

**Evaluation of waste policies
related to the Landfill Directive
Finland**

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Context

The Topic Centre has prepared this working paper for the European Environment Agency (EEA) under its 2007 work programme as a contribution to the EEA's work on policy analysis and assessment.

Disclaimer

This **ETC/RWM working paper** has not been subjected to European Environment Agency (EEA) member country review, but the interviewed Finnish stakeholders listed in annex I have given useful comments to a draft paper. Please note that the contents of the working paper do not necessarily reflect the views of the EEA.

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1. Introduction to Finland

Finland has a population of 5.3 million (2006) with an average annual population growth of 0.35% in the period 1990 to 2006. Finland has a very low population density; 17 inhabitants per km² compared to an EU average of 113 inhabitants per km². In Europe only Iceland and Norway have a lower population density. The Helsinki metropolitan area includes roughly one-sixth of the country's total population (Statistics Finland, 2006). The average number of persons per household is 2.2 (Eurostat).

One quarter of the country is north of the Article Circle and about 10 % of the total area consists of inland waters with about 190 000 lakes. Further 76 % of the land area is covered by forests and woodland (Nordregio, 2002).

In 2004 the Finnish GDP per capita was EUR 26 400, compared to the EU average of EUR 18,600 (in 1995-prices, Eurostat). Measured in Purchasing Power Standards (PPS) where the EU-25=100, the Finnish GDP per capita was 111 in 2004; 11% higher than the EU average. Finland also has a stronger growth in GDP per capita compared to the EU-25 over the period 1996-2006; around 3.8% p.a. compared to 2.4% p.a. (Eurostat, 2007).

According to the Finnish constitution, the country is divided into counties and further into municipalities (Nordregio, 2002). In 1997, Finland reduced the number of counties from 12 to 6. At the end of 2006, there were a total of 416 municipalities of which 64 are urban municipalities, 74 semi-urban municipalities and 278 rural municipalities (Statistics Finland, 2006).

The municipalities are self-governing units with considerable local autonomy including the levying of taxes, whereas the counties are state agencies at the provincial level. Thus, unlike many other EU countries, Finland does not have a proper self-government at secondary level (Nordregio, 2002). However, federations of municipalities exist within different functional areas, with membership numbering from a few to more than 20. One of these functional areas is the collection and management of waste.

Thirteen Regional Environment Centres were formed in the 1990s and are under the authority of the Ministry of the Environment. The centres deal with issues related to environmental protection, construction and land use planning, nature conservation and the management and use of water resources.

The Finnish Waste Act of 1993 requires that the Ministry of the Environment draws up a national waste plan. The 13 Regional Environment Centres make regional waste management plans based on data and information from the municipalities and private companies. The plans are not binding, but they do present data on wastes and the current state of waste management, the development targets and the possible measures necessary to achieve them (ETC/RWM, 2006).

The municipalities must organise the collection and management of waste from households. Until 1st June 2007 the municipalities were also responsible for organising the collection and management of municipal waste from enterprise sources, i.e. waste with a composition similar to waste from households.

Finland joined the EU in 1995. In preparation for EU membership, it was possible for the Finnish authorities to take into account existing and expected EU legislation on waste policy - for example the EU Landfill Directive - when debating the future of Finnish waste legislation.

2. Lessons learnt

The lessons learnt in Finland that may be useful to other countries are:

As in many other countries, the Finnish municipalities are responsible for collection and treatment of the generated municipal waste from households. Finland has many municipalities including many small ones and therefore it is an advantage that many municipalities have organised the management of waste through 39 inter-municipal associations. This has improved the municipal waste infrastructure during the last 15 years.

Finland was an early practitioner of strategies and policies designed to divert municipal waste and especially biodegradable waste away from landfills. Finland has a long tradition for involving relevant stakeholders in developing strategies and policies. However, when organizing the diversion of biodegradable waste away from landfills in accordance with the requirements of the EU Landfill Directive, stakeholder responsibility and targets were inadequately defined, so the process proved problematic.

The formulation of the right strategies, policies and legislation is insufficient if the targets for each biodegradable waste type, and the responsibilities between the relevant stakeholders, especially for the provision of treatment capacity, are not clearly defined. Finland has achieved very good results in those instances, such as tyres and paper, where waste streams have clear targets and division of responsibilities. Another example of clearly formulated targets and responsibilities is the fulfilment of the technical requirements for landfills; Finnish landfills will meet the requirements of the Landfill Directive by the end of 2007 – two years before the deadline.

Ill-defined targets and unclear division of responsibility for biodegradable waste, with the exception of waste paper, has been compounded by an inadequate national data system for biodegradable waste and uncertainty surrounding techniques for diverting biodegradable waste away from landfills. The intended contribution of incineration with energy recovery of biodegradable waste has changed over the years. Experiences in Finland highlight the difficulty in meeting the EU Landfill Directive targets for the diversion of biodegradable waste away from landfill without extensive use of incineration with energy recovery.

3. Understanding the overall strategy for diversion of waste from landfill

The EU Waste Framework Directive from 1975 (75/442/EEC, amended 2006/12/EEC) stipulates that Member States should draw up waste management plans. According to the Finnish Waste Act from 1993 Finland has met this requirement by giving the Ministry of the Environment the responsibility for drawing up a national waste plan.

Finland made its first national waste management plan in 1998 focusing on the period up to 2005. The plan includes prevention and recovery targets for each main waste stream (mining waste, agricultural waste, industrial waste, construction waste, wastes from energy and water supply, municipal waste, sewage sludge and hazardous waste). The targets are not binding; they are of a guiding and indicative nature. The aim is to give the general public, business and industry, and decision-makers an overall indication of which direction each sector should develop in order to support a sustainable development. The overall target (excluding mining wastes and manure utilized in agriculture) is to increase the waste recovery rate from 55% in 1992 to 68% in 2005¹.

The 1998 plan focused on the two waste streams with the lowest recovery levels; municipal waste (30%) and construction & demolition waste (27%). The target for both municipal waste and construction & demolition waste was a recovery rate of 70% in 2005.

Also a new Government Decision regarding landfills and a landfill tax was introduced between 1996 and 1998², as well as Government Decisions on separate collection and recovery of certain waste streams; tyres³, construction waste⁴, packaging and packaging waste⁵ and waste paper⁶.

As the above Government Decisions progressed concurrently with the development of the EU Landfill Directive (developed 1993-1999), the Finnish government had the opportunity to monitor the expected future requirements of the EU Landfill Directive during the formulation process of the Government Decisions. This meant that the Government Decisions could be moulded to meet the requirements of the Landfill Directive. This was the case for limitations regarding which kind of waste could be landfilled. The Landfill Directive demanded that the amount of biodegradable municipal waste going to landfills in 2006 was reduced to 75% of the total amount by weight of generated biodegradable municipal waste in 1995. Further that this amount is reduced to 50% in 2009 and 35% in 2016.

The Finnish Government revised the national waste management plan in 2002, but retained 2005 as the deadline for fulfilment.

The national Finnish waste policy over the last 10-15 years has focused not only on implementation of EU waste regulation but also on developing its own waste policy in priority areas. Much EU legislation focuses only on waste from discarded products, for example packaging waste. The Finnish waste policy has a broader focus. For example, Finnish waste paper regulation covers paper from packaging and newspapers. Construction and

¹ English summary of 1998 waste management plan. The plan was approved by the Government 14 August 1998.

² Tax on landfill of waste (.....1996) and Government decision on landfills (861/4 September 1997)

³ Council of State Decision on the recovery and disposal of discarded tyres (1246/12 October 1995)

⁴ Government Decision on construction waste (295/ 3 April 1997)

⁵ Government Decision on packaging and packaging waste (962/1997)

⁶ Government Decision on the collection and recovery of waste paper (883/1998)

demolition waste and used tyres are other examples of priority areas not closely related to EU Directives.

In general, the national Finnish waste policy seeks to find solutions to the following waste problems⁷:

- Growing volumes of waste,
- low recovery rate of some types of waste,
- inadequate waste disposal,
- certain gaps in waste management infrastructure,
- insufficient use of incentives and instruments,
- unsatisfactory waste sector monitoring and lack of coordination in the sector.

The overall goals in developing waste management in the two waste management plans are:

- Prevention of waste generation and minimization of the harmful properties of waste,
- increased waste recovery,
- safe and sound waste disposal,
- prevention of environmental and human health risks arising from waste,
- repair of any damage caused by waste,
- reduction of transfrontier shipments of wastes.

The most important instruments used to achieve the goals are:

- Waste management planning,
- laws and statutory orders,
- producer responsibility,
- taxes,
- grants,
- research,
- stakeholder involvement.

A working group set up by the Ministry of the Environment prepared a proposal for a new national waste plan in January 2007. Besides the national plan there will only be five regional plans since several districts have united their plans. The national plan describes the objective for the waste policy up to 2016. The plan includes different scenarios and envisages between 28% and 41% of municipal waste to be incinerated by 2016. A second Finnish municipal waste incinerator was completed in late 2007, but several more will be required to meet targets (refer section 5.7).

According to the working group, the proportion of biowaste going to landfill will, as a result, be cut from 63% in 2003 to 20% by 2016. The proposed plan was after a consultation period approved by the Council of State in the beginning of 2008.

⁷ The national waste plan from 1998 (page 3 in the English summary) and the revised one from 2002 for the period up to 2005, (page 5) approved by the Finnish Government on 14 August 2002.

3.1. Objectives

3.1.1. *Municipal waste*

The national waste plan of 1998 formulated the following targets:

- By 2000, waste generation should be equal or lower to that of 1994, and by 2005, it should be at least 15% lower than that which would have been reached without any reduction measures.
- The waste recovery level is increased to least 50% by 2000, and to at least 70% by 2005.

The revised national waste plan from 2002 sets the targets for municipal waste management:

- Generated municipal waste in 2005 should be at least 15% lower than predictions based on 1994 waste volumes and real GDP growth.
- A waste recovery rate of at least 70% in 2005.

The 2007 draft plan includes for 2016:

- Three different scenarios with minimum recovery rates of 76%, 79% and 84% respectively.

3.1.2. *Biodegradable Municipal Waste*

In 1997 the objective was to limit the amount of biodegradable waste sent to landfill. This includes biodegradables from households waste and similar waste coming from manufacturing industry, services and other industrial activities.

The national waste plan from 1998 set a target of 75% recovery of biowaste from municipal waste by either composting or anaerobic digestion by 2005.

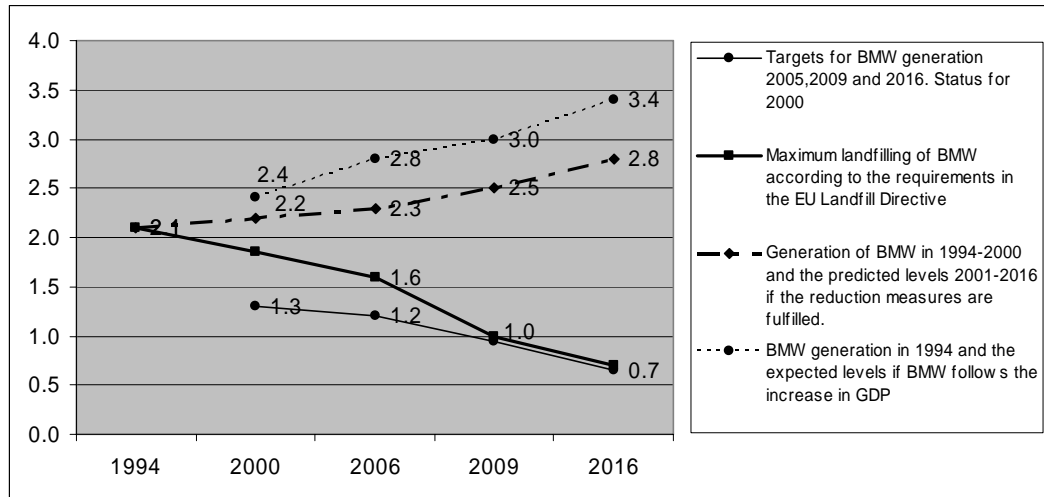
The revised national waste plan (2002) sets the following objectives for municipal waste to be achieved in 2005:

- By the beginning of 2010, municipal waste can only be deposited in a landfill if at least 80% of organic or biodegradable matter has been separated and removed for other disposal or recovery, i.e. a maximum of 20% of the generated biodegradable waste can be landfilled
- Creation of the biodegradable waste strategy required by the Landfill Directive.

According to the Landfill Directive the Member States must establish a national strategy for the reduction of biodegradable waste going to landfill before July 2003 and notify the EU Commission of the strategy. A detailed biodegradable waste strategy was delivered by a national working group in April 2003 and finally approved by the Government in December 2004.

Figure 3.1. shows how the management of biodegradable municipal waste is expected to develop through until 2016.

Figure 3.1 The expected generation and landfilling of BMW in Finland 1994-2016



Source: Ministry of the Environment, 2004

Extra treatment capacity is needed for biodegradable waste. This should consist mainly of pre-treatment and energy recovery. It is expected that an additional capacity of 600 000 tonnes is needed by 2009 and on top of that 900 000 tonnes by 2016. The plan suggests this recovery capacity should be provided at the regional level.

The draft national waste plan from 2007 proposes that by 2016, no more than 20% of generated biodegradable waste should be landfilled, i.e. the fulfilment of the 2010 target set in the 2002 plan is postponed by six years. Incineration with energy recovery also plays a much more important role. Between 27% and 42% of the municipal waste is expected to be incinerated with energy recovery in 2016 compared to 9% in 2003.

3.1.3. Used tyres

In 1996 the Finnish Government introduced a target of 90% annual recovery rate by volume for discarded tyres to be met by 2000. Further, tyres that cannot be recovered must be stored separately from other waste to enable their possible future reuse or other recovery.⁸ The objective relates to tyres, used tyres or tyre bodies of motorized or hauled vehicles or of other vehicles or machines.

The 1998 national waste plan sets a target of 90% recovery of used tyres by 2005, with energy recovery a less preferred means of recovery.

In November 1999 the Government introduced a ban regarding landfilling of discarded tyres from vehicles. The ban was part of the implementation of the EU Landfill Directive.

The revised national waste plan from 2002 sets the following objectives for discarded tyres to be achieved in 2005:

- The volume of discarded tyres in 2005 should be 10 % lower than predictions based on the volume of waste in 1992 and real economic growth in the sector.
- 100% recovery in 2005. Recovery is defined as use as secondary raw material and energy.

⁸ Government Decision on the recovery and disposal of discarded tyres (1246/1995)

3.1.4. Construction & demolition waste

In 1997 the Government formulated the goal to reduce the quantity and harmfulness of construction and demolition waste and to increase its recovery. The indicative target calls for the recovery of at least 50 % of all construction waste, except for soil, rock, and dredging waste, by 2000.

The national waste plans from 1998 and 2002 formulated the following objectives for construction and demolition waste:

- A volume of waste generated in construction (building and demolition waste and surplus soil) in 2005 at least 15 % lower on average than that predictable on the basis of the volume of waste in 1995 and real economic growth in the sector.
- Recovery of 70% of construction and demolition waste by 2005.

3.2. The package of measures to meet objectives and stages of implementation

The national waste plans from 1998 and 2002 include measures that should be implemented to reach the goals. The 2002 plan is more detailed regarding when the different administrative and legal instruments that have to be implemented. Therefore, the remainder of this report mainly refers to the 2002 waste plan (Ministry of the Environment, 2002).

The 2004 strategy states that future restrictions on biodegradable waste landfilled will be related to the number of inhabitants, week-end cottages and places of work who use the concerned landfill.

Economic instruments, primarily the landfill tax, provide another means to manage waste. It is stated that the landfill tax might be raised above the 2005 level of EUR30 per tonne. Extending the current tax reduction for electricity produced using fuels based on combustible waste beyond 2007 will also be examined.

The 2007 draft plan includes 45 key measures. Several measures aim to promote recycling and the use of recovered materials, especially in public sector construction projects. One of the scenarios in the plan reduce waste generation by one per cent per year (ENDS DAILY, 2007).

3.2.1. *Municipal waste*

Main instruments according to 2002 revised plan	Measures taken before 2002	Purposes	Timetable according to plan	Stage of implementation of 2002 plan
<p>Ban on landfilling of certain waste streams (1997)</p> <ul style="list-style-type: none"> • non-pre-treated waste • household waste and similar waste from industry & service, from which most of the biodegradable waste has not been collected separately. 	<p>Government decision on landfills (861/4 September 1997)</p> <p>Government Decision 1049/1999 (Implementation of the EU Landfill Directive)</p> <p>Government Decision 552/2001 (Change of implementing provision).</p>	<p>Implement the targets set in the bio-waste strategy and manage landfilling so that no hazard or harm is caused.</p>	<p>2005 for biodegradable waste streams</p>	<p>Government Decision 202/2006 including ban on landfilling of waste from which most of the biodegradable content has not been removed or collected separately for recovery came into force September 2006.</p>
<p>Landfill tax introduced 1996 for municipal landfills (not private landfills).</p>	<p>Waste Tax Act (495/1996) and amendment 923/2001 in connection with the 2002 budget proposal (EUR 15.15 per tonne).</p>	<p>To improve the incentive effect of the existing tax. I.e. to stimulate waste minimisation and reuse, and reduce landfilling.</p>	<p>2002 onwards</p>	<p>Waste Tax Act 1066/ 2002 (EUR 23 per tonne in 2003-04; EUR 30 per tonne from 2005).</p>

3.2.2. *Biodegradable Municipal Waste*

Main instruments according to 2002 revised plan	Measures taken before 2002	Purposes	Timetable according to plan	Stage of implementation of 2002 plan
<p>Restrictions on depositing organic and biodegradable waste in landfills.</p> <p>Drawing up of a biodegradable waste strategy.</p>	<p>Government decision on landfills (861/1997)</p>	<p>Fulfil the requirements of the Landfill Directive.</p> <p>Fulfil the targets set in the national waste plan from 2002, i.e. in 2010 municipal waste can only be deposited in a landfill if at least 80 % of organic or biodegradable matter has been separated and removed for other disposal or recovery.</p>	<p>2003</p> <p>2003</p>	<p>Government Decision 202/2006 including ban on landfilling of waste from which most of the biodegradable component has not been removed or collected separately for recovery, and introduction of acceptance criteria came into force September 2006.</p> <p>Biodegradable Strategy 2006-2016 was developed April 2003 and approved by the Government December 2004</p>
<p>Introducing producer responsibility for collection and recovery of waste paper.</p>	<p>Government decision (883/1998). Producer responsibility from January 1999. 70% recovery in 2000 and 75% in 2005.</p>	<p>Make collection and recovery more efficient and minimise the impact on them of harmful economic fluctuations.</p> <p>According to 2002 plan the recovery target is set to be 80% in 2005.</p>	<p>2005</p>	<p>Government Decision 584/2004 amended the producer responsibility, but the targets of 70% recovery before 2000 and 75% from 2005 remain in accordance with Government Decision 883/1998.</p>

Main instruments according to 2002 revised plan	Measures taken before 2002	Purposes	Timetable according to plan	Stage of implementation of 2002 plan
Introduction of legal requirement that biogas must be collected and utilized or treated at disused landfills, which are a significant source of greenhouse gas emissions.	Amendment of the Government decision on landfills (861/1997) which relates to landfills passed to aftercare stage after October 1997.	Avoid harm or hazard to the environment and human health.	2003	Government Decision 861/1997 requires the collection and recovery or treatment of biogas formed at the disused landfills. Section 4, appendix 1 of Decision 861/1997 relating to landfill gas control came into force in January 2002 and it concerns landfills that are passed to after-care stage after 1 January 2002. In addition, the competent authority can, on a case by case basis, require biogas collection from landfills, closed before this date, if there is any danger or harm to human health or to the environment.
Adequate recovery capacity.		Construction of plants for recovery of biodegradable waste. Secure fulfilment of the targets for recovery of biodegradable waste. According to 2002 plan 80 sites for biological recovery and disposal should be developed (uncertain estimate).	2002 onwards	By 2005 there were 35 biological recovery plants.

3.2.3. Tyres

Main instruments according to 2002 revised plan	Measures taken before 2002	Purposes	Timetable according to plan	Stage of implementation of 2002 plan
Producer responsibility for discarded tyres.	Council State Decision 1246/1996. 90% recovery in 2000.	Tyre producers must organise waste management. According to 2002 plan the recovery targets is tightened to 100 % in 2005.	2005	According to amendment 583/2004 the recovery rate is still 90%.
Ban on landfilling of tyres.	Government Decision 295/1997. Ban from January 1999.	Fulfil the requirements of the Landfill Directive Implement the targets set in the bio-waste strategy and to direct landfilling of wastes in such a way that no hazard or harm is caused.	No new initiatives. Ban from 1999.	
Recycling fee.	Purchaser of a new tyre pays a fee. Not statutory.	Cover the expenditures.		At the moment there are two producer organizations of tyres: North Re-Tyre Oy and Finnish Tyre Recycling Limited. The fee for a passenger car tyre is EUR 1.85 including 22% VAT.

3.2.4. Construction waste (building and demolition and surplus soil)

Main instruments according to 2002 revised plan	Measures taken before 2002	Purposes	Timetable according to plan	Stage of implementation of 2002 plan
Provisions for construction sites. If necessary, better sorting requirements on construction & demolition waste.	Government Decision on Construction Waste (295/1997). Introducing Government decision on collection and recovery of different construction and demolition waste types (concrete, brick, mineral tile, ceramic and gypsum wastes, non-impregnated wood wastes, metal wastes, soil and rock). Fulfil 50% recovery in 2000 according to 295/1997 and 70% recovery according to 1998 waste plan.	Secure better sorting of construction & demolition waste (2002-plan). 70% recovery rate is still the target in 2005.	2003	No amendment of 295/1997 has been made. Recovery level has increased from 20% to 38% from 1995 to 2003.
Amendment of existing Government Decision on Restrictions on depositing biodegradable waste in landfills.	Government decision on landfills (861/1997).	Fulfil the 70% recovery target for construction & demolition waste as well as the target for biodegradable wastes set in the national waste plan from 2002 to the effect that, as of the beginning of 2010, municipal waste can only be deposited in a landfill if at least 80 % of organic or biodegradable matter has been separated and removed for other disposal or recovery.	2003	Government Decision 202/2006 including ban on landfilling of waste from which most of the biodegradable component has not been removed or collected separately for recovery, and the introduction of acceptance criteria came into force September 2006.
Landfill tax introduced 1996 for municipal landfills (not private landfills).	Waste Tax Act (495/1996) and amendment 923/2001 in connection with the 2002 budget proposal (EUR 15.15 per tonne).	To improve the incentive effect of the existing tax. I.e. to stimulate waste minimisation and reuse, and reduce landfilling.	2002 onwards.	Waste Tax Act 1066/2002 (EUR 23 per tonne in 2003-04; EUR 30 per tonne from 2005).

4. Understanding the associated package of measures

4.1. Relationships with a package of other policy interventions (e.g. implementation of the Incineration Directive)

As well as initiatives designed to divert waste directly away from landfills, the Finnish Government has also taken initiatives that indirectly support this development.

Many of the Finnish initiatives are strongly related to implementation of EU regulation, for example producer responsibility for End of Life Vehicles (ELV) and Waste Electrical and Electronic Equipment (WEEE). Others are more related to national ideas and policies, for example, service standards in sparsely populated areas.

4.1.1. Extending producer responsibility

The 2002 national waste plan dictates that producer responsibility is to be applied for new waste streams like vehicles, electrical and electronic equipment, batteries and accumulators. These waste streams were subject to EU initiatives in the late 1990s to introduce producer responsibility. Therefore, the Finnish targets should be seen as reactions to EU initiatives.

4.1.2. Incineration

Government Decree on incineration of waste (362/2003) tightens existing emission standards for waste incineration. The implementation of these new standards will incur higher costs compared to other disposal and recovery methods. Since the Landfill Directive has much focus on diverting biodegradable waste away from landfills, (i.e. combustible waste), more restrictive requirements on incineration may influence whether the biodegradable waste goes to recycling including composting activities rather than to incineration.

4.1.3. Standards for services in sparsely populated areas

The 2002 plan calls for standards to be set for the quality and extent of waste management services in sparsely populated areas, and for wastewater sludge from properties to be included in organized waste management. The plan suggests that this could be achieved by issuing instructions and, if necessary, regulations. Implementation was planned for 2002 and 2003.

The Finnish Environment Institute, the Ministry of the Environment and The Association of Finnish Local and Regional Authorities have published a guide: 'Service Level Guide for Waste Management in Sparsely Populated Areas, Environment Guide 118, December 2004'. Sewage sludge is dealt with in a consultation paper made by a working group appointed by the Ministry of the Environment.

4.1.4. Allowances granted for developing environmental protection

The Finnish Government introduced a grant programme in 1996 (Government Decision 894/1996) to promote environmental protection. Projects promoting recycling and other waste recovery are included in the list of eight activities that may receive financial support. Support can be given to development, test and establishment phase of the project,

and must be in accordance with EU legislation. In general, no more than 50% of the expenses will be covered by this scheme.

The programme for promotion of environmental protection ended around 2004-05. The programme had no major effect in the municipal waste sector, but many objectives were achieved in the industrial (Ministry of the Environment, 2007b).

The Ministry of Industry and Trade has a system for development of programmes for technology and export, e.g. TEKES. One of the technology programmes 'Streams — Recycling Technologies and Waste Management' aimed to generate new business in sectors engaged in the reduction, handling, recovery and disposal of solid municipal waste (TEKES, 2007). The programme ended in 2004.

Another TEKES programme, Waste to Energy, concentrated on new business opportunities in using waste materials in energy generation, in line with contemporary European Waste strategies. The total financing of the four-year programme (1998 - 2001) was expected to be around EUR 13 million to EUR 20 million (TEKES, 2007).

4.1.5. Increased government economic involvement in the development of the waste sector

The 2002 plan states that proposals for the necessary appropriations are to be included in the operating and financial plans, spending limits and budgets of the ministries concerned. This was required from 2003 onwards, but has not yet been fulfilled (Huhtinen, K. et al. The Finnish Environment 16/2007, page 36.).

4.1.6. Increased inter-municipal co-operation

Finland has a long tradition of strong municipal independence. Municipal waste management used to be organised by independent municipalities; there were no inter-municipal associations. About 15 years ago there were 450 municipalities in Finland. Today the country still has about 400 municipalities. Many of these only had about 1000 inhabitants, which made it difficult for the municipalities to invest in expensive waste management technologies. In the 1990s the municipalities started to work together. Improving the infrastructure has been crucial in order to develop better waste management (Ministry of the Environment, 2007b).

The 2002 national waste plan explains that in 2000, 32 co-operative municipal areas were established, involving 65 % of Finland's municipalities and 80 % of the population. The plan estimates that there will eventually be about 50 co-operations in the form of limited companies or as multi-municipal companies involving all municipalities in Finland. There is no obligation to co-operate, but the need for municipalities to execute their waste management duties economically and efficiently is an effective driver for cooperation.

The inter-municipal companies are non-profit companies. The boards of the companies/co-operations consist of politicians and a number of city engineers and city directors. These boards make mainly operational decisions. Performance targets for the companies are based on political decisions taken by the municipalities. In the absence of a joint administrative board, municipalities must make all the authority decisions. (AFLRA/FSWA, 2007).

The municipalities have two functions regarding municipal waste management. An authority decision function and an operator-owner function. In most cases, the operation of waste collection and treatment plants has been transferred to the municipal companies/co-operations. However most of the practical operation of MSW management is outsourced.

For example, trucks and collection of MSW are outsourced. Even though the landfills are owned by the co-operation companies the operation of the equipment on the landfills is undertaken by private actors. Some composting plants are also operated by private actors. Also energy recovery is in many cases planned to be contracted to private or municipal energy companies engaged in the energy market (AFLRA/FSWA, 2007).

4.2. Objectives and stages of implementation

Measures according to 2002 plan	Purposes	Timetable	Stage of implementation of 2002 plan
Extending Producer responsibility Governmental Decrees on WEEE	Minimise the amount and harmfulness of waste from electrical and electronic equipment. Promote reuse, recycling and other recovery of these discarded products. The producer must organise separate collection of the wastes. Recovery target 70%	2002 onwards	Decree 852/2004 and into force 13-8-05
Extending Producer responsibility Governmental Decree on ELVs	Promote minimisation of the amount of waste from vehicles and promote reuse, recycling and other recovery of the discarded cars and its components. Recovery target 90%	2002 onwards	Decree 581/2004 and into force September 2004.
Standards for services in sparsely populated areas	To deal with the special problems related to waste management in sparsely populated areas	2002-2003	'Service Level Guide for Waste Management in Sparsely Populated Areas ' December 2004.
Incineration	Implementation of the EU Incineration Directive 2000/76. Secure better emission standards from incineration of waste both in dedicated incineration plants and in co-incineration plants		Government Decree 362/2003 on incineration of waste and into force June 2003.
Increased government economic involvement in the development of the waste sector	A more developed waste sector. Proposals on the necessary appropriations to be included in the operating and financial plans, spending limits and budgets of the ministries concerned	2003 onwards	Not fulfilled yet ⁹
Inter-municipal Waste Co-operations	All municipalities are participating in inter-municipal waste co-operations (50 co-operation areas)	2005	39 co-operations exist covering 81% of the municipalities and 95% of the population ¹⁰

⁹ Huhtinen, K. et al. The Finnish Environment 16/2007, page 36.

¹⁰ Finnish Waste Association, 2006

5. Factors influencing the effectiveness of a policy of waste diversion from landfill

In this section we present a reference indicator related to the Landfill Directive target on Biodegradable Municipal Waste (BMW), and a number of factors related to the landfill, incineration and recycling of waste. This information serves as input to the proposed methodology presented in Mazzanti and Zoboli (2007) which will also be used in the comparative analysis of the five countries and one region in the study. The information is summarised in Tables 5.11 - 5.14 at the end of this section.

The key idea of the proposed procedure is that the *causal relationship* between *specific* landfill policy *changes* and the *changes* of an indicator representing waste diversion from landfills is '*controlled*' by the state of other hindering/favouring factors *at the time of policy implementation*. This reflects a system-wide approach, and it should help us to identify the *specific role of policy change* in the framework of *co-causation* arising from the many factors at work in the waste system. The proposed methodology is a mixed quantitative/qualitative one, and it should be able to exploit the information on policy changes and other 'explaining factors' in a coherent model-like approach.

The time of policy implementation is the year when the Landfill Directive was transposed and in the study it is used to assess the trends before and after the policy implementation. In Finland the Landfill Directive was transposed in 1999.

5.1. Development in the reference indicator: BMW landfilled cf. generated amount in 1995 (Landfill Directive target)

The generation and landfill of BMW is shown in Table 5.1. The amount of BMW generated per capita has decreased by almost 10% between 2000 and 2007 whereas it has increased in many EU countries over the same time period. The total amount of BMW landfilled has also decreased. The absolute decline of BMW landfilled was 9% from 1995 to 2006, which equates to a decrease per capita of 15%.

The main reference indicator shows that Finland had already fulfilled the target of 75% in the Landfill Directive for 2006 (the maximum percentage of BMW landfilled in relation to generated amount of BMW in 1995) by 1995, (Table 5.1). In the last six years, however, the reduction in landfilling of BMW has only been three percentage points. This implies that the decline of BMW landfilled must accelerate in the coming years in order to fulfil both the Landfill Directive target for 2009 of 50%, and the present national target for 2010 that only 20% of the generated BMW is landfilled. The draft of the national waste plan (Jan 2007) indicates that this will be achieved by increasing incineration with energy recovery (Ministry of the Environment, 2007).

Table 5.1. Biodegradable Municipal Waste landfilled 1995 to 2005, cf. generated amount in 1995 (Landfill Directive target)

Finland	1995	2000	2001	2002	2003	2004	2005	2006
BMW generated, 1000 tonnes	2100	2174	1951	1904	1889	1909	1958	1966
BMW landfilled, 1000 tonnes	1365	1307	1217	1228	1197	1178	1234	1241
BMW landfilled in the percentage of BMW generated in 1995, cf. Landfill Directive target	65	62	58	58	57	56	59	59

Source: Statistics Finland. The figures for 2006 is own calculation based on raw data from Statistics Finland

5.2. Factors related to waste generation and collection

Municipal Waste Generation

Of the 33.3 million tonnes of waste (excluding mining and agriculture waste) generated annually in Finland, 54% was recovered in the late 1990s compared to 46% in early 1990s.

Finland had a slightly higher total municipal waste generation in 2005 than 1995 (table 5.2). Like other EU-15 countries, Finland has seen an absolute increase in municipal waste generation until 2000. After 2000 municipal waste generation in Finland declined then stabilized, but in the last two years there has been an 4% yearly increase.

According to the Finnish Ministry of the Environment, the relatively gradual increase in municipal waste generation over the whole period from 1995 to 2006 is due to increasing use of reusable return and refillable packaging (Ministry of the Environment, 2007a). However, since 1997 packaging generation totally and per capita has not decreased in Finland, but has in fact increased slightly (see also section 5.6). Therefore, the decrease/stabilisation of municipal waste generation must be explained by other factors than the development in packaging waste.

There are reasons to suspect some level of data error: At some treatment sites, municipal waste is recorded in statistics as industrial waste because the site's treatment permission is limited to industrial waste (AFLRA/FSWA, 2007).

Table 5.2. Municipal Waste Generation 1995 to 2005 in 1995 to 2005

Finland, 1000 tonnes	1995	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Total waste generation	-	70120	-	71981	68436	66101	63005	63636	-	-	-
Municipal waste generated	2500	2200	2300	2400	2607	2402	2334	2356	2374	2448	2566
Municipal waste landfilled	1750	1469	1514	1446	1582	1468	1485	1444	1423	1478	1504
Municipal waste separate collected	-	-	-	-	877	792	719	801	838	923	981

Source: Statistics Finland, 2007 and National Waste plan 2002

Finland has an annual per capita generation of municipal waste of about 470 kilos. This is quite low especially compared to other old EU Member States. The generation per capita over the last 10 years has been stable or decreased. This development is contrary to other old EU Member States where municipal waste generation is increasing considerably. The development in Finland is more similar to the development in the new EU Member States such as the Czech Republic, Hungary and Poland.

Table 5.3. shows the development in separately collected BMW in Finland from 2002 to 2006. Collection levels have increased by 18% in this period, with the largest percentage increase relatively in organic waste. This development indicates that national waste man-

agement plans and regulations have, to a certain extent, succeeded in establishing the separate collection process. However, the share of separately collected BMW in relation to generated amount of BMW has only increased by 4 percentage points in the same period.

Table 5.3. Separately collected BMW and its share of municipal waste, 1000 tonnes

1000 tonnes	1995	2000	2001	2002	2003	2004	2005	2006
Paper and cardboard waste				334	363	385	383	422
Organic waste				165	160	174	212	197
Wood waste				52	62	49	38	31
Total separately collected BMW				551	585	608	633	650
Total separately collected MSW				719	801	838	923	981
BMW in residual mixed waste				1340	1291	1275	1266	1316
BMW generated total	2100	2174	1951	1904	1889	1909	1958	1966
Generation of municipal waste	2500	2607	2402	2334	2356	2374	2448	2566
BMW share of MSW generated	84%	83%	81%	82%	80%	80%	80%	77%
Separately collected BMW and its share of BMW				29%	31%	32%	32%	33%

Source: Statistics Finland. The BMW in residual mixed waste is calculated as a constant proportion of 83 % of total residual mixed municipal waste.

Table 5.3 shows that the percentage of BMW in MSW ranges between 77% and 84%. This is considerably higher than the EU average of around 60%. One reason for this is a low quantity of glass in MSW because of the deposit- return system for bottles. Another reason is the large amount of paper in Finland. However, the amount of packaging waste is very low (AFLRA/FSWA, 2007).

It is important to note that Statistics Finland calculates biodegradable municipal waste as a constant 83% of total residual mixed municipal waste. The Finnish Environment Institute (SYKE) questions this assumption based on research carried out by the Helsinki metropolitan area waste company, YTV Waste Management. The company found that there is 69% of BMW in the mixed municipal waste in the Helsinki area. SYKE has now been given the task by the Ministry of the Environment to report on the actual levels of BMW in mixed municipal waste at nationwide (SYKE, 2007a).

Table 5.4 shows the development in composition of municipal waste in the last 40 years. The composition should be treated as indicative, but shows that the share of paper and cardboard has decreased, whereas the proportion of organic and plastic waste has increased. In the beginning of the period the waste included up to 20% ash, sand and other

Table 5.4. Development of the composition of Municipal Waste 1960-2000

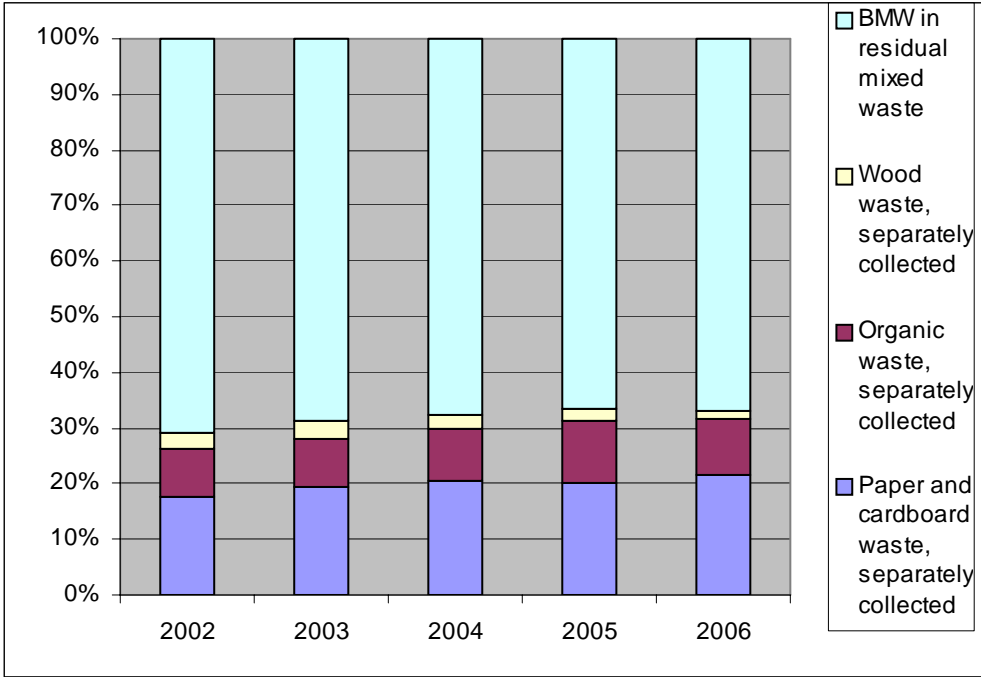
Year	Paper and cardboard (%)	Organic Waste (%)	Glass (%)	Metal (%)	Plastic (%)	Textile (%)
1960-1965	40-65	10-30	5-10	3-8	3	-
1970-1975	50-70	15-25	5-10	3-8	3-7	2
1980-1985	51	30	6	2	5	2
1990	51	30	6	2	5	2
1994 (Households)	40	33		5	10	2
1994 (Trade and industries)	51	26	5	2	7	2
1997-2000 (Households)	40	33	5	5	10	2
1997-2000 (Trade and industries)	51	26	5	2	7	2
1997-2000 (Construction and demolition)	21	4		5	5	-

Source: Sokka et al, 2007

non-combustible materials which has to be seen in connection with individual heating of houses. At the end of the 90s, this share was 5-7% (Sokka et al.,2007). Altogether the biodegradable part of the municipal waste seems to have declined from over to under 80% during the last 20 years.

Figure 5.1 shows the distribution of BMW collection in relation to total generation of BMW.

Figure 5.1. Distribution of BMW collection indicated in percent of the total generation of BMW



Source: Statistics Finland. The BMW in residual mixed waste is calculated as constant proportion of 83 % of total residual mixed municipal waste.

Municipal waste collection

For many years Finland has had a special system for collection of municipal waste. According to the Waste Act from 1993 the municipalities are responsible for arranging municipal waste collection, with two possible arrangements available:

1. Municipal waste collection can be arranged by the municipality, which selects through a tender who collects the MSW. Finnish municipalities or their companies do not operate or own waste collection vehicles.
2. The municipality can delegate this choice to waste producers, including households. Waste producers select and pay the waste collector directly for both collection and treatment. The municipality can set certain conditions including a maximum price for collection. The waste producers do not make any order or contract with the municipality, but responsibility for municipal waste remains with the municipality.

In practice it can be difficult for the municipality to control the waste streams when a household makes an individual arrangement with a private collector (FSWA, 2007).

In June 2007 the Waste Act was amended: now enterprises have a right to choose who collects their municipal waste even under the first scenario outlined above. The enterprises have welcomed this amendment (CFI, 2007; AEE, 2007), but it is not appreciated by the municipalities (AFLRA/FSWA, 2007).

Responsibility for Municipal Waste Management Capacity

The municipalities are responsible for providing sufficient waste treatment capacity for municipal waste. However the responsibility only applies to total capacity, not to different types of treatment. Thus, the responsibility can be fulfilled by providing landfill capacity. Landfilling is cheaper than other waste management options (SYKE, 2007).

After the Waste Act was changed in June 2007 the municipalities no longer have the responsibility for providing recovery and disposal capacity for municipal waste generated by enterprises.

Municipal waste fees

In 2006 the average annual tariff for collection and treatment of municipal waste was EUR159 for a single family house with collection of the residual waste every second week and where the waste paper/cardboard is delivered to collection sites. When a property has home composting the fee is about EUR13 less. If the system also includes separate collection of biodegradable waste every week the yearly average fee increases to EUR403. In the rural and isolated areas the municipal waste fee for a single family house is larger since the waste has to be transported at least 100 km and in Lapland even longer (Finnish Municipal Association, 2006).

At the beginning of 2004, municipal waste costs were, on average, EUR85 per tonne incl. VAT, although actual prices ranged between EUR39-165 per tonne incl. VAT. (<http://www.nordic-waste.info/index.php?id=211>).

In cases where individual households have an arrangement with a private waste collector, the collector charges a volume-based fee for a theoretical maximum weight of the bin. This can be an advantage for the collector if the actual weight is lower because the contractors only pay the municipal treatment site a fee for real weight (AFLRA/FSWA, 2007).

5.3. Factors related to the landfill sector

Total disposal of BMW of generated BMW

Table 5.5. BMW landfilled of total BMW generated and of total BMW generated in 1995

	1995	2000	2001	2002	2003	2004	2005	2006
BMW generated, 1000 tonnes	2100	2174	1951	1904	1889	1909	1958	1966
BMW landfilled, 1000 tonnes	1365	1307	1217	1228	1197	1178	1234	1241
BMW landfilled as share of BMW generated	65%	60%	62%	64%	63%	62%	63%	63%
MSW landfilled in percentage of MSW generated in 1995	65%	62%	58%	58%	57%	56%	59%	59%

Source: Statistics Finland.

The amount of biodegradable municipal waste generated and landfilled was considerably higher in 1995 than in 2006. It is unsurprising that the amount of biodegradable waste landfilled has decreased in the last ten years, but it is more difficult to understand why the amount of biodegradable waste generated has declined 7% to 10%. It may indicate that waste prevention initiatives have succeeded or home composting of biodegradable waste has increased. Home composting means that the waste is never registered. Home composting is encouraged by introduction of reduced waste fees.

Alternatively, the reduction in generated biodegradable waste could be the result of an improvement in the data system over the period. In this context it should be noted that if a Member State reported or estimated a higher amount of generated biodegradable municipal waste for 1995 than was actually generated, then it is easier for that Member State to fulfil the targets of the Landfill Directive concerning the relative reduction of landfilled

biodegradable municipal waste. This is because the reduction targets are related to amount of biodegradable waste generated in 1995. This, combined with the very high Finnish percentage of BMW out of the total MSW (see section 5.2), could have induced some bias in the figure reported for 1995.

According to SYKE the overview of waste data at the national level has only recently become sufficiently robust. The regional data are stored in a national system called VAHTI. SYKE first reported data about BMW to the Ministry of the Environment based on regional data in 2007. In late autumn (2007) SYKE will have an overview of recovery treatment capacity based on regional data (SYKE, 2007).

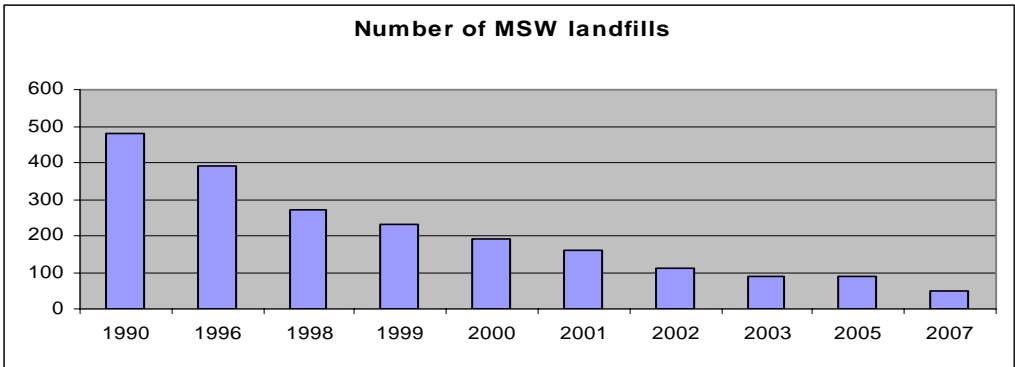
Number of landfills and residual capacity (for non-hazardous waste)

Landfilling is the predominant management method in Finland. Much land is available and huge areas have very low population density.

Most of the technical requirements of the Landfill Directive from 1999 were already transposed by Government Decision 861 from 1997 to come into force by 1 January 2002 and 1 January 2005 (the major part of biodegradable household waste and similar waste from other sources may not be landfilled). Therefore, already on 18 November 1999 Finland was able to transpose the Landfill Directive. At the end of October 2007 Finland closed all landfills that do not fulfil the technical requirements of the Landfill Directive. This is more than 20 months earlier than the date stipulated in the Directive (16 July 2009). The early fulfilment should be seen in connection with the Finnish interpretation and implementation of the IPPC Directive (Ministry of the Environment, 2007b). Of the existing municipal waste landfills, 38 continued to operate and 9 new landfills will be built. At the end of 2007, Finland had 47 municipal waste landfills.

Many landfills in the north of Finland will now be closed now because they do not comply with the technical provisions introduced in the EU Landfill Directive. In the future areas currently served by these landfills will then have to bear huge transportation costs (SYKE, 2007). There will be only three landfills for municipal waste in Lapland – an area of approximately 100 000 km² - after October 2007.

Figure 5.2. Development 1990-2007 in the number of landfills receiving municipal waste



Source: Finnish Waste Association, 2006; Ministry of the Environment, 2002 and Finnish Municipal Association, 2007.

Figure 5.2. shows that the reduction of municipal landfills was already underway in the first half of the 1990s, falling approximately 3% annually. After 1995, this process accelerated to an average yearly reduction of 8%. It is expected that an important part of the explanation for this process is the introduction in 1997 of the new landfill decision (861/1997) and the requirements introduced by the EU Landfill Directive, which must be

fulfilled by July 2009. Further, the development is fully in accordance with the 2002 waste management plan which suggested a total of 80 municipal waste landfills in 2005.

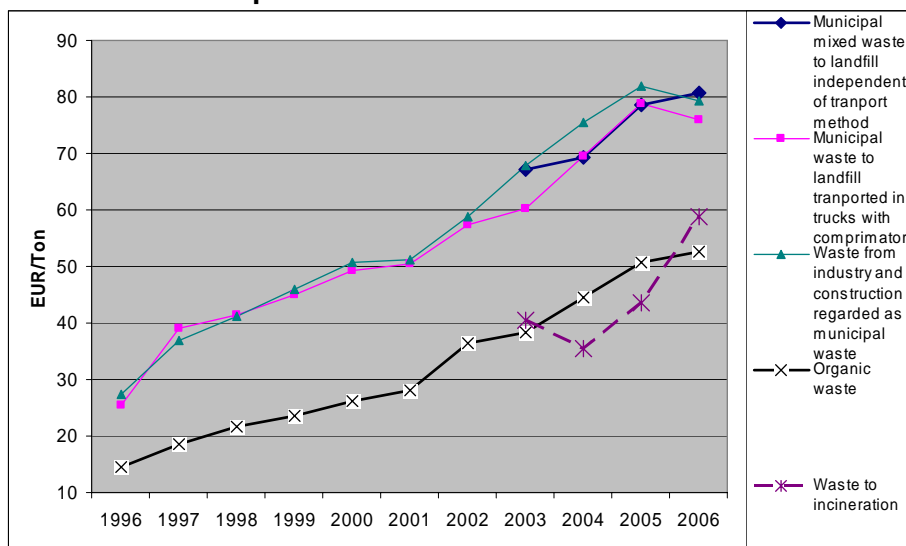
In 2005 88 industrial landfills existed but it is expected this figure is reduced to 52 in the end of 2007 (SYKE, 2007).

In 2003 the residual capacity was 400 000 tonnes for hazardous waste, 46.8 million tonnes for non-hazardous waste and 75.4 million tonnes for inert waste. In 2006 the residual capacity was 11 million for hazardous waste, 48.8 million tonnes for non-hazardous waste and 0.5 million tonnes for inert waste (SYKE, 2007b). Based on the 2006 figures the residual capacity at national level for non-hazardous waste including BMW seems to be sufficient for at least 30 years.

Landfill gate fees

It has not been possible to get information about municipal waste gate fees for landfilling. Figure 5.3, however, shows the development in fees per tonne for sending municipal waste to landfilling, incineration and biodegradable treatment.

Figure 5.3. Averages fees in current prices for landfilling, incineration and composting of municipal waste 1996-2006. Indicated in EUR per tonne incl. landfill tax but excl. VAT



Source: Finnish Municipal Association, 2006

The cost of sending municipal waste to landfill has increased by almost 200% in current prices, whereas the price index has increased by 14 percentage points. The landfill tax per tonne has increased by EUR15 over the same period which can explain some of the increase. However, a large part of the increase must be seen as extra costs for fulfilling the new requirements of the EU Landfill Directive. The higher gate fees at the landfills have also been a driver in relation to diverting municipal waste away from landfills (Ministry of the Environment, 2007b).

Landfill tax

The landfill tax per tonne of waste has increased from EUR15.15 in 1996 to EUR23 in 2003 and EUR30 in 2005. Only the common landfills are subject to the landfill tax (sites which mainly serve clients other than the owner). There is no landfill tax for waste, either municipal or industrial, which is landfilled at a private site, if the major part of landfilled waste is the operator's own waste. There are some private landfills for municipal waste but usually these are for rejects from pre-treatment of municipal waste (Ministry of the Environment, 2007b). The tax is the same for any type of waste subject to taxation.

This implies that a municipally owned landfill receiving mixed municipal waste pays tax for the part which goes as mixed waste. If mixed municipal waste from households or enterprises goes to pre-treatment and afterwards to a municipally owned landfill, then a landfill tax is paid for this reject waste. No landfill tax is paid if the waste is disposed of at a landfill owned by the private pre-treatment facility (Ministry of the Environment, 2007b).

Certain wastes are exempted from the taxation: separately collected contaminated soil which is placed on the landfill site; de-inking waste from the purification processes of waste paper; fly-ash and sulphur removal waste from energy production; and wastes that are utilised in landfill structures. In addition, the taxation is not applied to landfills where only soil and stone materials are deposited, or to facilities where separately collected bio-wastes or sewage sludges are composted. Also, taxation is not applied to activities where wastes are recovered.

The tax is normally based on weight. Weighing has been obligatory since 2002 if the waste volume arriving at the landfill is more than 30 000 m³ per year. If the waste arriving at the site cannot be weighed, the weight is estimated based on its volume using a table of conversion coefficients.

It is evaluated that the taxation has particularly reduced landfilling of construction and demolition wastes as well as industrial wastes and wastes from the commercial sector, by improving the competitiveness of the recovery operations. In general, waste taxation is considered not to have contributed so much to waste prevention, but has developed and increased recovery. The tax level is not high enough to change waste generators' behaviour; To produce such an effect, the tax level would have to be unrealistically high (CFI, 2007).

Further, the landfill tax has prompted the development of special landfills, e.g. for the energy sector, for clean soils, and for rejects from recycling since these waste types are not subject to the waste tax.

The revenues raised from the tax were very stable in the first years but have increased in the later years due to the increase of the tax, refer Table 5.6.

Table 5.6. Revenues raised from the landfill tax in million EUR

	1998	2000	2002	2003	2004	2005	2006
Waste landfill tax	31	33	32	41	42	53	62

Source: Norden, 2006

The revenues of the landfill waste tax are not earmarked but are passed on to the general budget. However, a 'gentleman's agreement' exists between the Ministry of Finance and the Ministry of the Environment, such that more money is made available to fund contaminated land remediation (EEA, 2005).

The Government has started to investigate whether the landfill tax is should extended to other types of landfills or waste types (Ministry of the Environment, 2007b). Industry fears that the landfill tax will be extended to private landfills (CFI, 2007), whereas the Finnish Solid Waste Association is not in favour of the landfill tax as it only applies to municipal landfills (AFLRA/FSWA, 2007).

5.4. Factors related to the incineration sector

It was more difficult than anticipated to implement policies that effectively divert municipal waste away from landfills. Two methods were considered: construction of composting plants/anaerobic digestion combined with incineration with energy recovery. In 1991 SYKE made a plan to build incineration plants combined with composting/anaerobic digestion. However, in general, politicians did not favour incineration of MSW in the 1990s except for hazardous waste. This was due to bad experiences with incineration, especially in the Helsinki area in the 1970s. Instead it was decided to promote waste prevention and recycling which meant a ban on incineration and focus on the development of capacity for treatment of biodegradable waste.

At the end of the 1990s when the first waste management plan was made there was renewed discussion about incineration. Very ambitious targets were set and establishment of significant co-incineration capacity was expected. In all, ten plants were expected. However, co-incineration encountered problems because it was realised quite late that these plants are also covered by the EU Incineration Directive (SYKE, 2007). The extra expenses incurred by stricter emission standards and the establishment mandatory smoke cleaning facilities, measurements and analyses would mean that the costs of waste incineration exceed the benefits and many factories stopped using recovered fuels (EEP Newsletter, 2006). The decline in demand for Refuse Derived Fuel leads to a similar decline in price for this waste.

According to Finnish Recycling News 250 000 to 300 000 tonnes of recovered fuels were co-incinerated in ten plants before 2005 by burning cardboard, plastic and wood collected from trade industry and households. This was approximately 10% of the total amount of generated municipal waste. The incineration took place mainly at parallel incineration plants in the wood and paper industry where coal, natural gas or peat were replaced by energy recovered from waste. Total capacity in the environment permits for these plants is about 300 000 to 400 000 tonnes per year. The estimated amount of co-incinerated municipal waste was about 100 000 tonnes per year in 2005 and 2006 (Kukkamäki and Leikoski, 2007). However, an investigation in summer 2007 found the used capacity for recovered energy fuel (REF) is now 300 000 tonnes. On the grounds of the environmental permits the co-incineration capacity planned or at the building stage is about 500 000 tonnes altogether. Theoretically the demand for REF could increase to 1 million tonnes, if the sites mentioned below (Riihimäki, Kotka, Helsinki metropolitan area) are included (Saarinen, E. Kierrätyspolttoaineen, 2007).

Until late 2007 Finland had only two dedicated waste incinerators (in fact only one for municipal waste). The Turku plant for municipal waste has a capacity of 50 000 tonnes per year. The Ekokem hazardous waste incineration plant manages hazardous municipal waste as well as other hazardous wastes.

A new planning round has started, focusing on incineration capacity. A new dedicated incineration plant has been built in Riihimäki 60 km north of Helsinki with a capacity of 150 000 tonnes. The plant is owned by Ekokem and started operation in late 2007. Ekokem is owned jointly by the state, the municipalities and private investors. Another dedicated plant is in Kotka (140 km east of Helsinki) with a capacity of 80-100 000 tonnes and municipally owned. It will start in 2008. An incineration plant will be built in Helsinki metropolitan area in 2012 but the decision on the site is still open. The sites under environment impact assessment are Lohja, in connection with a paper mill 70 km northwest of Helsinki, and four sites in the Helsinki metropolitan area. One in Helsinki, two in Espoo and one in Vantaa (Kukkamäki and Leikoski, 2007).

The 50% reduction of BMW landfilling will be nearly fulfilled in 2009. Further incineration plants are also planned, which should see sufficient incineration capacity in place by 2016. Still, many actors call attention to the fact that it takes at least two years to get an environmental permit for a dedicated incinerator not taking into account land permission and other concerns (AFLRA/FSWA, 2007).

It has to be underlined that almost every city and town already has central heating systems (CPH) provided by very effective coal or natural gas fired plants. Therefore, dedicated incineration capacity is not so easy to locate because it will give a heat loss in the summer. Incinerators connected to paper mills do not have this disadvantage since the mills' heat/steam consumption is stable. North of Tampere, for example, the municipality has decided to build a plant next to a paper mill so that heat can be supplied directly to the paper mill (SYKE, 2007).

In Finland 49% of the households are heated by district heating systems, 74% of which is delivered by combined heating and power plants. The remaining 26% is delivered by heating plants. These plants only operate as a supplement in the coldest months of the year. The fuel consumption in production of CHP is: natural gas (33%), coal (29%), peat (18%), wood (11%), oil (5%) and other (4%). Waste is included in 'other' and is 1%. The wood component is increasing by about 10% annually at the moment. The price of district heating has almost remained stable since 1981 in constant prices (CFI, 2007).

There is no Finnish national energy plan and no co-ordination with the waste plan. This is why the majority of the energy companies want to have either their own incineration plants or at least follow carefully the changes of the waste incineration policy (CFI, 2007).

Twenty energy plants currently consider co-incinerating Refuse Derived Fuel (RDF, or REF in Finland). It is realistic to expect that 10 plants will use waste as a fuel in the coming five to seven years and they are spread quite evenly over the country. There is an increasing demand for waste as a fuel for co-incineration since the prices for other fuels are increasing. REF is partly made of municipal waste - wood, plastics, paper and cardboard and such - but mainly of waste fractions from commerce, industry and construction. Utilizing the best fractions of municipal waste at these plants depends on, for example, how many contaminated substances the waste includes, costs for the flue gas cleaning and the price or income for receiving the waste. However, REF is usually only a small fraction of the total fuel input to those plants. Waste management may need power plants, but power plants do not necessarily need REF since other alternatives, especially biofuels are available. Finland has a huge amount of biofuels (Kukkamäki and Leikoski, 2007). The existing co-incineration plants have no interest in incineration of certain industrial materials like waste tyres. Steel wires inside the material cause damage to conveyors. Bone meal from animals is another example of an unwanted waste material, since it needs special conveyors.

The energy companies are interested in co-incineration of waste from enterprises and especially of biodegradable waste, but the costs for sorting combustible waste from households are too high to make it attractive. Also, the supply volume is not stable enough and the waste not clean enough. This kind of waste might contain too much chlorine, even when it is source separated (CFI, 2007).

Incineration gate fee

The gate fee at the plant in Turku is EUR 68 per tonne (January 2007). Gate fees of co-incineration plants have varied during the years depending on the market situation. In 2004-2005 the value of RDF was about EUR 30 per tonne, i.e. the plant paid for the RDF. In 2006 the value was negative from -10 to -15 EUR per tonne (the plants received

money for the RDF). In 2007 the value is between 0 and 20 EUR per tonne, i.e. the plants get the RDF free or pay for it).

5.5. Factors related to MBT

Composting facilities struggled with technical problems during the very cold Finnish winters. This led to composting plants being built as closed systems. Anaerobic digestion was not really discussed (SYKE, 2007).

Separate collection of biodegradable waste exists in approximately 200 municipalities with 3.7 million inhabitants. Source-separation of biowaste is not mandatory, but the individual municipalities can choose to introduce it. Several municipalities have decided to implement such systems and carry the costs. Some municipalities have decided that, in housing blocks with more than ten flats, separate biowaste collection should be organised (SYKE, 2007).

The treatment includes composting and anaerobic digestion and the plants also receive sewage sludge from municipal wastewater treatment. There are very few sorting plants for biodegradable waste coming from households. There are no plants for mechanically sorting mixed MSW (MBT). But for source separated waste (paper, cardboard etc.), there are some treatment plants (production of recycled fuel used in coal power plants).

The industrial sector's waste management was easier to develop. The targets were fulfilled for biodegradable waste from enterprises (slaughterhouses, food industry, construction and demolition waste, forest sector (pulp and timber)). It is easier to handle waste from enterprises/industries since it includes a small number of actors, more waste per actor and the costs are not so large.

The quality of products from composting BMW and sludge has not been high enough. The products have not been used as nutrients or for improving the structure of farmland, i.e. a part of the open market. The products have therefore been used mainly for secondary purposes such as landscaping and for top covering at landfills.

It is important that a proper market exists for these products; quality standards for the compost might help. Since 2006, general legislation on fertilisers has been applied to biowaste and sludge based fertilizers and soil improvers. The legislation defines criteria for the use of the compost. If the sludge and biocompost fulfil the criteria set for fertilizers, then it can be used on farmland etc. If the municipalities use their own compost, they have also to fulfil the legislative requirements for fertilizing. This has enhanced the quality demand (Ministry of the Environment, 2007b).

Biological treatment capacity

Many small municipalities have waited for the larger ones to decide to establish recovery capacity for biodegradable waste, in the hope that they could join later, but no initiatives were taken (SYKE, 2007).

In 2004, a total of 216,000 tonnes of biodegradable waste was treated in composting plants. The yearly compost production capacity increased from under 100 000 tonnes in 2000 to 232 000 tonnes in 2005 and to 492 000 tonnes in 2006 (Markku and Leikoski, 2007). These figures include compost capacity for both biodegradable waste and sewage sludge. The capacity includes 28 plants with capacities between 1 000 tonnes and 49 000 tonnes.

According to the 2002 waste management plan, the number of sites for recovery of biodegradable waste was planned to increase from 4 plants in 1990, to 9 in 1995, 51 in 2002 and to 80 in 2005. By 2005 there were 35 biological recovery plants, (table 3.2.2).

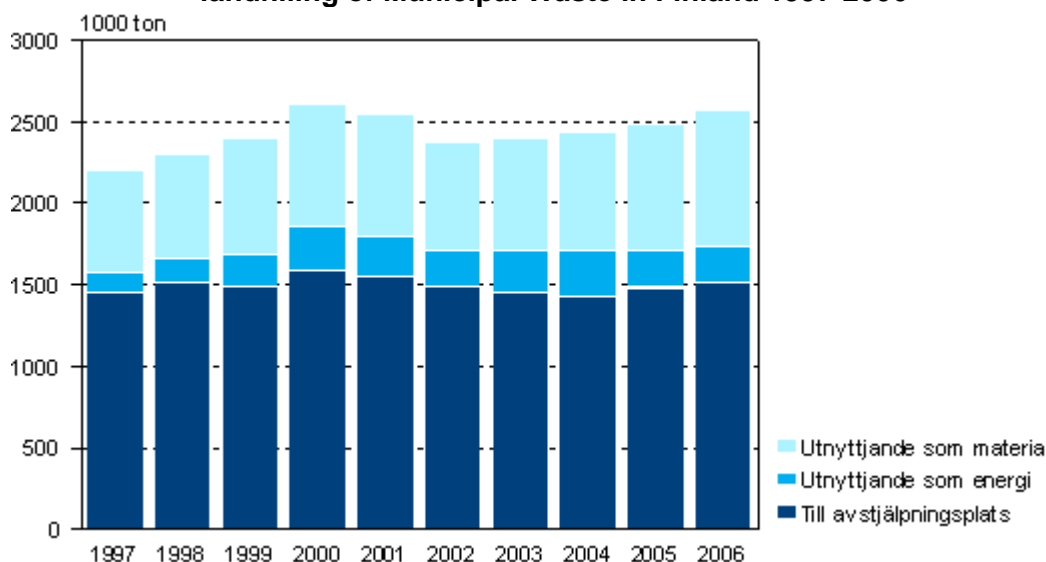
The average fee for treatment of biodegradable waste was about EUR 53 per tonne excluding VAT with a range between EUR20 and EUR100 per tonne. No tax is paid for biodegradable waste. Figure 5.3 shows that the average prices have increased more than 250% for treatment of BMW. The price level is under the landfill fee but is kept artificially lower than the real costs to promote more treatment of biodegradable waste (Leena Eränkö, 2007).

5.6. Factors related to the material recycling and recovery sector

In the late 1990s Finland had a recovered 54% of generated waste (excluding mining and agricultural waste), about average within the EU. Recovery of industrial waste (61%), waste from energy production (65%) and sewage sludge (91%) were the best performing, whereas municipal waste (38%) and construction and demolition waste (41%) were the worst performing sectors.

Regarding municipal waste Table 5.7 shows that although waste generation has increased since 1997 recycling and incineration have managed to divert waste from landfill, i.e. the amount of landfilled municipal waste has been very stable in tonnes.

Table 5.7. Generation, recycling, incineration with energy recovery and landfilling of Municipal Waste in Finland 1997-2006



Source: The figures are published by Statistics Finland in November 2007. The dark blue is landfilling, the medium blue is incineration with energy recovery and the light blue colour is recycling.

It seems that the policy measures introduced since late 1990s (for example, landfill tax and producer responsibility on paper and WEEE) have managed to avoid an increase in landfilling of municipal waste, but have been unable to reduce overall landfilling. In 2006 the recovery rate was 41,3 %, the recycling rate was 32,6% and the incineration with energy recovery was 8.7%

Packaging waste

Finland has the lowest generation of total packaging waste in the EU-15 (Table 5.8) The generation per capita is half of the EU average. The very low level of packaging waste per capita can be explained by more use of re-use packaging both in relation to transport and consumer packaging. Refilling beverage bottles has a long tradition in Finland and is encouraged by a deposit system. The deposit is not only on refillable bottles but also one

way beverages. Further, one way beverage packaging is charged a tax of EUR 0.51 per litre, which is reduced depending on the recycling rate in the return system that the one way packaging is a part of.

It was very easy to introduce the producer responsibility system for waste paper (e.g. newspapers, magazines, etc.). The packaging directive is much more difficult to deal with due to the variety of packaging types and materials. The major problem is that the producers do not have complete responsibility for the management of packaging waste. According to the Waste Act the producers are responsible for up to 61% of recycling of packaging waste. The remaining 39 % is the municipalities' responsibility. This divided responsibility makes managing the recycling of packaging waste very complicated as there is a conflict between the producer organisations and the municipalities (AEE, 2007 and Ministry of the Environment, 2007b). The municipalities are not satisfied with the shared responsibility. Municipalities do not have the same service country-wide, and the collection of packaging waste is mostly in the southern part of Finland. Finland has areas with very low population density where packaging waste is not collected (AFLRA/FSWA, 2007).

Table 5.8. Total packaging waste generation, recycling and recovery in Finland 1997-2005

Finland	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total quantities generated, 1000 tonnes	418	424	443	443	457	451	463	445	483
Total quantities generated, kg/capita	81	82	86	86	88	87	88	85	91
Total quantities recovered, 1000 tonnes	225	235	266	266	284	277	272	264	311
Total quantities recycled, 1000 tonnes	174	189	219	220	216	222	240	245	286
Total recovery rate	54	55	60	60	62	61	59	59	64
Total recycling rate	42	45	50	50	47	49	52	55	59
Paper and cardboard packaging waste recycled, 1000 tonnes	138	140	155	159	155	156	169	172	196
Paper and cardboard packaging waste recycling rate	57	57	61	62	58	61	63	70	79
Paper and cardboard packaging waste recovery rate	73	72	72	72	74	75	72	77	87

Source: EU Commission. In the total figures are included glass, metal, paper&cardboard and plastic packaging.

Tyres

The introduction of producer responsibility for used tyres and the target of 90% recovery in 2000 (see section 2.1.3) prompted the creation of Finnish Tyre Recycling Ltd by tyre manufacturers and importers in the mid 1990s.

Table 5.9 shows the development in recovery of used tyres. The amount of collected tyres increased by almost 200% between 1996 and 2006. The amount of used tyres utilized as recycling material has also increased considerably to an average recycling rate of 97%. Finland has an extremely high material recycling rate of used tyres compared with other EU Member States, and almost none are incinerated.

Tyres are an easy waste stream to deal with. The producers have the full responsibility. The main issue is to have or create a market for recycled products. In Finland, tyres are reused predominantly for construction purposes; roads, noise walls near streets, riding fields and sports areas (Ministry of the Environment, 2007b; CFI, 2007).

Attempts have also been made to incinerate tyres in the two Finnish cement kilns but this remained more or less at a pilot stage and never led to a holistic activity.

Table 5.9. Recycling and recovery of used tyres

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Average 1999- 2006
Utilization as energy	3 276	4 428	768	248	0	0	6	6	0	0	0	33
Utilization as material	357	13404	17599	27998	24792	40294	36674	29243	35261	42746	30348	33420
Retreaded tyres	1352	2223	1743	813	1386	987	1039	1329	1144	1632	1929	1282
Received tyres	15372	26140	28417	30117	32832	32306	31986	36156	37240	41773	44698	35889
New tyres sold				27710	39740	36493	38700	41435	34223	38390	42245	37367
% of received tyres related to sold new tyres				109	83	88	83	87	109	109	106	96
% recovered tyres related to received tyres	32	77	71	96	80	128	118	85	98	106	72	97

Source: Finnish Tyre Recycling Ltd, 2007

As mentioned in 5.4, the existing co-incineration plants do not want to incinerate certain industrial materials like waste tyres. Therefore, unlike some other EU countries, in Finland the incinerating and recycling industry do not compete for used tyres.

Tyre recycling is funded by a recycling fee, which is paid when new tyres are purchased. Thus it is possible for the consumers to bring their used tyres to their local tyre-dealers free of charge. In this way the fee is paid by the actual user of tyres instead of the general population paying for the costs in the form of taxation. The fee in January 2007 for passenger car tyres is EUR 1.85/each, incl. 22% VAT.

Construction and demolition waste

According to the national waste plan from 2002, in the late 1990s, 9.8 million tonnes of construction and demolition waste including surplus soil was generated, of which 41% was recovered. The plan expected the amount of construction waste to be 12 million tonnes in 2005 of which 70% is to be recovered.

In 2004 20.8 million tonnes of construction waste was generated of which 96% was mineral waste (Statistics Finland, 2007). No information is available about how much construction and demolition waste was recovered in 2004.

Construction and demolition waste is recovered by private companies. Wood, stone and metals are sorted out for recovery, while the unrecoverable share (less than 15 %) is landfilled at these companies' own landfills without paying tax. The municipalities consider this as unfair competition. However, if these private recovery facilities are forced to pay landfill taxes, a very important incentive for recycling will disappear (CFI, 2007). In the same way shredder waste from ELVs is recycled, but about 20 % is landfilled taxfree in the companies' own landfill.

Virgin material prices

High virgin material prices can provide an economic incentive to recycling of waste, since inexpensive waste materials can be used in place of expensive virgin material. Soil improvement and construction materials are especially easily substituted. Table 5.10 shows the prices of selected virgin materials that could potentially be substituted by recycled organic waste and construction and demolition waste.

Table 5.10. Prices of selected virgin materials

Virgin material prices		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
peat EUR/m ³	*	-	-	-	-	-	-	6.05	6.4	6.5	6.85	7.5
soil EUR/m ³	**	-	-	-	-	-	-	-	-	-	-	5-9
rock material EUR/t	***	0.15	-	-	-	-	0.4	-	-	-	-	0.7
gravel EUR/t	***	0.3	-	-	-	-	0.5	-	-	-	-	1
sand EUR/t	***	0.18	0.16	0.23	0.19	0.17	0.12	0.2	0.25	-	-	-

* Price without VAT and freight charge.

** The price for the producer that puts the soil on a market can be 0 - 3 EUR/m³. On the market the price may be between 5 - 9 EUR/m³ (prices without VAT and freight charge).

*** The prices are material prices when the material is in the ground, not yet excavated. The prices vary depending on the availability of the material and also on the markets and the situation where the material is bought, for example partly in exchange. Therefore no clear trend can be seen in all the prices. In northern Finland the prices are generally about 60-70 % of the price of the material in the Helsinki area.

Source: Kukkamäki and Leikoski, 2007

In general, the prices on the selected virgin materials are estimated to be quite low. Therefore, the price level of virgin materials does not seem to be a strong factor supporting recycling of construction and demolition wastes.

5.7. Factors influencing the effectiveness of a policy for diversion of BMW from landfill

On the following pages we present the favouring and hindering factors of the methodology presented in Mazzanti and Zoboli (2007) which will also be used in the comparative analysis of the five other countries and one region in the study.

The reference indicator was presented in table 5.1 and showed that Finland landfilled 65% of generated BMW in 1995. In other words, the Landfill Directive target for 2006 was already met in 1995, but not the Directive targets for 2009 and 2016.

Using the terminology in the methodology, there was not a trend of diversion from landfill (i.e. decreasing ratio 'BMW in landfill/BMW production') *before* the directive implementation but it *did* change after the implementation.

Table 5.11. Factors influencing the effectiveness of a policy for diversion of BMW from landfill

Favouring/hindering factors	Influence on diversion	Justification of the +/- sign	Indicator	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	
Factors related to BMW landfill policy																
Landfill Directive 1999/31/EC transposed	+	Legal framework in place	Dummy (1/0) If transposed no later than 2003 =1					1	1	1	1	1	1	1	1	
Landfill tariffs/gate fees for BMW or MSW (excl. VAT and landfill tax)	+	High cost of landfill	Average for country, or the highest gate fee and the lowest gate fee, % increase after transposition year		35%	80%	88%	100%	114%	118%	141%	125%	155%	163%	154%	
Landfill tax on BMW (or MSW)	+	High cost of landfill	Average for country, or the highest and the lowest tax, % of gate fee		146%	63%	58%	51%	44%	43%	36%	62%	49%	62%	65%	
Prohibition of untreated waste in landfill	+	Discourage landfill	Dummy (1/0) If implemented no later than 2005 =1													
Selective ban on BMW	+	Quantity limitation by law	Dummy (1/0) If implemented no later than 2005 =1				1(2005)	1(2005)	1(2005)	1(2005)	1(2005)	1(2005)	1(2005)	1(2005)	1(2005)	
Factors related to waste production and collection																
BMW generation	-	High production requires many management options	BMW generation per capita	410					420	377	367	363	366	374	373	
Separate collection for BMW: Split into the following fractions (if possible):	+	Basic requirement for recycling	Share of generated biodegradable waste collected separately, % of generated MSW								24%	25%	26%	26%	25%	
· paper and cardboard (incl. newspapers etc.)											14%	15%	16%	16%	16%	
· kitchen, garden and wood waste												9%	9%	9%	10%	9%
· BMW in residual waste				83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	83%	
'Full cost' collection tariffs/charges (excl. VAT and taxes)	+	Higher capacity to invest in separate collection and recovery/ recycling	Share of waste management cost covered by tariffs, %	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Favouring/hindering factors	Influence on diversion	Justification of the +/- sign	Indicator	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
Factors related to landfill sector															
Share of MSW landfilled	+	Pressure on capacity	Landfilled municipal waste over municipal waste generation, %	70%		67%	66%	60%	61%	61%	64%	61%	60%	60%	59%
Landfill residual capacity (non-hazardous waste)	-	Discourage diversion	Landfill residual capacity (non-hazardous waste), % of generated municipal waste									1986%	0%	0%	1902%
Land per capita	+	Land availability makes it a non-scarce resource	Land per capita in m2	66085	66085	65693	65536	65389	65265	65092	64949	64782	64573	64340	64079
Factors related to incineration sector															
Share of MSW incinerated	-	Low incineration rate: makes diversion more difficult	Incinerated municipal waste over municipal waste generation, %			5%	6%	8%	10%	9%	8%	9%	10%	9%	9%
Dedicated incineration capacity for MSW (available)	+	Makes diversion easier	Incineration capacity available, % of generated household waste			2.27%	2.17%	2.08%	1.92%	2.08%	2.14%	2.12%	2.11%	2.04%	1.95%
Incineration gate fees for MSW (excl. VAT and incineration tax)	-	High fee, low incentive to diversion	Average for country, or the highest gate fee and the lowest gate fee, % increase after transposition year									100%	87%	108%	145%
National policies on RES: Target for FI % in 2010	+	Targets for RES policies stimulate energy from MSW	Distance-to-target for E-RES on domestic electricity consumption, % points	3.9	6	6.2	4.1	5.2	3	5.8	7.8	9.7	3.2		
Factors related to material recycling and recovery															
Packaging and packaging waste policy (for FI)	+	Stimulates diversion	Recycling rate (recycling over paper packaging placed on the market), %			57	57	61	62	58	61	63	70	79	
MBT capacity	+	Favours diversion	MBT capacity, % of generated BMW (in 1995 for Finland)								6.7%				
Compost capacity (i.e. input of biowaste)	+	Favours diversion	Compost capacity, % of generated BMW (in 1995 for Finland)						3.7%	10.3%	11.0%			11.0%	23.4%

The information in table 5.11. is used for an evaluation of indicators for landfill policy, (table 5.12). Please be aware of the different years applied for evaluating whether an indicator is strong or weak.

Finland transposed the Landfill Directive in 1999. Since the evaluation year is three years after the transposition date, in general the evaluation is based on 2002. Table 5.12 and 5.13 are therefore based on 2002 unless figures are only available at a later year.

Table 5.12. Evaluation of indicators for landfill policy in 1999

Landfill policy	Indicator	Strong	Weak
Landfill Directive 1999/31/EC transposed	Dummy (1/0) If transposed no later than 2003 =1	1 Transposed in 1999	
Landfill tariffs/gate fees for BMW or MSW (excl. VAT and landfill tax)	Average for country, or the highest gate fee and the lowest gate fee, % increase up to 3 years after transposition (strong if > 20% increase)	1 The landfill gate fee in 2002 had risen by 41% compared to 1999	
Landfill tax on BMW (or MSW)	Average for country, or the highest and the lowest tax, % of gate fee 3 years after transposition (strong if > 50% of gate fee)		1 Assuming the landfill tax was EUR 15.15 per tonne in 2002, it was 36 % of the gate fee of average EUR 42 per tonne in 2002
Prohibition of untreated waste in landfill	Dummy (1/0) If implemented no later than 2005 =1		1 No prohibition of untreated waste exists
Selective ban on BMW	Dummy (1/0) If implemented no later than 2005 =1	1 The major part (80%) must not be landfilled. Implementation latest in 2005	
Summary evaluation		Globally strong: 3 out of 5	

Based on information in table 5.12 three of the five indicators are strong and thus the summary evaluation is 'globally strong'. In table 5.13 the favouring and hindering factors

Table 5.13. Evaluation of favouring and hindering factors in 1999

Favouring factors (+ sign)					Hindering factors (- sign)				
	Indicator	Strong if	Weak if		Indicator	Strong if	Weak if		
Related to waste production and collection									
1	Separate collection for BMW	Share of BMW collected separately of generated municipal waste, %	(>30%)	24% < 30%	1	BMW generation per capita	BMW generation, per capita tonnes	420 kg (> EU25 average)	< EU25 average
2	'Full cost' collection tariffs/charges	Share of waste management cost covered by tariffs, %	100% (> 90%)	<90%					
Related to landfill sector									
3	Landfilled MSW of MSW generation	Landfill share of municipal waste generation, %	60% >EU25 average	< EU25	2	Landfill residual capacity (non-hazardous waste)	Landfill capacity (non-hazardous), as % of household waste generated	20 years in 2003 (> 5 years of generation)	(< 5 years of generation)
					3	Land availability	Land per capita in m2	65,389 m2 (>5000)	(<5000)
Related to incineration sector									

Favouring factors (+ sign)				Hindering factors (- sign)					
	Indicator	Strong if	Weak if		Indicator	Strong if	Weak if		
4	Dedicated incineration capacity for MSW (available)	<i>Incineration capacity, as % of municipal waste generated</i>	(If capacity > 20% of generated MSW)	2% (If capacity < 20% of generated MSW)	4	Incineration gate fees for MSW (3 years after implementation)	<i>Average for country, or the highest gate fee and the lowest gate fee, EUR/tonne</i>	45% from 2003 to 2006 (> 30% increase in gate fees)	(< 30% increase in gate fees)
5	National policies on RES	<i>Distance-to-target for E-RES on domestic electricity consumption, %</i>	83% (> 50% of the 2010 target has been met)	(< 50% of the 2010 target has been met)	5	Share of MSW incinerated	<i>Incinerated municipal-waste over municipal waste generation, %</i>	(> EU25 average)	8% (< EU25 average)
Related to material recycling and recovery sector									
6	Packaging and packaging waste policy	<i>Recycling rate paper and paper-board, %</i>	61% (> 50%)	(< 50%)					
7	MBT capacity	<i>MBT capacity Per capita</i>	(> 20% of BMW generation)	7% (< 20% of BMW generation)					
8	Compost capacity	<i>Compost production capacity, tonnes/year</i>	(> 20% of BMW generation)	4% (< 20% of BMW generation)					
	Summary evaluation		4	4			4	1	
	Summary evaluation	Globally either strong or weak: 4 out of 8	Globally strong: If at least 5 strong out of 8	Globally weak: If at least 5 weak out of 8	Summary evaluation	Globally strong: 4 out of 5	Globally strong: If at least 3 strong out of 5	Globally weak: If at least 3 weak out of 5	

are evaluated. For favouring factors the summary evaluation is strong for four factors and weak for four factors. For the hindering factors the evaluation is four strong and one weak.

The summary evaluation means that the favouring factors related to waste production and collection, landfill sector, incineration sector and material recycling and recovery sector are either globally strong or globally weak, while the hindering factors are globally strong.

According to the methodology developed by Mazzanti and Zoboli (2007) the combined results of the evaluation of indicator for landfill policy and the valuation of favouring and hindering factors are related to Configuration 3 of the diversion indicator (Biodegradable Municipal Waste landfilled confer the generated amount in 1995). Further, according to the methodology we have chosen to relate the results to Combination 7 in the Configuration 3. However, this is a choice since four favouring factors are either strong or weak.

Table 5.14. Policy evaluation for Configuration 3 of diversion indicator: ‘There was not a diversion trend before the directive implementation, and a diversion trend started after the implementation’

Combination	Landfill policy change	Favouring factors +	Hindering factors -	Summary evaluation
7	Strong: <i>The existing policy was far from the directive or was already in line but its change went beyond the directive</i>	Weak	Strong	<i>Effective: an active policy has been able to create a positive trend by contrasting strong hindering factors in presence of weak favouring factors</i>

Based on the proposed methodology the interim summary evaluation shows that the policy has been ‘effective’. This could very well be due to the fact that the majority of policy measures in Finland were transposed soon after the Landfill Directive was passed in the EU in 1999. However, it is obvious that the recovery rate of BMW in Finland has not increased much since 1999, which means the interim summary evaluation of the policy must be adjusted based on further evaluation and interview with the key actors, (see also section 7.7).

6. Assessment of the status of municipal waste, tyres and C&D waste

The Finnish targets regarding municipal waste, tyres and C&D waste were listed in detail in chapter 3. The following can be said regarding the achievement of the targets.

6.1. Municipal waste

6.1.1. Generated waste

Generation of MSW in 2005 should be at least 15% lower than a scenario where MSW generation follows GDP. The GDP increased in constant prices approximately by 49% in the period 1994 to 2005 (Eurostat, 2007a), whereas the amount of generated MSW fell 50 000 tonnes to 2,450 000 tonnes (see also section 5.2). The target for MSW has therefore been fulfilled.

The target for generation of BMW was formulated in 2004. It prescribes a similar 15% reduction compared to a development in generation following the development of GDP (see Figure 3.1). The goal is 2 300 000 tonnes BMW in 2006 and 2 500 000 tonnes in 2009. Actual generation was 1 958 000 tonnes in 2005 and 1 966 000 tonnes in 2006 and therefore, the target is currently evaluated to be fulfilled.

6.1.2. Recovery of waste

The 1998 and 2002 waste management plans stipulated MSW recovery targets of 50% by 2000 and 70% by 2005. The actual recovery rate was 38% in 2000 and 41% in 2006 (see also Table 5.5). This means the targets have not been met and this failure was by a considerable margin.

The 1998 plan stipulated a target of 75% recovery of BMW by 2005. The 2002 plan changed this target to 80% recovery by 2010. The biodegradable strategy of 2004 formulates a target of 60% recovery by 2009 and 75% recovery by 2016.

The actual recovery rate of BMW was 40% by 2000 and 37% by 2006. The targets stipulated in the 1998 plan have not been met, and the actual BMW recovery level is quite far from the 2010 targets in the 2002 plan. The 2009 target formulated in the strategy from 2004 seems likely to be fulfilled since new incineration capacity will be available for 2008. The fulfilment of the 2016 target will, under all circumstances require an extra effort.

6.2. Waste Paper

The Government Decision from 1998 stipulates a recovery target of 70% by 2000 and 75% by 2005. The actual level in 2000 was 67%, in 2004 was 71% and in 2005 was 70%. (Figures are only found for total recycling rates for waste paper and not specific ones for municipal waste paper, Mia Mäki, 2006 and Paperinkeräys Group, 2006). The targets are almost fulfilled.

6.3. Used tyres

The Council State Decision in 1996 of 90% recovery by 2000 was fulfilled in 1999 and is currently about 97% on average.

6.4. Construction & Demolition Waste

In the late 1990s the recovery rate of construction and demolition waste was 41%. The targets of 50% recovery by 2000 and of 70% by 2002 according to the 2002 waste management plan seem not to have been met since no recycling data of construction and demolition waste exist to document the development.

7. Analysis of effectiveness of the policies implemented

7.1. Main actors' point of view

The different main actors involved in the biodegradable waste strategy have formulated the following explanations for the development in handling municipal waste and especially biodegradable waste during the last 10-15 years:

The Ministry of the Environment,:

- The formation of 30-40 inter-municipal waste associations in the last 15 years has been a very important step in the development of better MSW management.
- The most important measures for diverting MSW away from landfills have been higher gate fees at the landfills due to stricter requirements on landfills, the objectives of source separation, the landfill tax and a changed attitude among people.
- Insufficient MSW incineration capacity with energy recovery has been a particular hinderance in diverting waste away from landfills.
- There has been an uncertainty since 2002 about the future responsibility for MSW generated by enterprises, which may have increased the capacity problems.
- The landfill tax has given an incentive to develop special landfills for certain special waste streams not covered by the tax. It is not appropriate that the tax only includes landfills owned by the municipalities.
- The quality of products from composting BMW has not been high enough.
- If it was possible to make a fresh start, Finland should have made a more clear division of responsibility, especially in packaging waste management.

The Finnish Environment Institutet (SYKE):

- Finland has a long tradition of consensus between the main actors when making strategies, implementation etc. Despite this tradition the strategy and legislation for diverting waste, especially biodegradable waste, away from landfills has not been clear enough regarding goals, responsibility for action and deadlines.
- The overview of waste data at the national level has only recently become sufficient.
- The schemes for producer responsibility have worked well.
- The landfill tax has not influenced the waste producers as such but it has been important for giving the waste management sector an incentive to choose other options than landfilling.
- If it was possibly to make a fresh start, Finland should have had a much earlier discussion on the use of incineration with energy recovery, and the responsibilities of different actors in the waste field should have been clearer.

The Association of Finnish Local and Regional Authorities (AFLRA) and the Finnish Solid Waste Association (FSWA):

- The establishment of inter-municipal waste companies has been important in order to improve the municipal waste management infrastructure. The improvement includes high standards at the landfills.
- The national waste plan should define precise targets for municipal waste and these targets should be the same for all municipalities.
- AFLRA is of the opinion that the municipalities must have the right to decide how household waste is collected, including the possibility that each household chooses its own waste collector, whereas FSWA is of the opinion that such a system makes it very difficult to establish where the different municipal waste streams are delivered and consequently to provide sufficient recovery treatment capacity.

- The most important measure taken to divert biodegradable waste away from landfills has been the introduction of producer responsibility for waste paper, as well as source separation schemes for kitchen and packaging waste.
- The political opposition to incineration with energy recovery has meant that it has been impossible to establish sufficient recovery capacity for biodegradable waste, since recycling alone is insufficient, to reach the EU targets in the landfill directive
- If it was possible to make a fresh start Finland should have made a total ban on BMW to landfills instead of only limitations, combined with a clear message that it is the responsibility of the municipalities to provide the necessary recovery capacity.

The Finnish Energy Industries:

- Earlier, energy plants were essentially uninvolved in waste policy.
- Finland has a long tradition of effectively operating combined central heating plants. But these plants need additional heating in two to three of the coldest months of the year. Waste is interesting as additional fuel for these power plants if it is clean enough and without too much chlorine, and the supply is stable. Therefore, non-household municipal waste is the most relevant waste for the power plants.
- There is no national energy plan and no national co-ordination regarding where co-incineration of waste would be most appropriate. Twenty power plants currently consider co-incineration, but waste levels are only sufficient to feed 10 plants during the next ten years.

The Confederation of Finnish Industries (CFI),

- Few initiatives have been taken to divert biodegradable waste away from landfills.
- Much more emphasis should have been put on incineration with energy recovery.
- From June 2007, municipalities do not have the responsibility for collection and management of municipal waste from enterprises. Because enterprise generates approximately 50% of the total MSW, the new legislation will induce more private investments in recovery capacity of municipal waste.
- CFI fears the landfill tax will be extended to private landfills.
- The producer responsibility was originally opposed by CFI. But as it seems to work the attitude has become more approving. Lately, shared responsibility in packaging waste has been considered problematic by the municipalities.

The Association of Environmental Enterprises

- In the 1990s many municipal waste management co-operations were started. This helped with the effective management of landfills, but it created unfair competition between municipally and privately owned recovery plants. The municipalities support their own plants.
- The June 2007 change in the waste act in relation to municipal waste from enterprises is seen as a positive development. But there is still too much ambiguity regarding responsibilities.
- There is insufficient capacity for biodegradable municipal waste because the national waste strategies are not clear about targets and responsibilities. Further, too much municipal waste including biodegradable waste ends up in municipally owned landfills instead of being recovered.
- The shared responsibility for packaging waste does not work. It would be better that the producers had full responsibility

7.2. The responsibilities of key policy measures

The main policy measures for diverting waste away from landfills are:

- the ban and restriction on landfilling of certain waste streams,
- the biodegradable waste strategy,
- the landfill tax and,
- the producer responsibility and recovery targets on paper waste, packaging waste and tyres.

Table 7.1. gives an overview of some of the responsibilities regarding these measures and below are effectiveness discussed in more detail.

Table 7.1 Responsibilities of key policy measures

Policy measures	Responsibilities
Ban and general restrictions on landfilling of certain waste streams including tyres	The operator of the landfill has a general duty to monitor that everything transported to the landfill fulfils the quality requirements. The 13 Regional Environmental Centres are the permit authorities for the landfills and also audit the ban/restrictions.
Biodegradable waste strategy	The Ministry of the Environment formulates the policy, carries out strategic planning and prepares legislation etc. However, the targets in the strategy are only intended as a guide. The landfills are only allowed to receive waste if the majority of biodegradable content has been separately collected from the other waste. This decision was made in 1997, when the Government Decisions on landfills were adopted. There is no clear definition of “the majority”; it has been considered to relate the amount of BMW to number of persons and places of work using the landfill, but no amendment has been made yet. In practice, the municipalities and the inter-municipal Waste Co-operations have the responsibility for collection and management of MSW including the provision of sufficient capacity, but no statutory order or similar exists that legally binds the municipalities to introduce separate collection of BMW, or to build sufficient BMW recovery capacity. The responsibility applies only to total MSW capacity, not to different types of treatment. The responsibility can be fulfilled by providing landfill capacity.
Landfill tax	The municipal landfill sites collect the national landfill tax for the waste delivered. The revenue of the tax is transferred to the national authorities.
Producer responsibility	The producers/importers and their organisations have the responsibility for fulfilling the requirement including the payment. The Pirkanmaa Regional Environment Centre (PIR) acts as a national supervision authority in supervising compliance with the provisions concerning producers, producer corporations and producer responsibility. Producers provide PIR with information on products put on the market, collection of discarded products, reuse, recovery etc.

7.3. The ban and restriction on landfilling certain waste streams

This measure has been very effective in preventing the landfilling of used tyres. Combined with the producer responsibility on tyres and the recovery requirements, it has produced positive results, (See section 5.6). The measure was introduced in 1997, i.e. before the EU Landfill Directive was passed.

It has turned out to be difficult to implement the restrictions on the landfilling of BMW. The first reductions were formulated already in a Government Decision from 1997 albeit in more general terms. The 2002 management plan announced that more detailed restric-

tions would be passed in the form of a Government Decision in 2003. However, this Government decision was not passed until 2006 and came into force September 2006.

Unlike other EU countries like Denmark, the Netherlands and Sweden, Finland has not implemented a total ban on landfilling BMW. A total ban is often easier to enforce and audit, whereas restrictions or a partial ban can be more difficult to develop effective mechanisms for. The more detailed legislation, regulating landfills receiving waste from households and similar waste from industry and the service sector, prescribes that the landfills are only allowed to receive waste if the majority of the biodegradable component has been separately collected from other waste or in other ways has been delivered for recovery (Government Decision 861/1997 and 202/2006). Such a wording allows for some interpretation which might be an advantage but it also gives the possibility for quite different assessments of what is 'the majority'.

The 2004 biodegradable waste strategy announced that future levels of allowed biodegradable waste allowed to enter landfills will be related to the number of inhabitants and workplaces who use the landfill. These kinds of limitations are more similar the instruments used in for example Flanders (Belgium) and Italy. They have not yet, however, been implemented.

7.4. The Biodegradable Waste Strategy (BWS)

It took more than five and a half years to formulate the strategy, even though the EU Landfill Directive requires that such a strategy should be developed before July 2003. However, the preliminary ideas of how to divert BMW away from landfills were already formulated in the national waste management plans from 1998 and 2002.

It seems that the strategy changed focus during this process. At the beginning of the process the focus was on composting and anaerobic digestion. Later the focus shifted towards incineration with energy recovery. The latest the draft national waste management plan from January 2007 suggests different scenarios for incineration with energy recovery of MSW in 2016. It means that between 27% and 42% of the BMW is to be incinerated with energy recovery. Further, the fulfilment of the targets is postponed by six years from 2010 to 2016, refer also section 3.1.2.

This change in focus came about because composting and anaerobic digestion alone proved insufficient to meet the recovery targets of BMW. Further, the political opinion regarding incineration with energy recovery has become more positive due to the climate debate and the introduction of new stricter EU standards for emissions from incineration plants.

Altogether it seems that the recovery capacity for BMW grew only about 300 000-400 000 tonnes totally in the period from 1995 to 2006. One would have expected a more intensive establishment of extra recovery capacity of BMW. The lack of recovery capacity for BMW may be attributable to the ill-defined responsibility for the provision of such recovery capacity, perhaps aggravated by the 5 year debate on who was responsible for municipal waste from enterprise. The amendment of the Waste Act in 2007 clarified that private enterprises themselves have the responsibility for providing the sufficient recovery capacity.

Further, the municipalities are not obliged to transpose the national waste management plan into local waste management plans that are sympathetic to local conditions. This might weaken the political and administrative commitment. The only 'decentralised plans' are made in the form of regional plans made by the 13 Regional Environment Centres who are under the authority of the Ministry of the Environment; the municipalities are not, however, bound to these plans.

Another explanation why there is only a minor reduction in the amount of BMW landfilled might be that the Finnish legislation does not specifically require the municipalities to introduce separate collection schemes of BMW (the legal requirements are instead related to the receiver of the waste, i.e. the operator of the landfills). However, an obligation to introduce separate collection for BMW would not make sense if the waste will be sent to incineration with energy recovery.

In 2007-08 two new incinerators with energy recovery were started operating. The total incinerating capacity will be increased by 250 000 tonnes. The two plants will be able to reduce the amount of BMW landfilled by about 10%, i.e. that the amount of BMW landfilled as a percentage of BMW generated in 1995 (confer the EU Landfill Target) will be reduced to just under 50% and fulfil the EU requirements for 2009.

7.5. The landfill tax

The landfill tax was evaluated in a study commissioned by the Ministry of the Environment (Plancenter Ltd., 2005).

The tax on waste to municipal landfills was introduced in 1996. Between 1995 and 1997 the amount of landfilled MSW declined by about 15% (table 5.2). Since then the amount of MSW landfilled has not decreased. Thus, it seems that the landfill tax seems to have supported the policy to divert waste away from landfills to a limited degree only. The largest change has occurred in the amount of construction and demolition waste landfilled. Even the increases of the tax in 2003 and 2005 have not resulted in a major reduction of MSW landfilled.

The present level of EUR30 per tonne is low compared to landfill taxes in other EU Member States. This might explain why the tax seems not to give sufficient incentive for diverting MSW and BMW away from landfills.

7.6. Producer responsibility

Producer responsibility has been introduced for WEEE, ELV, batteries, tyres, packaging and paper. The producer responsibility on packaging, paper and tyres is most relevant in relation to the EU Landfill Directive.

Producer responsibility on tyres is extremely successful with a high amount of used tyres returned and with a very high percentage of recovery (average 96%). Further the major part of recovery is material recycling (average 93%). Compared to other EU countries it seems that there is no controversy among stakeholders regarding recycling versus incineration of used tyres. This can be explained by the fact that the existing co-incineration plants are not interested in incinerating certain industrial materials like waste tyres. Steel wires inside the material cause a lot of harms to conveyors (FEI, 2007).

The measures introduced to obtain the high recovery rates are quite simple; producer responsibility to organise the waste management of used tyres combined with an almost total ban on landfilling of used tyres and recovery targets set in a Government Decision. Recovery of the used tyres is financed by a fee which is collected from the purchaser of a new tyre.

Producer responsibility for packaging has not been very successful. It was introduced in 1995 as a voluntary agreement and later as a shared producer responsibility, where industry has the responsibility for 61% of the packaging waste and the municipalities have the responsibility for the rest. All the main actors agree that the shared responsibility is difficult to deal with. Nonetheless, total recycling of glass, paper & cardboard, metals and plastics has increased from 42% in 1997 to 60% in 2005 and the recovery rate has in the same period increased from 54% to 65%. Especially, for paper & cardboard packaging

the increase has been large, since the recycling increased from 57% to 79% and the recovery rate from 73% to 88%.

Producer responsibility on paper had a recovery target of 75% in 2005. The current recycling rate is about 71% - one of the highest in the EU.

7.7. General conclusion

Since 1998 Finland has made national waste plans covering many kinds of waste streams. A national strategy on biodegradable waste has also been elaborated, though somewhat late. Instruments like national plans and strategies are normally a prerequisite for improving waste management and in the case of Finland, it seems that the way the plans and the strategy have been implemented is very crucial for the results.

Where the responsibility for the waste management stream including planning, provision of treatment capacity, collection of the waste stream and financing is very clear, and combined with clear targets for recovery and recycling, Finland has succeeded in diverting waste from landfills (good examples are tyres, waste paper and packaging).

Where the responsibility is more divided between different actors or when the target is implemented in detailed legislation but with more general wording, as for example in the prescriptions about the permitted amount of BMW deposited on landfills, it seems that it takes much longer time to achieve the desired results. Further, it seems that it has also been necessary to change strategy and put more focus on incineration with energy recovery of BMW instead of composting and anaerobic digestion.

The interim summary evaluation of the Finnish policy in section 5.7 (table 5.14) concluded that the policy was effective. Based on further assessments and interviews made with relevant stakeholders it is reasonable to modify this interim conclusion since the policy has not been able to make real changes regarding the amount of biodegradable municipal waste diverted away from landfills. A more correct conclusion is that the Finnish policy includes many of the necessary elements but, apart from waste types with producer responsibility, the policy does not include precise wording in relation to the targets for municipal biodegradable waste streams or the responsibilities of stakeholders, including the provision of sufficient recovery treatment capacity.

8. Main findings

- Total MSW generation has declined or stabilised in the last ten years, despite an increase in population and GDP. MSW generation per capita is among the lowest in the old EU countries (EU-15), which can partly be explained by the lowest amount of packaging waste per capita among the EU-15 countries. The rate of BMW in MSW is over 80%, which is a very high rate compared to the EU average of 60%.
- Total BMW generation has decreased both per capita and absolutely in the last ten years, but the development cannot be adequately explained. However, that the data quality on BMW generation, the composition of mixed landfilled MSW and the amount of BMW landfilled, has been insufficient, would be an important component of that explanation.
- The weight of MSW recovered has doubled in the last 10 years, whereas the amount of BMW recovered has decreased slightly.
- Over the last 15 years, 39 inter-municipal waste associations have been established. This has enabled important improvements in the municipal waste management infrastructure.
- Compared with other EU countries Finland has a peculiar legal framework for collection of municipal waste from households; municipalities have the right to decide that each household chooses its own waste collector. In practice, when a household makes an individual arrangement with a private collector, it can be difficult for the municipality to control the waste streams.
- After many years of discussion it was decided in 2007 that the enterprises, and not municipalities, are responsible for the collection and treatment of municipal waste generated by enterprise. Municipalities are only responsible for the MSW of the households and public utilities like schools and hospitals etc.
- The EU Landfill Directive was transposed as early as in 1999. The Finnish landfills will meet the technical requirements in the Landfill Directive by the end of 2007, two years before the deadline.
- Waste policies and strategies were initiated before the EU Landfill Directive was passed in 1999. For example; producer responsibility on paper and tyres, shared producer responsibility for packaging, waste tax on landfilling, landfilling restrictions on certain waste streams and other initiatives which in principle should encourage recovery of BMW and MSW.
- The policies and strategies have for diversion of biodegradable waste away from landfills have shifted focus. In the 1990s focus was primarily on recycling including composting and anaerobic digestion, with no political support to incineration with energy recovery. The Finnish climate, combined with a different composition of BMW compared to other EU countries, gave rise to technical problems regarding composting plants. Therefore, from 2000 to 2005, the focus shifted toward co-incineration until it was realised that co-incineration plants must also meet the standards set by the new EU Incineration Directive. However, independent of strategy and policy focus, for those waste types not covered by producer responsibility, a lack of clarity in targets and responsibilities for establishing recovery capacity of BMW has been a problem. The municipal responsibility applies only to total MSW capacity, not to different types of treatment. The responsibility can be fulfilled by providing landfill capacity.
- The latest draft strategy from 2007 focuses on dedicated incineration plants combined with co-incineration in about 10 energy plants. It means that between 27% and 42% of BMW (MSW) is to be incinerated with energy recovery. Since at least two of these plants started operating from 2007 and 2008 it seems Finland will be able to fulfil the EU requirement that in 2009 the amount of BMW landfilled is less than 50% of the BMW amount generated in 1995.

- The main conclusion is therefore that it is not sufficient to have the right strategies, policies and legislation, if targets for each waste type and responsibilities including provision of treatment capacity are not clearly defined.

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