological treatment. Demand can only be created if products are of good quality (i.e. containing

low levels of heavy metals and other unwanted substances) and this quality is recognized by potential users. Good quality compost requires separate collection of biowaste combined with plenty of information and guidance to households and potential users of the compost. It also requires the setting up of monitoring systems and possibly quality standards or labels.

In some cases biological treatment capacity is available but the quality or the 'purity' of the collected biodegradable waste is inadequate to produce good quality compost. National quality standards set in the Flemish Region, Germany and Italy seem to have been effective in ensuring that compost quality is sufficient for agricultural use, wholesale and private gardening.

In Germany the quality of compost is defined in an ordinance and the Bundesgütegemeinschaft Kompost association awards certificates for products complying with the ordinance. Around 3 million tonnes of compost products were produced by members of the association in 2006 (36 kilograms per capita).

In the Flemish Region the compost organisation, VLACO, is responsible for coordinating the implementation of systems to collect and manage kitchen and garden waste, including home composting. More than 300 000 tonnes of compost were produced in 2006 (92 kilograms per capita). Good quality compost is sold at EUR 6–7 per tonne.

Italy has generated compost of an acceptable quality but has found it difficult to establish a well functioning market. High quality compost is defined in the Italian regulation and can be used in organic agriculture. In 2002, the annual production of compost was estimated to be between 800 000 and 900 000 tonnes (CIC, 2009), or about 15 kilograms per capita.

In Finland the quality of products from composting BMW and sludge has not been sufficient to be used as fertiliser or soil improver. A market could therefore not be established for these types of use. Instead, they have been used for landscaping and for top covering at landfills.

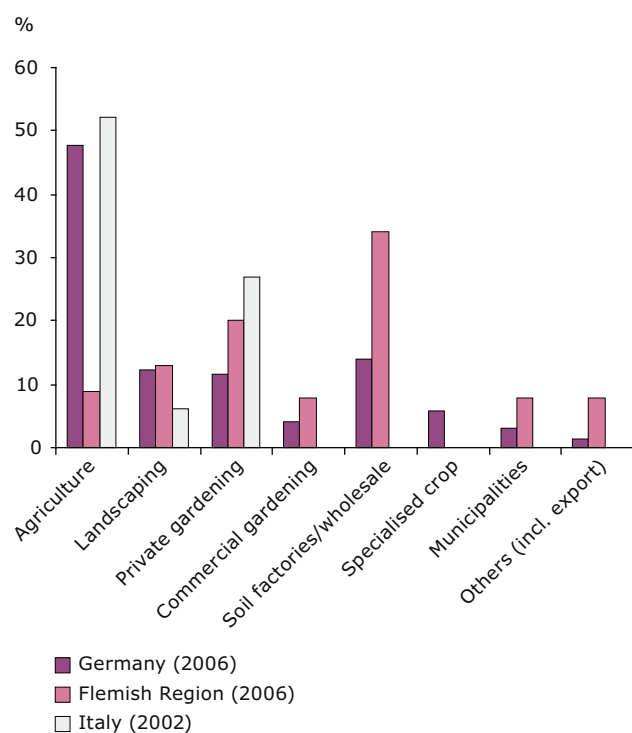
To counter poor compost quality, in 2006 Finland introduced a regulation for biowaste and sludge-based fertilisers and soil improvers, defining criteria for the use of compost. If the compost fulfils the criteria given in the legislation, it can be used e.g. on farmland. If the municipalities use their

own compost, they have also to fulfil the legislative requirements for fertilisers. The regulation has led to improved compost quality but it is too early to assess whether it has led to compost being used for other purposes than the existing routes of landscaping and landfill cover. In the absence of policies which aim at increasing the quality of the compost and creating a market, the compost is probable to be used as landfill cover or in landscaping. However, one may expect that this option will become less relevant after 2009 when many existing landfills that do not comply with the provisions of the directive are closed.

The Hungarian market for compost does not work very well as there is little interest in compost derived products. The closing of old landfills will absorb unsold compost materials in the short term. Nonetheless, due to strict technical standards on soil fertilizers and the general public aversion to waste derived products, the market for recycled products including composts is still limited.

Figure 10.6 shows compost usage in the Flemish Region, Germany and Italy. In Germany and Italy the majority of compost is used in agriculture, whereas the Flemish Region only uses 9 % for this purpose. Other major destinations of compost

**Figure 10.6 Use of compost in Germany, the Flemish Region and Italy**



Source: ETC/RWM, 2008c, d, f.

are wholesale markets, private gardening and landscaping.

Compared to markets for compost, the situation with respect to marketing recycled paper and cardboard collected separately from households is much more favourable. The countries included in this study did not cite it as a major obstacle to paper recycling. The revised Waste Framework Directive's new 50 % recycling target for paper, metal, glass, and plastic from households might nonetheless create the need for policies to improve the markets for these secondary raw materials.

There are also indications that the market for recycled waste materials is negatively affected by the current economic downturn. Decreased global demand for materials, including waste-derived materials, means lower prices for them (ENDS Europe, 2008). Additional measures might be necessary in the future to maintain current recycling levels and further increase recycling.

## 10.8 Landfill taxes and gate fees

In general it appears that a combination of policy instruments is required to divert waste from landfills effectively. Economic instruments such as user charges for the management of municipal waste (e.g. 'pay-as-you-throw' schemes), landfill tax and product charges can have a significant role if designed to regulate the behaviour of households, waste companies and producers.

For a landfill tax to be effective, the tax level should be relatively high, although public perceptions of the tax burden are arguably as important as the tax rate. In Estonia, for example, the landfill tax rate is relatively low compared to many other European countries and not even particularly high in Estonian prices but has increased considerably within a few years. The rapid increase means that Estonian waste companies and municipalities consider the tax to be high and it therefore has the desired effect. Besides ensuring that fiscal measures are onerous enough to create adequate incentives, regular communication activities are particularly important to keep households and others aware and active in separating waste and participating in home composting schemes.

The Landfill Directive provides that Member States must ensure that all costs involved in setting up and operating a landfill site, as well as the estimated costs of the closure and after-care of the site for a period of at least 30 years, are covered

by the gate fee. The Waste Incineration Directive sets emission limits and monitoring requirements for pollutants entering air and water, and many plants also have to apply best available techniques according to the Integrated Pollution Prevention and Control Directive. These provisions have increased abatement costs and thus also gate fees (Figure 10.7). In this section we discuss the gate fees for landfill and incineration. Collection and transport costs are not considered.

In 2004, Germany and Italy had the highest gate fees for landfilling at EUR 80–90 per tonne in 2005 prices. Costs were lower in the Flemish Region and Finland at EUR 47–60 per tonne. Hungary and Estonia had the lowest gate fees at EUR 30–36 per tonne.

Reviewing gate fee growth in the decade to 2006, it is interesting to note that fees have rocketed in Estonia by 700 %. Finland has experienced a similar change as fees have risen by almost 300 %. The increase has been more moderate in the Flemish Region in the last ten years with a rise of 40 %. It seems reasonable to attribute these cost increases to implementation of the Landfill Directive — and anticipation of it.

Gate fees for incineration are higher than for landfill and have risen by 5–12 % per annum. Information on landfilling and incineration gate fees derives mainly from the Flemish Region and Finland, however, as information for the other countries is scarce.

In the Flemish Region, Germany and Italy incineration prices are 30–70 % higher than landfill gate fees whereas the price in Finland was lower until 2006 when it rose to 25 % higher than landfill. The price increase is the result of increasingly strict environmental standards, for example investments to abate dioxin and NO<sub>x</sub> emissions.

### 10.9 Regional responsibilities and cooperation

When the competent waste authorities or government sets targets for waste management, there is a need to define clearly not only those targets but also the institutions and actors responsible for meeting them.

In the Flemish Region, the Waste Plan's provisions apply to all public authorities,

**Figure 10.7 Gate fees for landfilling municipal waste (excluding tax and VAT)**



Source: ETC/RWM, 2008a–f; and Eurostat HICP.

including municipalities and the public or private institutions that carry out tasks for them. Thus, when the Plan includes per capita targets for collecting residual waste, these have to be met by each municipality. A similar situation exists in Italy where 'optimal management areas' are responsible for meeting per capita targets for landfilling BMW. The lack of clearly defined responsibilities was one of the factors limiting further diversion of municipal waste from landfill in Finland. Two previous EEA policy effectiveness studies on packaging waste (EEA, 2005a) and wastewater treatment (EEA, 2005b) also highlight the importance of defining clear institutional responsibilities and their geographical scope.

Cooperation between municipalities or larger geographical units such as provinces or districts seems to be a necessary condition to ensure the availability of necessary financial and human capacity to build up alternatives to landfill. At the same time, cooperation needs to be well planned. In Hungary, for example, some cooperation associations overlap with regional planning areas, creating problems with regard to institutional responsibilities.

In the Flemish Region the already densely populated municipalities enhanced their capacities by forming inter-municipal associations in the 1980s. In Finland the process started in the 1990s, when policy-makers realised that the small, fragmented and sparsely populated municipalities would manage waste better if they united to form inter-municipal companies. Although the Landfill Directive did not initiate regional cooperation in the Flemish Region and Finland, the cooperation has been an important factor in establishing the necessary capacity and systems to recover waste.

In Italy, regions define 'optimal management areas' that generally correspond to provincial boundaries. The aim is to achieve a 'critical mass' for economically feasible waste management.

In the 2000s, municipalities in Estonia and Hungary faced an increasing number of waste management obligations but lacked the financial resources to fulfil them. After a difficult period during which municipalities struggled alone, policy-makers created more incentives for them to work together. There are already several positive examples of regional cooperation.

## 10.10 Public acceptance

Public acceptance is absolutely crucial in determining what alternatives to landfilling are politically feasible. Communication and information programmes therefore clearly have an important role to play in explaining to the general public the true costs and benefits of alternative waste management (and energy generation) strategies.

In Hungary, for example, the public has broadly supported material recovery during the last ten years but is largely opposed to waste incineration because of environmental concerns. This puts significant constraints on the options for policy-makers when formulating waste diversion strategies. In Estonia, by contrast, enthusiasm for material recovery is matched by a broadly favourable attitude towards using waste incineration to produce energy in place of highly polluting oil shale combustion.

In Finland there was a negative attitude to incineration in the 1980s and 1990s. Like Estonia, however, Finland expects that incineration will be one of the pillars of its waste policies in the future in order to meet the Landfill Directive targets. Opinion in Finland on incineration with energy recovery became more positive due to the climate change debate and the introduction of new and stricter EU standards for emissions from incineration plants.

In the Flemish Region waste incineration with energy recovery is fully accepted as a means to divert waste from landfills. In Germany and Italy public acceptance of dedicated incinerators varies among the federal states and regions. In federal states and regions opposed to dedicated incineration, however, there is an acceptance of mechanical-biological treatment, which usually includes incineration of a part of the residues in cement kilns and power stations. In Italy the output is mainly used in landfill daily coverage and land reclamation activities, or it is landfilled.

Estonia has not experienced problems selecting locations for new landfills as the population is well aware of the benefits of a modern landfill. This does not seem to be the case in Hungary and Italy where the 'not-in-my-backyard' syndrome prevails. However, in Italy, information campaigns and the promotion of best available techniques have raised acceptance of new landfill sites.

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## 12 Glossary of abbreviations and definitions

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ATO	Optimal areas for the management of waste in Italy (Ambito Territoriale Ottimale)
BMW	Biodegradable municipal waste
EEA	European Environment Agency
ETC/RWM	European Topic Centre on Resource and Waste Management
MSW	Municipal solid waste
MBT	Mechanical-biological treatment
NGO	Non-governmental organizations
OVAM	Public waste agency of Flanders (De Openbare Vlaamse Afvalstoffenmaatschappij)
PAYT	Pay-as-you-throw system of charging for waste collection depending on the amount of waste the user of the system throws into the waste bin
RDF	Refuse derived fuel
TASi	German Technical Guidance on MSW Treatment
TOC	Total organic carbon
VAT	Value added tax
VLACO	Flemish compost organisation (Vlaamse Compostorganisatie)

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