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Design and Application of an Innovative Composting Unit for the Effective Treatment of Sludge and other Biodegradable Organic Waste in Morocco

MOROCOMP (*LIFE TCY05/MA000141*)

Deliverable 3:

Assessment of the existing situation and the related legislation in EU in connection to BOW management

Evaluation de l'état actuel de la gestion des dechets organiques biodegradables et leur législation dans l' UE

composting MOROCOMP

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1. Introduction

The aim of this report is to present the existing situation in the European Union (EU) with respect to the management of Biodegradable Organic Waste (BOW) as well as the related EU legislative framework. Biodegradable waste is defined as any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, paper and paperboard (Council Directive 1999/31/EC).

'Council Directive 1999/31/EC on the landfill of waste (the landfill directive) places targets on Member States to reduce the quantities of biodegradable waste going to landfill. To meet these targets, Member States are obliged to set up national strategies for the implementation of the reduction of biodegradable waste that ends up in landfills.

The Waste Framework Directive (91/156/EEC amending 75/442/EEC on waste) establishes the waste management hierarchy so that Member States should take the appropriate measures for the optimization of their waste management schemes. The EU hierarchy on waste management places its priority on the reduction of produced waste and secondly on the reuse and the recovery of materials (recycling), which implies the separation of waste at source involving consumers in the scheme of waste management. Priority is given to material recycling over energy recovery. The least desirable option is disposal of waste to landfills (Gómez Palacios et al., 2002).

2. Municipal Waste Generation

The majority of biodegradable waste is part of Municipal Solid Waste (MSW). The biodegradable part of MSW is known as Biodegradable Municipal Waste (BMW). Consequently, Biodegradable Municipal Waste (BMW) is biodegradable waste that originates from households, as well as other biodegradable waste, which because of its nature and composition is similar to biodegradable waste from households (European Environmental Agency, 2002). The average amount of municipal waste generated per capita per year in many Member States of the EU exceeds 500 kg, while in 1985 it was 300 kg (European Environmental Agency, 2005). Data regarding municipal waste generation in Western European (WE) and Central & Eastern European (CEE) countries between 1995 and 2003 are presented in Table 1. It is observed that municipal waste generation rates in western Europe are higher than those of central and eastern Europe.

Table 1: Municipal waste generation in WE and CEE countries (kg per capita)

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003
Austria	437	516	532	533	563	579	577	611	612
Belgium	443	440	474	470	475	483	461	461	446
Denmark	566	618	587	593	626	664	660	667	675
Finland	413	410	447	466	484	503	465	456	450
France	500	509	516	523	526	537	544	555	560
Germany	533	542	556	546	605	609	600	640	638
Greece	306	344	372	388	405	421	430	436	441
Ireland	513	523	545	554	576	598	700	695	735
Italy	451	452	463	466	492	502	510	519	520
Luxembourg	585	582	600	623	644	651	648	653	658
Netherlands	548	562	588	591	597	614	610	613	598
Portugal	391	404	410	428	432	447	462	454	461
Spain	469	493	513	526	570	587	590	587	616
Sweden	379	397	416	430	428	428	442	468	470
United Kingdom	433	510	531	541	569	576	590	599	610
Iceland	914	933	949	967	975	993	1011	1032	1049
Norway	624	630	617	645	594	613	634	675	695
Western Europe	**476**	**499**	**513**	**518**	**546**	**556**	**560**	**575**	**580**
Cyprus	529	571	582	599	607	620	644	654	672
Chech Republic	302	310	318	293	327	334	274	279	280
Estonia	371	399	424	402	414	462	353	386	420
Hungary	465	474	494	492	491	454	452	457	464
Latvia	261	261	254	248	244	271	302	370	363
Lithuania	426	401	422	444	350	310	300	288	263
Malta	331	342	352	377	461	481	545	471	547
Poland	285	301	315	306	319	316	287	275	260
Slovak Republic	339	348	316	315	315	316	390	283	319
Slovenia	596	590	589	584	549	513	482	487	458
Central and Eastern Europe	**364**	**362**	**366**	**344**	**357**	**362**	**343**	**343**	**336**

Data Source: Eurostat, World Bank (Ref: www.eea.eu.int/coreset)

3. Biodegradable Municipal Waste

'Biodegradable waste' is any waste that can undergo anaerobic or aerobic decomposition, such as food waste, garden waste, paper and paperboard (Directive 91/156/EEC). Biodegradable Municipal Waste (BMW) is waste, generated by households and commercial activities. BMW can be biologically decomposed into a stabilized product. The waste categories of BMW include food waste and garden waste, paper and cardboard. The majority of Municipal Solid Waste (MSW) is biodegradable. Although, the proportion of BMW in MSW varies from country to country, it always constitutes the largest fraction. It is estimated that approximately 50-60% of municipal waste is biodegradable. In 1995, approximately 107 million tonnes of BMW were generated in EU plus Norway (http://waste.eionet.europa.eu/waste/)

Alternative Management Routes for BMW

The available treatment technologies are the following:

- Composting
- Anaerobic Digestion
- Thermal treatment methods of

i) Pyrolysis
ii) Gasification
iii) Incineration

There are a number of parameters that influence the applied treatment technology. Regional conditions greatly influence the chosen treatment technology in a specific area. The market for products such as compost, distribution of heat and energy, transport distances of waste, the potential of separate collection and many other issues are in the core to waste planning. Furthermore, national regulations and restrictions posed may favour material or energy recovery treatment options (European Environmental Agency, 2002).

Table 2 provides an overview of the technologies that are employed for the treatment of BMW in the European Union (EU) (European Environmental Agency, 2002). This Table is a

comparative summary of the various treatment methods with respect to efficiency, cost, environmental impacts, types of waste treated etc.

The “experience” of countries and regions that have succeeded in diverting large quantities of BMW away from landfill indicates that an integrated package of options is needed at national level to achieve high diversion rates. Countries with high rates of diversion of BMW away from landfill employ a combination of separate collection, thermal treatment, centralized composting and material recycling. Thermal treatment, mainly incineration, is generally used for the treatment of bagged waste, while composting, re-use and recycling are used for separately collected waste, such as paper and cardboard, textiles, wood, garden waste and food waste. Technologies, such as anaerobic digestion, gasification and pyrolysis are not commonly used. These technologies must be enhanced and optimized in order to have widespread use.

Table 2: Comparison of Alternative Treatment Technologies for the treatment of Biodegradable Organics (EEA, 2002)

Treatment Technologies for Biodegradable Waste	Composting	Anaerobic Digestion	Incineration	Pyrolysis	Gasification
Proven technology	Yes	Yes	Yes	Partly	Partly
Track Record	Very Common	Common	Very Common	Few	Few
Basic principle	Degradation by aerobic micro-organ.	Degradation by anaerobic micro-organ.	Combustion	Anaerobic thermo-chemical conversion	Thermo-chemical conversion
Treatment Cost	Low to High	Medium to High	Medium to High	Medium to High	Medium to very high
Suitability	Good	Good	Good	Medium	Depending on Technology
Waste Acceptance	Source separated waste only; matter and nutrients must be recovered as pure as possible	Source separated waste only; matter and nutrients must be recovered as pure as possible	All waste	Contaminated dry waste fractions	Source separated dry waste only unless combined with better cleaning technology
Acceptance of Wet household Waste	Yes	Yes	Yes	Possible but normally no	Possible but normally no
Acceptance of wet household waste	Yes	Yes	Yes	Yes	Possible

Treatment Technologies for Biodegradable Waste	Composting	Anaerobic Digestion	Incineration	Pyrolysis	Gasification
Acceptance of garden and park waste	Yes	No	Yes	Yes	Possible
Acceptance of waste from hotels and restaurants	Yes	Yes	Yes	Yes	Possible but not normal
Excluded Waste Fractions	Metal, plastic, glass	Metal, plastic glass, garden waste,	None	Wet household waste	Wet household waste
Solids Output	High	Medium-low	Medium - high	Medium	Medium
Required Air	Low	Medium	Medium-high	Medium	Medium
Required Water	Medium-high	High	High	Medium-high	Medium-high
Acceptance of paper and board waste	Small amounts of paper possible	No	Yes	Yes	Possible

Treatment Technologies for Biodegradable Waste	Composting	Anaerobic Digestion	Incineration	Pyrolysis	Gasification
Control of Odors	Bad-good	Bad-good	Good	Medium-good	Good
Working Environment	Bad-good	Medium-good	Good	Good	Good
Energy Recovery	None	Yes; 3 200 MJ/ tn waste	Yes; 2 700 MJ/ tn waste	Yes; approx. 70 % of incineration + energy contained in the by-product char	Yes; as incineration
Carbon Cycle (% of weight)	50 % in compost 50 % to air	75 % in fibres/ liquids 25 % as biogas	1 % in solids 99 % to air	20–30 % in solids 70–80 % to air	2 % in solids 98 % to air
Nutrient recovery (kg nutrient/tn waste input)	Yes; 2.5–10 kg N 0.5–1 kg P 1–2 kg K	Yes 4.0–4.5 kg N 0.5–1 kg P 2.5–3 kg K	No	No	No

Table 2: Comparison of Alternative Treatment Technologies for the treatment of Biodegradable Organics (EEA, 2002)

Treatment Technologies for Biodegradable Waste	Composting	Anaerobic Digestion	Incineration	Pyrolysis	Gasification
Products for recycling or recovery, (weight-% of waste input)	30-50% of compost	30 % fibres, 50–65 % fluids	15–25 % bottom (incl. clinker grit, glass), 3 % metal	30–50 % char (bottom ash, clinker, grit, glass) 3 % metal	15–25 % vitrified bottom ash (incl. clinker grit, glass); 3 % metal
Residuals for other waste treatment or for land filling (weight - % of waste input)	2–20 % overflow sieving (plastic, metal, glass, stones)	2–20 % overflow sieving (plastic, metal, glass, stones)	3 % fly ash (incl. flue gas residues)	2–3 % flue gas residues	2 % gas cleaning residues

4. Legislative Framework

The relevant legislative framework is presented and analysed in detail as follows:

Directive 75/442/EEC: Council Directive on waste

The Directive 75/442/EEC poses regulations regarding waste disposal. Specifically, the Directive aims at ensuring that waste is disposed of, without endangering human health and without using processes or methods, which can be proved harmful for the environment (in the stages of transportation, treatment, storage and deposition).

Directive 75/442/EEC encourages Member States (MS) to take the appropriate measures in order to prevent, recycle and treat solid waste. Thus, reclamation of raw material and energy recovery can be feasible. Moreover, MS must inform the committee for every draft rule concerning:

- The use of products, which are harmful for the environment,
- The encouragement of the reduction and treatment of waste, as well as the recovery of raw material and/or the production of energy from certain waste streams,
- The replacement of natural resources by recovered materials

The Directive also indicates that MS must establish or designate the competent authorities, which are responsible for the planning, organization, authorization and supervision of waste disposal operations. The competent authority is obliged to establish, as soon as possible, one or more waste management plants, which must integrate the type, quantity and origin of waste recovered or disposed of, any special arrangements for particular waste and suitable disposal sites or installations. These plants must also regulate the natural and legal individuals, who are responsible for carrying out the management process, estimate the cost of the recovery and disposal operations and encourage the rationalization of the collection, sorting and treatment of waste.

According to the Directive, waste must be handled by a private or public waste collector or by an enterprise, which carries out the operation, or by entities (waste holders) that ensure the recovery or disposition of waste. Every treatment facility must have a permit from the

competent authority regarding the types and quantities of waste, the technical requirements, the security precautions, the disposal site and the treatment methods. These facilities are subjected to appropriate periodic inspections by the competent authorities.

The cost of the disposal process depends on the holders, who handle the waste, as above mentioned, and/or the previous holders or the producer of the product that constitutes the source of waste. This principle is known as 'the polluter pays' principle. Finally, it is suggested that every three years, MS must compose a report on the existing situation in regard to the waste management. The report must be sent to the European Commission (EC).

Decision 76/431/EEC: Setting up a committee on waste management

The formation of the committee on waste management aims at supplying the Commission with the following proposals:

- The formulation of a policy for waste management, which will ensure the best use of resources and the safe and effective disposal of waste;
- The implementation of technical, economic, administrative and legal measures which will give priority to waste prevention, followed by waste reduction, re-use, recycling, and energy recovery;
- The implementation of Directives on waste management and the introduction of innovative proposals in this field.

The committee on waste management consists of two members of the Commission and two members from each MS. The Commission, after consulting the MS concerned, appoints the members, who are experts in the field of waste management, for a three-year period. In order to achieve its goals, the committee has to set up working groups, convened by the chairman of the committee. If the chairman considers that the suggested proposals are strongly confidential, the members of the committee on waste management are obliged not to disclose relative information. In such cases, only the committee members and representatives of the commission departments concerned must attend the meetings. During the discussion of the committee, no vote is taken and the chairman provides with proposals, related to waste management in the EC within a time frame.

Council Directive 89/369/EEC: Prevention of air pollution from new municipal waste incineration plants.

Directive 89/369/EEC obliges all MS to take necessary measures in order to ensure that the prior authorisation required to operate all new municipal waste incineration plants according to Directives 84/360/EEC and 75/442/EEC is defined regarding the conditions stated to these Directives.

The Directive 89/369/EEC presents the emission limits in the new municipal waste incinerators, as well as the conditions, according to which these plants must be designed, equipped and operated.

Council Directive 2000/76/EEC on the incineration of waste

Directive 2000/76/EEC on the incineration of waste aims to prevent or reduce, as far as possible, air, water and soil pollution caused by the incineration or co-incineration of waste, as well as the resulting risk to human health. Directive 2000/76/EEC on the incineration of waste lays down stringent limit values for air emissions and emissions for discharges of waste water from the cleaning process of exhaust gases. This Directive aims to complement Directives 89/369/EEC and 89/429/EEC concerning the operation of existing incineration facilities for municipal waste as well as Directive 94/67/EEC concerning the incineration of hazardous waste. Directive 2000/76/EEC requires (i) the attainment of a certain efficiency level for the incineration process (ii) the attainment of temperatures around 850^{o}C for the air emissions for at least 2 seconds in order to ensure the completion of the combustion process (iii) heat recovery and (iv) the operation of an automated feeding system for the input waste (Council Directive 2000/76/EC).

Article 6 of the Directive specifies the operation conditions according to which the incineration and co-incineration plants should be designed, equipped and operated. In particular (Council Directive 2000/76/EC):

- The content of Total Organic Carbon (TOC) in bottom ash and slag must be less than 3% or the loss of ignition less than 5% of the dry weight of the material.
- The temperature of the gas resulting from the process must be 850^{o}C and if the hazardous wastes contain more than 1% of halogenated organic substances, expressed in chlorine, the temperature must be raised to 1100^{o}C.
- Each line of the incineration plant must be equipped with an auxiliary burner in order

to sustain the temperature at desirable levels, as the case may be.

- An automatic system which will regulate the waste feed must be installed and operated whenever temperature is not maintained as the Directive indicates, whenever any emission limit is exceeded and at the initiation of the process until temperature reaches the specific values.

Directive 2000/76/EEC determines the following:

- The required details for the procedure of application submission and for the license issue, concerning the construction of a waste incineration plant
- The required precautions during the delivery and acceptance of waste, for the prevention or the reduction of negative effects on the environment
- The operation conditions. The incineration plants operate in a manner which ensures such a degree of incineration that the atmospheric emissions should not cause significant atmospheric pollution
- The limit values of atmospheric pollutants. The exhaust gases from the plants should not exceed specific limit values which are stringent
- The procedure of rejection of the wastewaters that are generated from the treatment process of exhaust gases
- The residue management
- The procedure of control and monitoring of the installation
- The measurements of atmospheric pollutants that are required
- The ways of accessing to the information and participation of the public
- The tackling of unusual operational conditions
- The cases of re-examination
- The procedure of report submission
- The ways of future re-adaptation of the Directive
- The penalties applied in case of non-conformance to the Directive's requirements

Council Directive 91/156/EEC amending Directive 75/442/EEC on waste

This Directive was developed in order to utilize the experience gained by the implementation of Directive 75/442/EEC. Modifications on certain rules have been realized in Directive 91/156/EEC in order to achieve environmental protection.

In Article 3, the EC presents the waste policy schedule by introducing the waste management, as a priority in EU. According to this policy, MS must take the appropriate measures, regarding the optimisation of waste disposal, giving priority to waste prevention, followed by waste reduction, re-use, recycling and energy recovery. These measures contribute to the development of "clean" technologies and products so as to eliminate the pollution level. The EC must be informed about these measures and policies.

Among others, MS have to take the appropriate measures in order to ensure that waste is recovered or disposed of, without endangering human health and using processes or methods which could be proved harmful for the environment. Particular concern must be given to water, air, soil, plants and animals in order to prevent noise and odour dispersion. Furthermore, the Directive indicates that it is essential to ensure cooperation between the MS, by establishing an integrated and completed network of waste disposal facilities, taking into consideration the available technologies. The aim of this network is to provide a self-sufficient waste disposal installation, among all MS and to enable each MS to become individually dependent.

The competent authorities, appointed by MS, are responsible for the supervision and implementation of this Directive. In order to attain its objectives, the competent authorities must organize one or more waste management plans, which must include:

- The type, quantity and region of waste recovered or disposed of,
- Specific arrangements for particular waste and
- Suitable disposal sites or installations

In addition, the competent authorities provide permits to the establishments or enterprises which carry out the operations as specified in Annex IIA and IIB of the Directive. Such permits must include:

- the types and quantities of waste
- the technical requirements
- the security precautions
- the disposal site
- the treatment method.

These permits must be granted for a specific period of time, be upgraded, be subjected to specific conditions and be refused if the proposed method of waste disposal is not effective for the environmental protection. Establishments or enterprises, which carry out their own waste disposal at the production place, or those, which recover their waste, are exempted from the permit requirements and they must be registered to the competent authority. The competent authorities adopt general rules for each activity, defining the types and quantities of waste, as well as the conditions in which the activity may be exempt from the permit requirements.

Establishments or enterprises, which want to receive permits from the competent authority have to record the quantity, the nature, the origin, the destination, the frequency of collection, the means of transportation and treatment method of waste. This information must be available to the competent authorities. The cost for the above mentioned procedures depends on the waste holder and/or on the previous holders or on the producer of the product – "source" of waste ('polluter pays' principle). Finally, every three years, MS must provide the EC with a report on the measures taken to implement this Directive.

Directive 94/62/EC: European Parliament and Council on packaging and packaging waste

This Directive aims at harmonizing national measures, concerning the management of packaging and packaging waste in order to prevent or reduce any negative environmental effects by providing environmental protection and ensuring the function of the internal market. The measures defined by the Directive aim at preventing the production of packaging waste, re-using packaging, recycling and other forms of recovering packaging waste and hence, reducing the final disposal of such waste. Moreover, the Directive covers all packaging placed on the market in the community and all packaging waste, whether it is used or released at industrial, commercial, office, shop, service, household or any other level, regardless of the material used.

Article 3 introduces terms, such as "packaging", "packaging waste", "packaging waste management", "prevention", "reuse", "recovery", "recycling", "energy recovery", "organic recycling", "disposal", "economic operators" and "voluntary agreement" which are clearly defined according to the European specifications.

Article 4 obligates MS to ensure that, in addition to the measures taken to prevent the formation of packaging waste in accordance with the current Directive, other preventive measures are implemented which must consist of national programmes or similar actions adopted, and designed to collect and take advantage of initiatives taken within MS with regards to prevention.

MS must encourage the use of packaging system, which can be reused without endangering the environment. In parallel, they must take the necessary measures to attain the following targets covering the whole of their territory:

- No later than 5 years after the date of implementation of the Directive in national law, the packaging waste must be recovered between 50% as a minimum and 65% as a maximum by weight.
- Within the same time frame MS must recycle between 25% as a minimum and 45% as a maximum by weight of the totality of packaging materials contained in packaging waste, and with a minimum of 15% by weight for each packaging material.
- No later than 10 years after the date of implementation of the Directive in national law, a percentage of packaging waste must be recovered and recycled. This percentage must be determined by the Council, in order to increase substantially the above mentioned targets.

MS must encourage, when it is considered appropriate, the use of materials obtained from recycled packaging waste for the manufacturing of packaging and other products. The measures and targets referred must be published by the MS and must be the subject to an information campaign for the public and for economic operators.

MS are also obligated to take the necessary measures in order to ensure the installation of systems which must provide:

- The return and/or collection of used packaging and/or packaging waste from the consumer, other final user, or from waste stream in order to channel it to the most appropriate waste management alternatives.

- The reuse or recovery, including recycling of the packaging and/or packaging waste collected.
- The participation of the economic operators of the sector concerned and the participation of the competent authorities.

In order to facilitate the collection, reuse and recovery (including recycling) processes, packaging must indicate the nature of the packaging materials used for the purpose of its identification and classification by the industry concerned. The EC must determine the numbering and abbreviation on which the identification system is based on and must specify which materials must be subject to the identification system in accordance to the same procedure within a year after the entry into force of the Directive. The packaging must bear the appropriate marking which must be clearly visible, easily legible, durable and lasting even when the packaging is opened.

According to the standardization, the EC must promote the preparation of European standards relating to the essential requirements referred in Annex II of the current Directive. Therefore, the EC promotes the preparation of European standards which are related to:

- Criteria and methodologies for life-cycle analysis of packaging;
- The methods for measuring and verifying the presence of heavy metals and other dangerous substances in the packaging and packaging waste;
- Criteria for a minimum content of recycled material in packaging for appropriate types of packaging;
- Criteria for recycling methods;
- Criteria for composting methods and produced compost;
- Criteria for the marking of packaging

Regarding the heavy metal concentration in packaging, MS must ensure that the sum of concentration levels of lead, cadmium, mercury and hexavalent chromium existing in packaging waste or packaging components do not exceed specific limit values. Regarding the information system the Directive indicates that MS must take the necessary measures in order to ensure that databases on packaging and packaging waste are established on a

harmonized basis, so that MS and the EC will be able to monitor the implementation of the objectives which have been set out in this Directive. These databases must provide information on the magnitude, characteristics and evolution of the packaging and packaging waste flows for each MS. MS must ensure that the users of packaging, including in particular consumers, obtain the necessary information about:

- The return, collection and recovery systems available to them;
- Their role in contributing to reuse, recovery, and recycling of packaging and packaging waste;
- The meaning of markings on packaging existing on the market;
- The appropriate elements of the management plans for packaging and packaging waste.

Finally the current Directive presents information on the following issues:

- The formulation of management plans pursuant to article 17 of Directive 75/442/EEC;
- Adoption of economic instruments by the Council in order to promote the implementation of the objectives set by the Directive. In the absence of such measures, MS may adopt measures, which are in accordance to the principles of the EC environmental policy;
- Obligation to report to the EC
- Freedom to place on the market
- Adaptation to scientific and technical progress
- Implementation of national law

The annexes attached to the current Directive are the following:

Annex I: Identification System.

Annex II: Essential requirements on the composition and the reusable and recoverable, including recyclable, nature packaging.

Annex III: Data included by MS in their databases of packaging and packaging waste.

Commission Decision 96/350/EC adapting *Annex IIA and IIB* to Council Directive 75/442/EEC on waste

Annexes IIA and IIB to Directive 75/442/EEC, on disposal and recovery operations respectively, are replaced by *Annexes IIA and IIB* to the present Decision.

Council Directive 1999/31/EC: On the landfill of waste

Council Directive 1999/31/EC of 26th April 1999 refers to the disposal of waste to landfills. The aim of the current Directive is to define measures, directions and guidance in order to prevent or reduce, as far as possible, the adverse effects of the landfill of waste on the environment, in particular on surface water, groundwater, soil, air and human health, by providing stringent operational and technical requirements on the waste and landfills.

As far as the technical characteristics of landfills are concerned, to which Directive 96/61/EC is applicable, the current Directive includes the relevant technical requirements in order to elaborate in concrete terms the general requirements of that Directive. The relevant requirements of Directive 96/61/EC must be deemed to be fulfilled, if the requirements of this Directive are satisfied.

Article 2 defines the terms “waste”, “municipal waste”, “hazardous waste”, “non-hazardous waste”, “inert waste”, “underground storage”, “landfill”, “treatment”, “leachate”, “landfill gas”, “eluate”, “operator”, “biodegradable waste”, “holder”, “applicant”, “competent authority”, “liquid waste” and “isolated settlement”.

Article 3 designates the scope of the Directive according to which:

- The Directive must be applied by the MS to any landfill;
- The Directive excludes from its scope the following issues:
  - Spreading of sludge (including sewage sludge),
  - The use of inert waste in redevelopment/restoration and filling-in work, or for construction purposes in landfills,

- The disposal of non-hazardous dredging sludge alongside small waterways from where they have been dredged out and of non-hazardous sludge in surfaces water including the bed and its sub soil,
- The disposal of unpolluted soil or of non-hazardous inert waste resulting from prospecting and extraction, treatment and storage of mineral resources, as well as, from the operation of quarries.

- MS may declare, at their own option, that the deposit of non-hazardous waste other than inert waste, which originates from prospecting and extraction, treatment and storage of mineral resources, as well as from the operation of quarries, and which are deposited in matter preventing environmental pollution or harm to human health, can be excluded from the provision in Annex I, points 2, 3.1, 3.2 and 3.3 of this Directive.

Directive 1999/31/EC divides landfills into three classes:

- Landfill for hazardous waste
- Landfill for non-hazardous waste
- Landfill for inert waste

Moreover, the Directive requires from the MS to:

- Set up a national strategy for the implementation of the reduction of biodegradable waste going to landfills in a specific interval of time by means of recycling, composting, biogas production or materials/energy recovery, and notify the Commission of this strategy.
- Ensure that this strategy fulfils the following targets:
  - In 2006, BMW going to landfills must be reduced to 75 % of the total amount of BMW produced in 1995, for which standardised Eurostat data are available;
  - In 2009, BMW going to landfills must be reduced to 50 % of the total amount of BMW produced in 1995 for which standardised Eurostat data are available;
  - In 2016, BMW going to landfills must be reduced to 35 % of the total amount of BMW produced in 1995 for which standardised Eurostat data are available.

Countries, such as Greece and United Kingdom, where more than 80% of the waste ended up at landfills in the reference year (1995) gained a 4-year extension in order to reach the aforementioned targets. The above mentioned countries are formulating their strategies by placing targets for the years 2010, 2013 and 2020.

- According the Directive the following waste is NOT accepted in landfills:
  - liquid waste;
  - flammable waste;
  - explosive or oxidising waste;
  - hospital and other clinical waste which is infectious;
  - used tyres, with certain exceptions;
  - any other type of waste which does not meet the acceptance criteria laid down in Annex II.

Also the Directive prohibits the dilution of the waste mixture in order to meet the waste acceptance criteria.

MS are obliged to take the necessary measures so that waste is accepted in the different types of landfills. Analytically, the Directive indicates that:

- Landfilling of waste must take place only when it has been previously treated. This provision does not apply to inert waste for which treatment is not technically feasible, nor to any other waste for which such treatment does not contribute to the aim of this Directive;
- Hazardous waste is assigned to hazardous landfill only when it fulfils the criteria set out in accordance with Annex II;
- Landfill for non-hazardous waste can be used for:
  i. Municipal waste;
  ii. Non-hazardous waste which fulfils the criteria for the acceptance of waste at landfill for non-hazardous waste set out in accordance to Annex II;

iii. Stable, non-reactive hazardous waste with leaching behaviour equivalent to those of the non hazardous waste referred in point (ii), which fulfils the relevant acceptance criteria set out in accordance to Annex II. This hazardous waste is not deposited in cells destined for biodegradable non-hazardous waste;

- For inert waste, only inert waste landfill sites must be used

In *Article 7*, the Directive sets up a system of operating permits for landfill sites. An application for a permit must contain the following information:

- The identity of the applicant and, in some cases, of the operator;
- A description of the types and total quantity of waste, which are authorised to be deposited in the landfill;
- The capacity of the disposal site;
- A description of the site;
- The proposed methods for pollution prevention and abatement;
- The proposed operation, monitoring and control plan;
- The plan for closure and after-care procedures;
- The applicant's financial security;
- An impact assessment study, which is required under Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment.

Following a successful application for a permit, this information must be made available to the competent national and Community statistical authorities, when requested for statistical purposes.

Article 8 presents the measures that MS must take in order to meet the conditions of a landfill permit:

- The competent authority does not issue a landfill permit, unless it is satisfied that:

- The landfill project complies with all the relevant requirements of this Directive, including the Annexes;
- The management of the landfill site will be in the hands of an individual who is technically competent to manage the site; professional and technical development and training of landfill operators and staff are provided;
- The landfill must operate in such a manner that the necessary measures are taken to prevent accidents and limit consequences;

- The landfill project is in line with the relevant waste management plan or plans referred in Directive 75/442/EEC;
- Prior to the commencement of disposal operations, the competent authority must inspect the site in order to ensure that it complies with the relevant conditions of the permit. This will not reduce in any way the responsibility of the operator under the conditions of the permit.

Article 9 specifies the content of the landfill permit which must state the following:

- The class of the landfill;
- The list of defined types and the total quantity of waste, which are authorised to be deposited in the landfill;
- Requirements for the landfill preparations, landfilling operations and monitoring and control procedures, including contingency plans, as well as provisional requirements for the closure and after-care operations;
- The obligation on the applicant to report at least annually to the competent authority on the types and quantities of waste disposed of and on the results of the monitoring programme.

With regard to the cost of the landfill of waste, *Article 10* indicates that MS must take measures to ensure that all of the costs related to the setting up and operation of a landfill site, including, as far as, possible the cost of the financial security or its equivalent referred to in Article 8(a)(iv), and the estimated costs of the closure and after-care of the site for a period of at least 30 years must be covered by the price to be charged by the operator for the

disposal of any type of waste in that site. MS shall ensure transparency in the collection and use of any necessary cost information.

Article 11 mentions the measures that MS must take in order to accept waste at the landfill site. According to this article:

- Before or at the time of delivery, or of the first in a series of deliveries, provided the type of waste remains unchanged, the holder or the operator must show, by means of the appropriate documentation, that the waste in question can be accepted at that site according to the conditions set in the permit, and that it fulfils the acceptance criteria set out in Annex II;
- The operator must comply with the following reception procedures listed above:
  - checking of the waste documentation
  - visual inspection of the waste at the entrance and at the point of deposit and, as appropriate, verification of conformity with the description provided in the documentation submitted by the holder.
  - keeping a register of the quantities and characteristics of the waste deposited, indicating origin, date of delivery, identity of the producer or collector in the case of municipal waste, and, in the case of hazardous waste, the precise location on the site. This information shall be made available to the competent national and Community statistical authorities, when requested for statistical purposes.
- The operator of the landfill site must always provide written acknowledgement of receipt of each delivery accepted;
- If waste is not accepted at a landfill, the operator must notify the competent authority of the non-acceptance of the waste.

Moreover, *Article 11* obliges MS to provide the necessary measures for landfill sites, which have been exempted from provisions of this Directive, as indicated below:

- Regular visual inspection of the waste at the point of deposit in order to ensure that only non-hazardous waste from the island or the isolated settlement is accepted at the site; and

- A register on the quantities of waste that are deposited at the site be kept.

MS shall ensure that information on the quantities and, where possible, the type of waste going to such exempted sites forms part of the regular reports to the EC on the implementation of the Directive.

In Article 12, Directive 1999/31/EC mentions that MS must attend all the control and monitoring procedures in the operational phase in order to meet at least the following requirements:

- The operator of a landfill site must implement a control and monitoring program during the operational phase as specified in Annex III;
- The operator must notify the competent authority of any significant adverse environmental effects revealed by the control and monitoring procedures and follow the decision of the competent authority on the nature and timing of the corrective measures to be taken. These measures must be undertaken at the expense of the operator.

All monitoring results must be reported to the competent authorities in order to demonstrate the compliance with the permit conditions and increase the knowledge on waste behavior at the landfill sites. The frequency of the reports is being determined by the competent authorities. The quality control of the analytical operations of the control and monitoring procedures and/or of the analyses is carried out by competent laboratories. Referring to the closure and after-care procedures of the operations, *Article 13* indicates that MS must take the necessary measures which must be in accordance, where appropriate, with the permit conditions:

- A landfill site or part of it must start the closure procedure:
  - when the relevant conditions stated in the permit are met; or
  - under the authorization of the competent authority, at the request of the operator
  - after justified decision of the competent authority;
- A landfill or a part of it may only be considered as definitely closed after the competent authority:

- has carried out a final on-site inspection,
- has assessed all the reports submitted by the operator and
- has communicated to the operator its approval for the closure.

- After a landfill has been definitely closed, the operator is responsible for its maintenance, monitoring and control in the after-care phase for as long as may be required by the competent authority, taking into account the time during which the landfill could present hazards.
- The operator shall notify the competent authority of any significant adverse environmental effects revealed by the control procedures and shall follow the decision of the competent authority on the nature and timing of the corrective measures to be taken;
- The operator of the landfill site is responsible for monitoring and analyzing landfill gas and leachate from the site and the groundwater regime in the vicinity of the site in accordance to Annex III, for as long as the competent authority considers that a landfill is likely to cause a hazard to the environment,

Provisions are also foreseen for landfill sites, which have already been granted by a permit, or which are already in operation at the time of transposition of this Directive. According to *Article 14*, MS may not continue to operate the existing landfill sites, unless the steps outlined below are accomplished within eight years after the Directive enters into force:

- The operator of a landfill shall prepare and present to the competent authorities, for their approval, a conditioning plan for the site and any corrective measures, which the operator considers will be needed in order to comply with the requirements of this Directive with the exception of the requirements in Annex I, point 1;
- Following the presentation of the conditioning plan, the competent authorities shall take a definite decision on whether operations may continue on the basis of the mentioned conditioning plan and this Directive. MS shall take the necessary measures to close down, as soon as possible the sites, which have not been granted by a permit to continue to operate;

- On the basis of the approved site-conditioning plan, the competent authority shall authorize the necessary work and shall lay down a transitional period for the completion of the plan.

MS are obliged to send a report to the EC at intervals of three years, on the implementation of Directive 1999/31/EC, paying particular attention to the national strategies. On the basis of these reports, the EC must publish a Community report on the implementation of the Directive. Any amendments necessary for adapting the Annexes to this Directive to scientific and technical progress and any proposals for the standardization of control, sampling and analysis methods in relation to the landfill of waste shall be adopted by the EC, assisted by the Committee established by *Article 18* of Directive 75/442/EEC and in accordance to the procedure set out in *Article 17* of this Directive.

The following Annexes are included in the Directive:

Annex I: General requirements for all classes of landfills

Annex II: Waste acceptance criteria and procedures

Annex III: Control and monitoring procedures in operation and after-care phases

Council Resolution 97/C 76/01 on a Community strategy for waste management

This regulation is a review of the Community strategy for waste management and a valuable guideline for matters to be addressed throughout the EU in the waste sector.

According to this Resolution, the Council of the EU:

i) Considers that:

- Legislative, economic and technical progress has been achieved in waste treatment;
- Community policy on waste management must be guided primarily by the need for a high level of environmental protection having also, in mind the potential benefits and costs of action or lack of action and the functioning of the internal market.
- In accordance to the polluter pays principle and the principle of shared responsibility, all economic actors, including producers, importers, distributors and consumers, bear

their specific share of responsibility as regards the prevention, recovery and disposal of waste;

- The producer of product must have a strategic role and responsibility in relation to the waste management potential of a product through its design, content and construction;
- The minimisation of the production and hazardous properties of waste must be first priority of all rational waste policy
- Efforts must be made in the waste prevention strategy by improving the environmental dimension of technical standards, by reducing the presence of dangerous substances where less dangerous alternatives are available, by the use of eco-audit schemes and scientific data, and by promoting changes in consumption patterns by means of consumer information and education;
- Community standards on emissions from incineration installations to air, water and soil should be strictly respected. As for the existing incineration plants, monitoring measures must be envisaged
- Only safe and controlled landfill activities must be carried out throughout the Community
- Council Regulation No 259/93 is an important legal instrument to the supervision and control of shipments of waste within, into and out of the European Community and must be fully implemented in all its provisions

ii) Notes:

- The increasing concern of the population regarding waste-related problems throughout the EU
- The need for a comprehensive waste policy in the Community
- The importance of statistics in the identification of waste-related problems, the assessment management priorities and the formulation and implementation of realistic objectives within the framework of waste management policies
- The need for adequate waste-related data on regular basis
- The need for promoting waste recovery with a view to reducing the quantity of waste for disposal and saving natural resources, in particular by reuse, recycling, composting and recovering energy from waste;

- The need for appropriate Community criteria for waste recovery operations, particularly energy recovery operations, in order to provide for a level playing field in the waste sector
- The need for the minimization of waste disposal
- The conclusions related to the priority waste streams programme initiated by the EC
- The concern of MS at the large-scale movements within the Community of waste for incineration with or without energy recovery;
- The importance of appropriate waste management planning at all competent levels including local and regional levels and, where appropriate, cooperation between MS;

iii) Calls on:

- EC and MS to ensure the implementation and enforcement of Community legislation on waste management and to intensify their cooperation in this regard;
- EC, in cooperation with MS, to intensify its efforts to develop agreed terminology and definitions in order to facilitate the achievement of a greater degree of harmonization in the application of Community legislation and to consider the need for review of the European Waste Catalogue (EWC) and the Hazardous Waste List with a view to improving operational effectiveness;
- EC to establish, in cooperation with the European Environment Agency and MS, a Community-wide reliable system of data collection for waste, which should be based on common terminology, definitions and classifications and should operate at the lowest public and private cost;
- EC to further develop the design, content and construction of products and to ensure that the responsibilities of the different economic actors are translated into practical action, taking into account the specific characteristics of each product group and the need for flexibility of implementation;
- EC to promote and the MS and economic operators to establish and pursue quantitative targets of an indicative nature which aim to achieve significant reductions in the amount of waste generated and increased levels of reuse, recycling and recovery;

- EC to consider and report to Council the additional actions which might be taken at Community level to promote waste prevention
- EC to collect information on those environmentally dangerous substances and materials in waste which cause special problems in MS and to bring forward recommendations for measures to deal with these problems;
- EC to promote the development and application of life-cycle analyses and eco-balances and to disseminate information generated by the use of such instruments in order to assist in the identification of future waste management priorities;
- EC and MS to promote return, collection and recovery systems;
- EC and MS to take concrete action in order to promote markets for recycled products that comply with Community requirements;
- EC to bring forward as soon as possible a proposal for a Directive on landfills to achieve this objective;
- The MS to take the necessary measures to ensure to the fullest practicable extent that old landfills and other contaminated sites are properly rehabilitated;
- EC to develop, as soon as possible, an appropriate follow-up to the priority waste streams programme
- EC to further explore whether and how other waste streams should be dealt with at Community level;
- EC to examine the possibility of simplifying the administrative procedures of Regulation (EEC) No 259/93, without lowering the level of environmental protection, with a view to improving the efficiency of the control system
- The MS to increase and improve cooperation, in particular in the field of illegal shipments and the fight against environmental crime;
- EC to consider the scope for the amendment of Community legislation in relation to the incineration of waste with energy recovery in order to address this concern, and to present appropriate proposals;
- The MS to use a broad range of instruments, including economic instruments in order to achieve the waste policy objectives;

- The MS to orientate their waste management policies in order to realize the opportunities arisen on growth, competitiveness and employment, the job creation potential that the protection of the environment, may have;
- EC to report to the Council on the progress made in the areas covered by this resolution.

iv) Recognizes:

- The continuous growth of waste generation, despite the efforts during the last few years
- The need to distinguish more clearly between waste and non-waste goods and between operations which are waste recovery activities and those which are disposal activities;
- That at present and until scientific and technical progress is made and life-cycle analyses are further developed, reuse and material recovery must be consider as preferable environmental options
- The importance of Community criteria concerning the use of waste, in particular as a fuel or other source of energy;
- The need to establish an adequate and integrated network of disposal facilities, as envisaged by Council Directive 91/156/EEC amending Directive 75/442/EEC on waste;
- That the protection of the environment, and in particular a coherent and sound waste management policy contribute on growth, competitiveness and employment as well as job creation potential;
- The need for appropriate support for small and medium-size enterprises in order to encourage responsible waste management policies;

Commission Decision (1999/412/EC) concerning a questionnaire for the reporting obligation of MS pursuant to Article 41(2) of Council Regulation (EEC) No 259/93

According to Council Regulation no 259/93 of February 1993, MS are obliged to report annually on the supervision and control of shipment of waste within, into and out of the European Community. Commission Decision 1999/412/EC attaches a questionnaire related

to Regulation 259/93, which must be used by MS in order to supply information to the EC, on annual basis. This information must be transmitted before the end of each calendar year for the previous calendar year.

The questionnaire contains questions related to the Council Regulation (EEC) No 259/93 on the:

- Control and shipment of waste listed in Annex II to the Regulation
- Measures taken to prohibit generally or partially shipments of waste between MS
- Measures taken to object systematically to shipments of waste between MS
- Exceptions to the implementation of the principle of proximity, priority for recovery and self-sufficiency
- Objections to planned shipments
- Directions of competent authorities having jurisdiction over specific recovery facilities not to raise objections concerning shipments of certain types of waste to a specific recovery facility
- MS' system for the supervision and control of shipments of waste within their territory
- Illegal traffic of waste
- Financial guarantees or equivalent insurance covering costs for shipment of waste covered by this Regulation, including cases referred to in *Articles 25 and 26*, and for disposal or recovery
- Customs posts designated by MS for shipments of waste in and out of the Community

Commission Decision (2000/532/EC) of 3 May 2000 replacing Decision 94/3/EC establishing a list of waste pursuant to Article 1(a) of Council Directive 75/442/EEC on waste and Council Decision 94/904/EC establishing a list of hazardous waste pursuant to Article 1(4) of Council Directive 91/689/EEC on hazardous waste.

The EWC classifies waste materials and categorises them according to what they are and how they were produced. The Commission Decision 2000/532/EC re-enlists and recasts the EWC in order to increase the transparency of the listing system and to simplify existing

provisions, it is considered to establish one Community list which integrates the list of waste laid down in Decision 94/3/EC and that of hazardous waste laid down in Decision 94/904/EC.

Commission Decision (2000/738/EC) of 17 November concerning a questionnaire for Member States reports on the implementation of Directive 1999/31/EC on the landfill of waste.

The Commission's Decision 2000/738/EC questionnaire on the implementation of Directive 1999/31/EC on the landfill of waste is based on *Article 15* of the same Directive according to which MS are obliged to send to the EC a report on the implementation of the Directive.

This questionnaire comprises two types of questions. The first type concerns questions relevant to the transposition into national law and the second one to the implementation of the Directive. Among others the questionnaire includes questions relevant to:

- The national strategy development on the reduction of biodegradable waste going to landfills.
- Which waste are classified at national level as biodegradable waste and which waste as BMW
- The annual amount of the BMW generated
- The annual amount of BMW and other biodegradable waste going to landfills

It, also, includes a table which, must be completed with the number of the existing landfills in accordance to the landfill classes (hazardous waste, non-hazardous waste, inert waste) and in accordance to the:

- Total number of existing landfills
- Number of these landfills, which comply with the Directive
- Number of landfills closed
- Number of landfills re-equipped
- The rest capacity

Regulation (EC) No 2150/2002 of the European Parliament and of the council of 255 November 2002 on waste statistics

The objective of this Regulation is to establish a framework for the production of Community statistics on the generation, recovery and disposal of waste. Those statistics exclude radioactive waste which is already covered by other legislation.

MS must acquire the necessary data for the specification of the characteristics listed in Annexes I and II by means either of:

- Surveys,
- Administrative or other sources, such as the reporting obligations under Community legislation on waste management,
- Statistical estimation procedures on the basis of samples or waste-related estimators, or
- A combination of these means.

Enterprises of less than 10 employees must be excluded from surveys, unless they contribute significantly to the generation of waste.

MS must produce statistical results following the breakdown set out in Annexes I and II.

According to Annex I on the generation of waste, section 1 covers:

- Waste generated by households.
- Waste arising from recovery and/or disposal operations.

Section 2 of Annex I produces statistics on the waste categories.

Section 3 of Annex I describes the characteristics for the waste categories, as also the regional characteristics.

Section 4 of Annex I presents the reporting unit used for all waste categories (1,000 tonnes of wet waste and for the waste categories ‘sludge’ an additional figure for dry matter must be provided) and for regional characteristics (percentage of the population or dwelling).

Section 5 of Annex I presents the first reference year and its periodicity.

The first reference year is the second calendar year following the entry into force of this regulation. MS must provide data for every second year after the first reference year.

Section 6 of Annex I informs that the produced results must be transmitted within 18 months of the end of the reference year to Eurostat.

Section 7 of Annex I describes the report on the coverage and quality of statistic data collected. MS must submit a quality report, indicating the degree of precision for the collected data. A description must be given on the estimations, aggregation, or exclusions, and the way these procedures affect the distribution of waste categories.

Finally, in Section 8 of Annex I the results compiled by sections, divisions, groups and classes are presented.

Annex II on the recovery and disposal of waste, presents the following sections:

Section 1 presents the recovery and disposal facilities for which statistics are to be compiled, excluding the facilities whose waste treatment activities are limited to the recycling of waste on the site where the waste was generated.

Section 2 categorises waste for which the statistics are to be compiled, according to each recovery or disposal operation.

Section 3 presents the characteristics for which the statistics are to be compiled on recovery and disposal operations

Sections 4, 5 and 6 present the reporting unit used for all waste categories, the first reference year and the periodicity of each report, and the transmission of the statistic results to Eurostat respectively.

Sections 7 and 8 describe the reports on the coverage and quality of statistic data collected and the production of the results respectively.

Annex III presents the waste statistical nomenclature by classifying waste into hazardous and non-hazardous, including:

- Spent solvents
- Acid, alkaline or saline waste
- Used oils
- Spent chemical catalysts
- Off-specification chemical waste
- Unused explosives

- Mixed chemical waste
- Chemical deposits and residues
- Industrial effluent sludge
- Radioactive waste
- Health care and biological waste
- Metallic waste
- Non-ferrous metal waste and scrap
- Non-metallic waste
- Discarded equipment
- Animal and vegetal waste
- Mixed ordinary waste
- Common sludge
- Mineral waste
- Solidifies, stabilised or vitrified waste

Commission Decision (2001/118/EC) of January 2001 amending Decision 2000/532/EC as regards the list of waste

The aim of the current decision is to re-enlist and recast the EWC in order to increase the transparency of the listing system and to simplify existing provisions. The enforcement of the new EWC took place on January 1st 2002.

Proposal for a Directive of the European Parliament and of the Council on waste (2003/731/EC)

The purpose of proposal 2003/731/EC is to undertake a codification of Council Directives 75/442/EEC and 91/156/EEC (amending75/442/EEC) on waste. This codification aims at the simplification and clarification of the Community law in order to make it clearer and more accessible to the ordinary citizens, thus giving them new opportunities and the chance to make use of the specific rights it gives him.

Besides the two annexes on waste categories and disposal operations (presented also in Directive 91/156/EEC), the proposal also introduces two new annexes. Annex III displays the repealed Directives with their successive amendments and the list of time limits for transposition into national law while Annex IV shows the correlation table between Directive 75/442/EEC and the current proposal articles.

5. Existing Situation in the EU

5.1 Biodegradable Organic Waste Generation in Europe

The landfill Directive (1999/31/EC) sets out clear targets and a clear time framework for reducing the absolute amount of BMW, being diverted to landfills. Clear targets have been set on the basis of 1995 generation data for each country, provided that reliable data, or at least agreed data, is available for BMW generation in 1995 in accordance to the requirements of the Directive. The impact of future growth in BMW generation is that larger quantities of BMW will require treatment other than landfill. It is, therefore, essential that, as part of its national strategy, each country sets up a monitoring and management system that will allow it to track BMW generation and management on continuous basis. Such a system would make the link between generation of BMW, its subsequent management and the final destination or use of materials, such as compost, produced during its management. Monitoring should be conducted on continuous basis so that instruments and strategies in use to divert BMW away from landfill are regularly audited and checked for their relative effectiveness and remedial action is taken where necessary (European Environmental Agency, 2002). Eurostat has conducted a preliminary evaluation of its standardised data on household and municipal waste and has developed a set of statistics for EEA member countries. The preliminary data is presented in Table 3, along with supporting footnotes and remarks.

Table 3: Baseline data for BMW (Eurostat, 2006)

Country	**Year**	**MW produced**	**BMW produced**	**BMW landfilled**
		Ktn	Ktn	Ktn
Austria	1995	2664	1495	302
Belgium	1995	2890	1671	623
Denmark	1995	2787	1813	205
Finland	1994	2100	1664	1085
France	1995	36200	15746	5988
Germany	1995	18300	5859	2502
Greece	1997	3900	2613	2324
Ireland	1995	1503	990	903
Italy	1996	25960	9170	6821
Netherlands	1995	7105	4830	1365
Norway	1995	2722	1572	1069
Spain	1995	2834	1985	1481
United Kingdom	1997	25980	16366	14675

Table 4 provides an overview of waste paper and paperboard generation in the various countries that provided data for the years 1998-2003.

Table 4: Waste paper and paperboard

Country	1998	1999	2000	2001	2002	2003
	Ktn	*Ktn*	*Ktn*	*Ktn*	*Ktn*	*Ktn*
Belgium	823	876	865	877	862	
Germany		6944	7263	7550	8590	
Spain		4236	4402	4444	4443	
France	6650	6676	6823			
Ireland	642		849	804	846	
Cyprus	129	134	139	143		
Lithuania			217			
Hungary	785	884	560	670	699	
Malta					27	31
Netherlands	2184	2292	2281	2257		
Austria		724				
Slovakia			222			

Source: Eurostat http://epp.eurostat.ec.europa.eu

Table 5 provides an overview of organic materials waste generation in the various countries that provided data for the years 1998-2003.

Table 5: Organic materials waste

Country	1998	1999	2000	2001	2002	2003
	Ktn	*Ktn*	*Ktn*	*Ktn*	*Ktn*	*Ktn*
Spain		11196	11634	11745	11743	
Cyprus	181	187	194	199		
Lithuania			543			
Hungary	1348	1343	1662	1697	1317	
Malta					112	130
Netherlands		3237	3188	3199		
Austria		712				

Source: Eurostat http://epp.eurostat.ec.europa.eu

Table 6 provides an overview of food and garden waste generation in the various countries that provided data for the years 1998-2002.

Table 6: Food and Garden Waste

Country	**1998**	**1999**	**2000**	**2001**	**2002**
	Ktn	*Ktn*	*Ktn*	*Ktn*	*Ktn*
Belgium	1886	1836	1868	1845	1894
France	9263	9403	9692		
Ireland	460		528	578	575
Lithuania			543		
Hungary	1348	1343	1662	1697	1317
Malta					
Netherlands	3169	3140	3075	3065	
Slovakia			648		

Source: Eurostat http://epp.eurostat.ec.europa.eu

5.2 BMW management in Europe

BMW landfilling varies widely from one country to another. This means that some countries, such as Denmark, Austria and the Netherlands, have already reduced their reliance on landfill to the point that the targets set by the Directive have been effectively met. Other countries, such as Italy, United Kingdom and Ireland, still send most of their BMW to landfills and have a long way to go to reach the respective targets.

It is, therefore, important to document the practices in countries with low level of BMW ending up at landfills so that other countries can benefit from this information, when preparing and formulating their own strategies.

Figure 1 provides an overview of BMW waste management practices in the countries and regions surveyed. This gives an indication of the range and extent of practices applied. For instance, countries such as Denmark, the Netherlands, Belgium and Austria that have low reliance on landfill, apply a combination of incineration, composting and recycling to handle the generated BMW. Reliance on landfill for the management of BMW ranges from as low as 5 % in Denmark to over 80 % in the United Kingdom and Ireland.

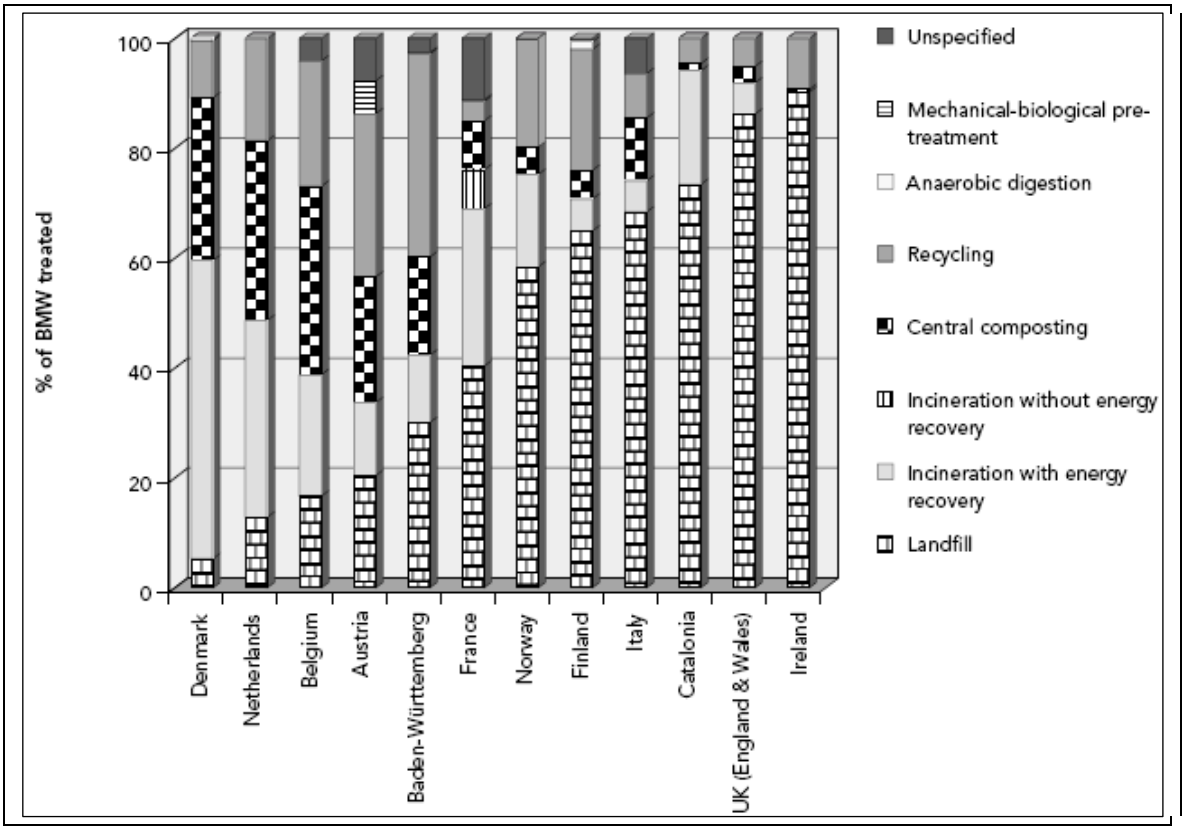

Figure 1: Management of BMW in countries and regions surveyed (EEA, 2002)

Information on BMW management practices and strategic approaches to the management of BMW was collected initially from the European Topic Centre on Waste (ETC/W) consortium countries (Austria, Denmark, Ireland, Spain and Germany) using a questionnaire. The intention was to gather sufficient information so that the stream of BMW (i.e. the amount being produced, how it is collected and how it is managed) could be described for each country. Information on strategic approaches to the management of BMW was also gathered so that the instruments used could be evaluated in respect to their relative success in diverting BMW away from landfill.

Following analysis of the information received from the consortium countries/regions, a simplified version of the questionnaire was prepared and sent out to each EEA National Reference Centre for Waste (NRC/W) asking for summary information on BMW flows, along with information on the various strategies and instruments employed for the management of BMW. In several cases, the information supplied was insufficient to enable

analysis and requests for further information and clarifications were made (EEA, 2002). More specific information regarding certain European countries follows.

5.2.1. Austria

Austria has a legal obligation to collect biodegradable waste separately, which is then composted. Packaging waste must also be separately collected and reused or recovered. In larger construction projects the biodegradable waste must be separated. Landfills may only accept waste, which has been pre-treated by incineration in order to attain a TOC of less than 5% or has undergone biological mechanical treatment (European Commission, 2005). A total amount of 33 millions tonnes of biodegradable waste constitutes the potential for direct reuse, material recycling or organic treatment, through composting, anaerobic digestion, mechanical biological co-treatment, etc. Only about 11% (3.7 millions tonnes) may be addressed as organic waste in a narrower sense for biological waste treatment (http://ecn2.wwkunden.de/index.php?id=50). Table 7 provides an overview of the BMW waste management practices for the years 1995 and 1996.

Table 7: Summary BMW waste flow for Austria (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Other (unspecified BW)**	**TOTAL**	**%**
	1995						
Landfill	298000					302000	**20.2**
Incineration with Energy Recovery	203900			6100		210000	**14.0**
Composting		346000		600		346600	**23.2**
Recycling			406000	13300		432300	**28.9**
MBT before Landfill	92500					92500	**6.2**
Unspecified	5600				106000	111600	**7.5**
	40 %	**23%**	**27%**	**1.3%**	**7%**	**1495000**	
1996							
Landfill	317500				4500	322000	**20.4**
Incineration with Energy Recovery	203300			6700		210000	**13.3**
Composting		360000					
Recycling			439000	14600	13500	467100	**29.7**
MBT before Landfill	94000					94000	**6.0**
Unspecified	10200				111000	121200	**7.7**
	39.7%	**22.8%**	**27.9%**	**1.4%**	**8.2%**	**1575000**	

5.2.2. Germany

According to the German legislative framework, the landfilling of BMW has been banned since June 2005. As a result, the demands of the Landfill Directive have been already satisfied in Germany. German law provides a general separate collection obligation. BMW is separately collected and composted. Waste wood may not be landfilled. Packaging waste is collected and recovered to a high extent. Numerical data referring the management of BMW in Germany for the years 1995 and 1998 is provided in the following tables.

Table 8: Summary BMW waste flow for Germany (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Packaging**	**TOTAL**	**%**
	1995						
Landfill	2486399	15650				2502049	**42.7**
Incineration with Energy Recovery	690222					690222	**11.8**
Biological Treatment	135873	792430				928303	**15.8**
Recycling	785611		733446	120200	12100	161357	**28.2**
Unspecified	15650	86664				102314	**1.7**
	70.2%	**15.2%**	**12.4%**	**2%**	**0.2%**	**5858595**	
1998							
Landfill	1683473	21203				1704676	**30.2**
Incineration with Energy Recovery	690567	2091				692658	**12.3**
Biological Treatment	968	1008069				1009037	**17.9**
Recycling	1140395		811062	120300	23900	2095657	**37.1**
Unspecified	6000	141256				147256	**2.6**
	62.4%	**20.7%**	**14.3%**	**2.1%**	**0.5%**	**5649284**	

5.2.3. Belgium (Flanders)

Belgium has submitted regional strategies for the Flemish Region. No strategy was submitted for the Brussels Region.

The Flemish Waste Management Plan provides further reductions by banning the landfilling of some waste, such as unsorted household waste, waste collected for recovery and the combustible fraction (with a TOC of more than 6%) (European Commission, 2005).

Table 9 presents the biodegradable waste generation and management options for the years 1995 and 1998 in Belgium.

Table 9: Summary BMW waste flow for Belgium (Flanders) (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill	528907	19723	179	2450	71260	622519	**37.2**
Incineration with Energy Recovery	493815	4302		1601	22135	521853	**31.2**
Composting		264812		6825		271637	**16.3**
Recycling			198849	8352		207201	**12.4**
Reuse		46572		1326		47898	**2.9**
	61.2%	**20%**	**12%**	**1.3%**	**5.5%**	**1671108**	
	1998						
Landfill	237666	14680		3812	65503	312661	**16.7**
Incineration with Energy Recovery	381627	6686		74	36700	425087	**22.1**
Composting		651602		8321		659923	**34.3**
Recycling		829	391271	45938		438038	**22.8**
Reuse		79357		237		79594	**4.1**
	32.2%	**39.1%**	**20.4%**	**3.0%**	**5.3%**	**1924304**	

5.2.4. Spain

In the last 10 years, the Spanish waste generation rate has raised 70% to the current generation rate of 17,175,186 tons of MSW per year. That is equivalent to 1.2 Kg/habitant/year. Currently, roughly 74% of the waste is being landfilled, 13% is being composted and 11.6 % is being recycled (http://ecn2.wwkunden.de/index.php?id=44). Table 10 provides an overview of the BMW management practices for the years 1995 and 1998.

Table 10: Summary BMW waste flow for Spain (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper**	**Wood**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill	1480609					1480609	**74.6**
Incineration with Energy Recovery	417608					417608	**21.0**
Composting							
Mass Composting	62157					62157	**3.1**
Recycling			23388			23388	**1.2**
Unspecified	1150					1150	**0.1**
	98.8%		**1.2%**			**1984912**	
1998							
Landfill	1536340					1536340	**73.4**
Incineration with Energy Recovery	433326					433326	**20.7**
Composting		9096				9096	**0.4**
Mass Composting	18108					18108	**0.9**
Recycling			95942			95942	**4.6**
Unspecified							
	94.9%	**0.5%**	**4.6%**			**2092812**	

5.2.5. Denmark

The Danish waste hierarchy is the basis for the priorities of waste management: recycling ranks higher than incineration with energy recovery and landfilling ranks lowest. In Denmark incineration does not count as recycling.

Waste 21, the Government's plan for the Danish waste policy up to year 2004, envisages a change of focus resulting in more efficient and sound waste management in Denmark. One of the key principles of Waste 21 is to have more types of waste collected and treated separately and to develop new methods to treat waste (Danish Ministry of Environment and Energy, 1999).

Organic domestic waste is a resource which today is not utilised sufficiently in composting or bio-gasification. Bio-gasification has tradition in Denmark and has very high priority for organic domestic waste, as both energy and fertiliser contents of waste are recovered.

Composting, mostly garden waste and home composting, is still a suitable way of treatment to utilise the fertiliser contents of waste (http://www.mst.dk/homepage/).

A full-scale pilot project with 12,000 households in several municipalities is launched in the Copenhagen region to gain further documentation and demonstration of bio-gasification. The project will be located in a number of municipalities with separate collection of organic household waste and treatment at centralised biogas plants co-digesting manure and organic waste. The experiences of this project will influence the organic waste strategy for the next years. Denmark distinguishes between garden and park waste and household waste (kitchen and food waste separated at source). Theses plants treat 37,000 tons of organic household waste and 615,000 tons of garden and park waste (the latter means a recycling quota of 98%). The composting plants produced 388,000 tons of compost in 1999. Denmark has already reached the last reduction target by banning the landfilling of waste that can be incinerated. Table 11 provides an overview of the BMW management practices for the years 1995 and 1998.

Table 11: Summary BMW waste flow for Denmark (EEA, 2002)

Management route	**BMW collected**	**Food**	**Paper**	**Garden**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill	178745			25839		204584	**11.3**
Incineration with Energy Recovery	1006026			11606		1017632	**56.1**
Composting		34000		378736		412736	**22.8**
Anaerobic Digestion		5000				5000	**0.3**
Recycling			173330			173330	**9.6**
Unspecified							
	65.3%	**2.2%**	**9.6%**	**22.9%**		**1813283**	
1998							
Landfill	81846			23869		105715	**5.3**
Incineration with Energy Recovery	1080346			9120		1089466	**54.3**
Composting		42000		552546		594546	**29.6**
Anaerobic Digestion		9000				9000	**0.4**
Recycling			208486			208486	**10.4**
Unspecified							
	57.8%	**2.6%**	**10.4%**	**29.2%**		**2007213**	

5.2.6. Finland

In Finland there is at present only one MSW (50,000 t/y) incinerator in operation. The Finnish MSW strategy is based on the source separation of waste for fuel production and separate biodegradable treatment. The biodegradable treatment is mainly based on composting. In addition, there is one anaerobic digestion plant in Finland, which treats about 25,000 tons of biodegradable waste and 15,000 tons of sludge annually. In year 2002 about 140,000 tons of biodegradable were treated in biological treatment plants (about 15% of the total amount of organic waste) (EEA, 2002)

Table 12 presents the biodegradable waste generation and management options for the years 1994 and 1997 in Finland.

Table 12: Summary BMW waste flow for Finland (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1994						
Landfill	928000				156800	1084800	**65.2**
Incineration with Energy Recovery	50000					50000	**3.0**
Composting		70000				70000	**4.2**
Anaerobic Digestion							
Recycling			392000		67200	459200	**27.6**
Unspecified							
	58.7%	**4.2%**	**23.6%**		**13.5%**	**1664000**	
				1997	**Packaging**		
Landfill	1153400		382	245	1391	1155418	**64.9**
Incineration with Energy Recovery	80000		385	5790	17996	104171	**5.8**
Composting		93376				93376	**5.2**
Anaerobic Digestion	25000					392376	**22.0**
Recycling			349824	19320	23316	25000	**1.4**
Unspecified					9413	10320	**0.6**
	69.2%	**5.3%**	**19.7%**	**1.4%**	**2.4%**	**1780745**	

5.2.7. France

France has already met the targets for 2006 and 2009. Since 2002 only 'final waste', (waste that can not be treated under the current technical and economic conditions) may be accepted at landfills. Paper recycling will be increased, due to the new targets for recovery of packaging waste. The development of separate collection schemes for biodegradable waste is included in many regional waste management plans. Several regional waste management plans provide new incineration plants (European Commission, 2005).

Table 13: Summary BMW waste flow for France (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill	5854855	133500				5988355	**38.0**
Incineration with Energy Recovery	4273331	5000				4278331	**27.1**
Incineration without Energy Recovery	1628866	5300				1634166	**10.4**
Composting	1030361	516000				1546361	**9.8**
Anaerobic Digestion	43119					385844	**2.4**
Recycling	165844		220000			43119	**0.3**
Unspecified		1870200				1870200	**11.9**
	81.5%	**17%**	**1.5%**			**15746376**	
	1998						
Landfill	6608614	133500				6742114	**40.3**
Incineration with Energy Recovery	4784806	5000				4789806	**28.6**
Incineration without Energy Recovery	1192955	5300				1198255	**7.1**
Composting	973432	516000				1489432	**8.9**
Anaerobic Digestion	71625					585625	**3.5**
Recycling	48568	60000	454000			48568	**0.3**
Unspecified		1870200				1870200	**11.2**
	81.5%	**15.7%**	**2.8%**			**16724000**	

5.2.8. Italy

Italy has already met the target for 2006. Through economic measures, including an ecotax, the price of landfilling will be increased, which will lead to further reduction of landfilling. An increase in separate collection of organic waste is foreseen, in particular, in the southern regions. New incineration installations will be constructed. There are landfill bans for high and medium risk animal by-products and organic healthcare waste [European Commission, 2005]. Data regarding the generation and management of BMW in Italy for the years 1996, 1997, 1998 is provided in the following table.

Table 14: Summary BMW waste flow for Italy (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper**	**Wood**	**Bulky**	**TOTAL**	**%**
	1996						
Landfill	6820890					6820890	**74.4**
Incineration with/without Energy Recovery	493076					493076	**5.4**
Composting	328718	376100				704818	**7.7**
Anaerobic Digestion							**6.3**
Recycling			576490			576490	
Unspecified	575256					575256	**6.3**
	89.6%	**4.1%**	**6.3%**			**9170530**	
	1997						
Landfill	6586207					6586207	**68.4**
Incineration with/without Energy Recovery	544042					544042	**5.7**
Composting	494584	598342				1092926	**11.4**
Anaerobic Digestion							
Recycling			782484			782484	**8.1**
Unspecified	618230					618230	**6.4**
	85.5%	**6.4%**	**8.1%**			**9623889**	
	1998						
Landfill	6347005					6347005	**62.9**
Incineration with/without Energy Recovery	598619					598619	**5.9**
Composting		891150				891150	**8.8**
Anaerobic Digestion							
Recycling			1000993			1000993	**9.9**
Unspecified							
	68.8	**8.8**	**9.9**			**10092409**	

5.2.9. Netherlands

Holland has already accomplished the last reduction target. Most of the municipal waste is incinerated. Home composting is encouraged. Targets are set for the separate collection of organic waste. The landfilling of separately collected biodegradable waste has been banned. Incineration of waste outside of installations is prohibited. Regarding the management of separately collected biodegradable waste, composting and fermentation are the preferred options. Table 15 provides an overview of the BMW management practices for the years 1995 and 1998 (European Commission, 2005).

Table 15: Summary BMW waste flow for Netherlands (EEA, 2002)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill	1265000	110000				1365000	**27.3**
Incineration with Energy Recovery	1255000					1255000	**24.2**
Composting		1575000				1575000	**34.1**
Anaerobic Digestion							
Recycling			735000			735000	**14.8**
Unspecified							
	51.1%	**34.1%**	**14.8%**			**4930000**	
1998							
Landfill	605000	95000				700000	**12.8**
Incineration with Energy Recovery	1940000	10000				1950000	**35.8**
Composting		1780000				1780000	**32.7**
Anaerobic Digestion							
Recycling			1015000			1015000	**18.6**
Unspecified							
	46.8%	**34.6%**	**18.6%**			**5440000**	

5.2.10. United Kingdom (England and Wales)

The United Kingdom takes advantage of the possibility given by the Landfill Directive to postpone the attainment of the targets for four years. In order to attain the targets the waste disposal authorities will be allocated allowances for the landfilling of biodegradable waste. Recovery and recycling targets are set for packaging waste. These allowances are tradable. Regional strategies have been developed for England, Scotland, and Wales (European Commission, 2005). Table 16 provides an overview of the BMW management practices for England and Wales for the years 1995 and 1998.

Table 16: Summary BMW waste flow for United Kingdom (England and Wales)

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1996						
Landfill	11550000	2225000			900000	14675000	**89.7**
Incineration with Energy Recovery	750000					750000	**4.6**
Composting		282000				282000	**1.7**
Recycling			625000			625000	**3.8**
Unspecified							
	75.3%	**15.4%**	**3.8%**		**5.5%**	**16332000**	
1998							
Landfill	11750000	2500000			1000000	15250000	**86.2**
Incineration with Energy Recovery	1000000					1000000	**5.7**
Composting		525000				525000	**3.0**
Recycling			864000			864000	**5.1**
Unspecified							
	72.2%	**17%**	**5.1%**		**5.7%**	**17639000**	

5.2.11. United Kingdom (Scotland)

The main option for waste disposal in Scotland is landfill, with 7.9 million tonnes deposited in 2003. BMW accounted for 1.8 million tonnes (23%) of this total. The target for the amount of BMW sent to landfill is 1.32 million tonnes by 2010, falling to 880,000 tonnes by 2013, and 620,000 tonnes by 2020 [Scottish Office Statistical Bulletin, 1996].

The Landfill tax was introduced in 1996 in order to discourage the disposal of waste at landfill. The tax rate was increased to £18 per tonne for biodegradable waste in 2005/2006, and will continue to rise by £3 each year until it reaches £35 per tonne [Scottish Environment Protection Agency, 2003]

The recycling and composting rate for Scottish local authorities was 12.1% in 2003/2004. This rate has risen significantly in the last two years (2002/2003 and 2003/2004) and preliminary data for the first three quarters of 2004/2005 indicate that this trend will continue. Despite this, 2003/2004 data suggest that local authorities need to double the quantity of waste they recycle and compost to meet the Scottish Executive's target.

Figure 2 shows the annual recycling and composting rate for the period 1989 to 2003/2004 compared with the Scottish Executive's target for 2006 [Scottish Environment Protection Agency, 2003].

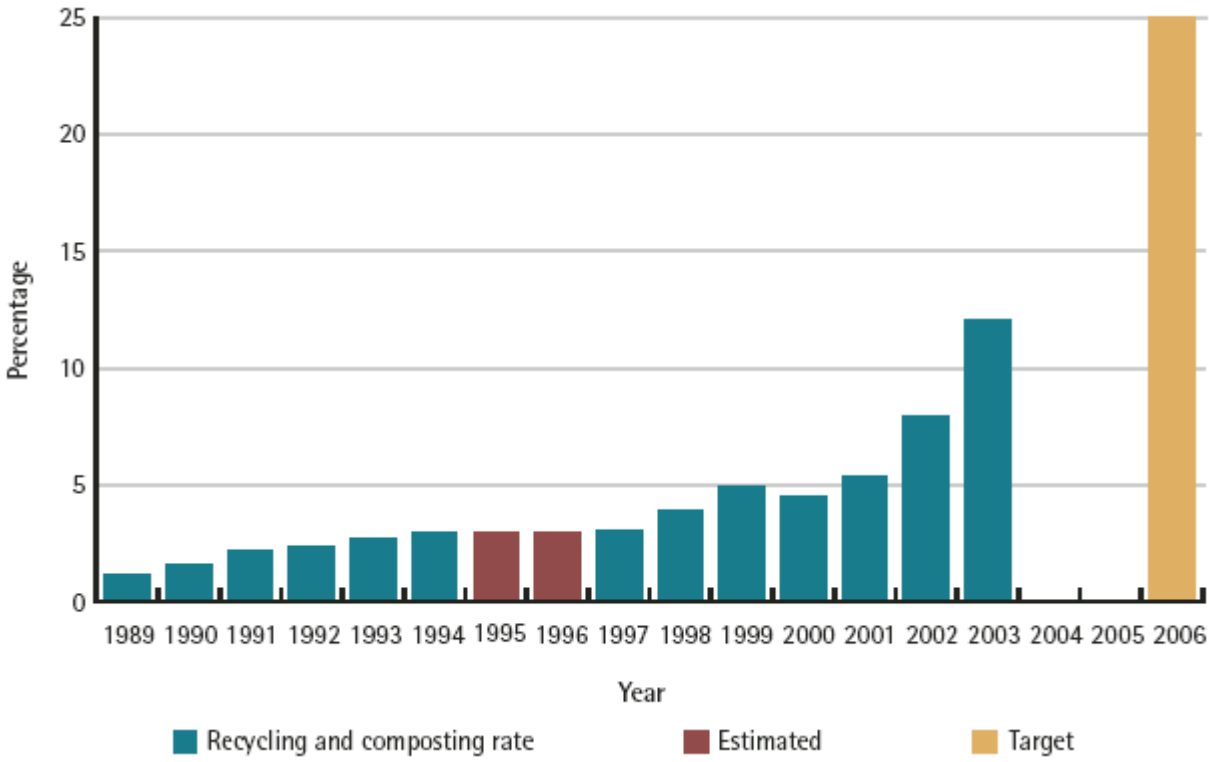

Figure 2: Annual average recycling and composting rate for Scotland 1989–2003

The quantity of BMW landfilled by local authorities has dropped slightly over the last four years from 1.90 million tonnes in 2000/2001 to 1.79 million tonnes in 2003/2004. It is presently below the target for 2005/2006, but exceeds the target for 2006/2007 by 284,000

tonnes. To calculate the BMW in the years before 2003/2004, it has been assumed that 63% of the waste landfilled was biodegradable. A more accurate mass balance calculation has been used to provide the data for 2003/2004 [Scottish Environment Protection Agency, 2003].

Figure 3 shows the quantity of biodegradable waste landfilled by Scottish local authorities compared with the Scottish Executive's target for 2005/2006 and 2006/2007.

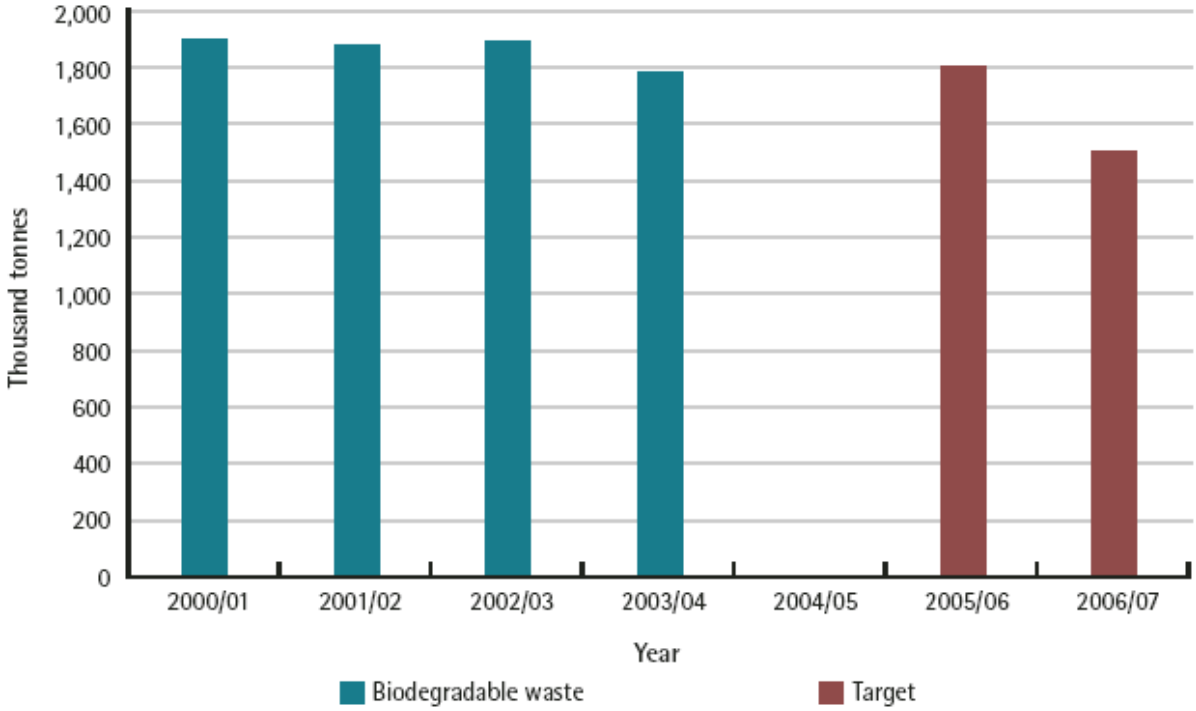

Figure 3: Biodegradable waste landfilled by Scottish local authorities 2000 to 2004

5.2.12. Ireland

Ireland is in the process of developing an integrated waste management system, moving away from the traditional reliance on landfill disposal. Performance in terms of waste recycling and recovery is improving. It should be noted that in the case of Ireland, the quantities of the generated waste are continually increasing.

Table 17 present details of the generation and management of the various categories of BMW in 2003 and 2004.

Table 17: BMW Generation and Management in Ireland

Material (tonnes)	Gross Quantity Available	Landfill	Recovered	Rate
2003				
Paper/ Cardboard	812 038	453 160	358 878	44.2%
Textiles	148 253	144 790	3 463	2.3%
Organic Waste	753 083	705 775	47 308	6.3%
Wood	142 132	13 836	128 296	90.3%
Total	**1 855 505**	**1 317 561**	**537 944**	**29.0%**
2004				
Paper/ Cardboard	821 903	446 306	375 597	45.7%
Textiles	157 521	146 986	10 535	6.7%
Organic Waste	780 460	696 955	83 505	10.7%
Wood	175 330	14 180	161 150	91.9%
Total	**1 935 214**	**1 304 426**	**630 788**	**32.6%**

Source: Derived from the National Waste Database, 2003, 2004, taking account of improved information and knowledge accumulated by the EPA since original publication.

'Organic' or 'putrescible' household and commercial waste and other BMW, such as green waste, currently account for approximately 83,505 tonnnes of BMW material composted in Ireland in 2004 (EPA, National Waste Report, 2004).

There were sixteen composting facilities in operation in the Republic of Ireland at the end of 2003, with four further facilities located in Northern Ireland. Windrow composting remains the main composting technology used in Ireland followed by in-vessel and aerated systems. All facilities are working at near full capacity and significant expansion is underway with several new facilities in the process of seeking authorisation and / or under development.

There are currently three centralised Anaerobic Digesters operating in the Republic of Ireland, with a fourth operating in County Fermanagh. The three plants operating in the Republic of Ireland, at Ballymacarbery, Co. Waterford; Adamstown, Co. Wexford; and the

Camphill Community in Kilkenny have focussed on farm waste since their commissioning, while the latter two still operate solely from the use of viable farm wastes as their bio-matter source. The AD plant in Ballymacarbery has been performing trials on the biodegradable fraction of both MSW and commercial / industrial waste [Environment Department of Ireland, 2004].

Table 18: Summary BMW waste flow for Ireland

Management route	**BMW collected**	**Food**	**Paper**	**Wood**	**Bulky**	**TOTAL**	**%**
	1996						
Landfill	902712					902712	**91.4**
Composting		30				30	
Recycling			84000			84000	**8.6**
	91.4		**8.6**			**986742**	
1998							
Landfill	1049005					1049005	**90.5**
Composting		5664				5664	**0.5**
Recycling			94302	10000		104302	**9.0**
	90.5%	**0.5%**	**8.1%**	**0.9%**		**1158971**	

5.2.13. Norway

In Norway the source separation of biodegradable waste started in the 1990s motivated by a landfill ban and a state tax on end disposal of waste. The landfill ban for easy degradable organic waste was first proposed by the authorities in a report to the Parliament in 1992, but a country wide ban was not effective until 2001. A specific final disposal tax was introduced in 1999 and its amount is argued as being the socio-economic costs for landfilling not covered by regular landfill fees.

These measures have motivated many of the municipalities to include biological waste treatment in their waste management plans. Today most regions either have introduced source separation of biodegradable waste or incinerate the biodegradable waste together with other residual waste from households. Only a few municipalities are combining source separation of biodegradable waste with residual waste incineration.

Source separation

Source separation of biodegradable waste has been introduced for 61% of the population (2.8

millions) and about 140,000 tonnes were collected (2002). Biodegradable waste in Norway consists in most regions of 90 - 100 % kitchen waste, including kitchen waste of animal origin. Only 25 % of the population have a collection system for garden waste, among the rest many may deliver it at the local recycling station. About 84,000 tonnes of garden waste from households was registered in 2002.

Home composting

Many municipalities allow their citizens to compost their own organic waste in home composters. In return for not having to collect the waste, the municipality may grant the household a reduction in the waste collection fee and/or a reduced price for certified compost bins. There are no national statistics on the use of home composting in Norway, but in many municipalities about 5-10 % of the households have a home composting contract with their municipality.

Centralised biological treatment

In 2001 approximately 40 centralized biological plants treated 298,000 tonnes of organic waste (including amendment). Composting is the dominating technology. In 2003 there were only plants using anaerobic biogas technology. Among the aerobic treatment plants, the majority of the plants are small plants operating in open facilities, using turned windrows or static piles. Local farmers operate some of the small facilities. Approximately 10 plants have closed, using vessel technology. The largest plant, situated outside Stavanger, has a design treatment capacity of 28,000 tonnes/year.

Table 19: Summary BMW waste flow for Norway

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
	1995						
Landfill						1068693	**68.0**
Incineration with Energy Recovery						282889	**18.0**
Composting						15716	**1.0**
Recycling						204309	**13.0**
						1571607	
1997							
Landfill						914500	**59.0**
Incineration with Energy Recovery						263500	**17.0**
Composting						77500	**5.0**
Recycling						310000	**20.0**
						1550000	

5.2.14. Greece

Greece will postpone the attainment of the targets by four years. Greece has set up a system for the separate collection and recovery of packaging waste. Biomechanical treatment plants and/or energy recovery plants will be constructed where economically and technically feasible. The regional plans have to be updated and include the measures to reach the reduction targets set in the national plan. Operators of new and existing landfills must select a solution for the pre-treatment of the waste [European Commission, 2005]. Table 19 provides an overview of the BMW waste management practices in 1997.

Table 20: Summary BMW waste flow for Greece

Management route	**BMW collected**	**Food & Garden**	**Paper & Paperboard**	**Wood**	**Bulky**	**TOTAL**	**%**
1997							
Landfill						2324100	
Incineration with Energy Recovery							
Composting		31500				31500	**1.2**
Recycling			257400			257400	**9.9**
		1.2%	**9.9%**			**2613000**	

5.2.15. Sweden

Since 2002 it is not allowed to landfill combustible waste and since 2005 it is not allowed to landfill organic waste in Sweden. There is a landfill tax as well. Altogether, this means that the recycling of organic waste is promoted and the capacity of biological treatment is increasing. About 35% of the Swedish municipalities have separate collection of biodegradable household waste with central treatment. 344,500 t of organic waste (105,000 t household and restaurant waste and 239,500 t green waste) was recovered in 2004 [Swedish Association of Waste Management, 2005].

Most composting plants (approximately 100) are rather small (<5000 t/a), while only about 25 composting plants are considered to be large. 12 anaerobic digestion plants are working and several new large scale AD plants are planned. Mechanical-biological-pre-treatment is out of discussion in order not to disturb the growing composting business (http://ecn2.wwkunden.de/index.php?id=41).

5.2.16. Czech Republic

In the Czech Republic 41.5 million tonnes of different wastes are generated annually. Biological degradable part of industry and energy waste is 11 % or 2.1 million tonnes. Biological degradable part of agricultural waste is 82 % or 5.7 million tonnes. Annual agricultural production of solid organic manure is 11.8 urine – 6.3 and slurry – 8.6 million tonnes. These organic manures (in total 26.7 million tonnes) are not included into the agricultural waste.

MSW is 4.5 million tonnes annually or near 11 % of the total waste. Biological degradable part of MSW is 60% or 2.7 million tonnes. More than half of municipal waste disposal in the Czech Republic is still largely dependent upon landfilling. Today 55% of total MSW are landfilled, mainly without any pre-treatment and 23.3 % of MSW are combusted as mixed municipal waste, while source separation and recycling averaged 21.7 % of national MSW generation. It means that more than 220,000 tonnes of BMW are composted annually, 380,000 tonnes of paper from municipal biowaste are recycled and 630,000 tonnes are combusted as the mixed communal waste. Although the new legislation doesn’t allow disposing waste to landfills without pre-treatment, there is no usual to pre-treat waste before landfilling.

In the Czech Republic there are 10 biogas plants, which use the agricultural waste as raw materials. They have the annual total capacity of 200,000 tonnes. There is no biogas plant for MSW treatment. At the same time, it is seeking to build up biogas plants for treatment of separated communal bio-waste. Mechanical-biological pre-treatment of residual solid municipal waste has not yet been carried out. The rest waste is deposited on degasification dumps as mixed municipal waste.

5.2.17. Switzerland

Although not a Member State of the EU, the examination of the case of Switzerland is interesting. In Switzerland, some 1.3 million tonnes of organic waste are generated every year. 740,000 tonnes are processed in the country's 333 composting and anaerobic digestion plants with an annual capacity exceeding 100 tonnes / year, while 300,000 tonnes is reckoned to be recycled in private gardens and on neighbourhood compost heaps. Nevertheless, further 250,000 tonnes or so still finds its way into the MSW incinerators along with the normal domestic refuse.

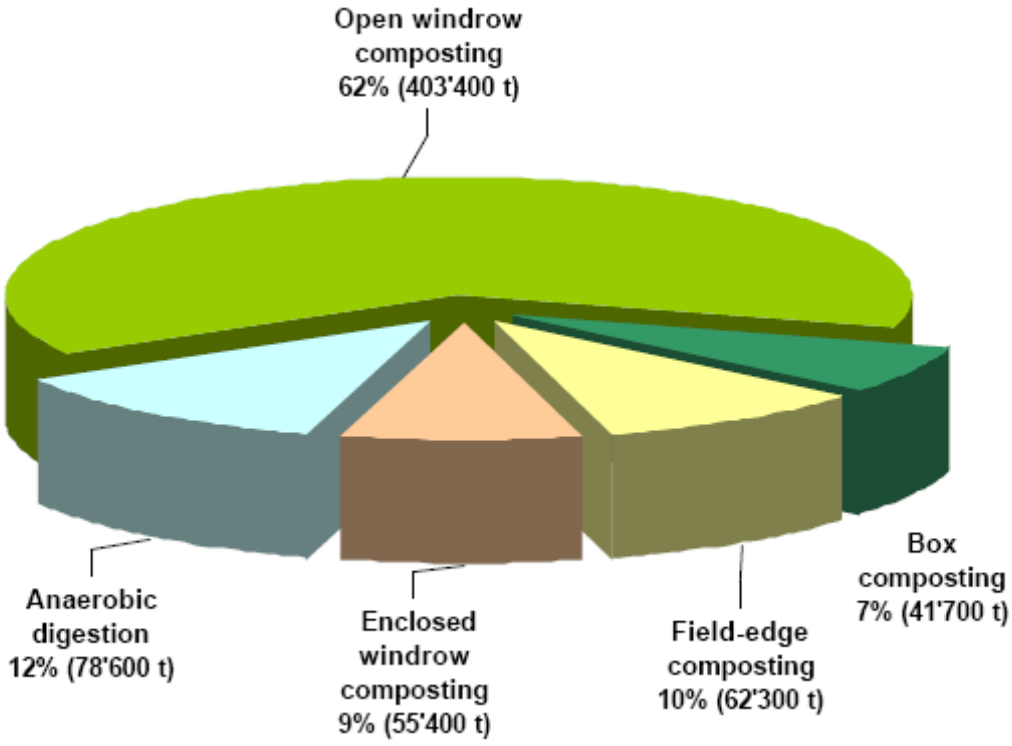

Figure 4: Treatment of BMW in Switzerland (2000)

In 2000, most of the 641,400 tonnes of biodegradable waste collected were treated by the 107 large plants with capacities over 1,000 tonnes/year. Nearly two-thirds (62%) were composted in open-air windrows (figure 4). 16% of the waste was treated in closed or covered plants, 10% by field-edge composting. Some 78,600 tonnes (12%) were anaerobically digested in the 13 existing plants (Federal Office for the Environment, 2000). It is estimated that 300,000 tonnes of biodegradable waste is treated by home or community composting, or in plants with a capacity below 100 tonnes/year.

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