Germany

1. Overview

- Germany has had landfill restrictions for municipal waste since 1993:
  - There are strict landfill admission criteria for residual municipal wastes – the part of municipal wastes that *cannot be recovered*
  - There is a landfill ban on both separately collected waste materials and unsorted municipal waste – the part of municipal wastes that *can be recovered*
- The strict landfill admission criteria for residual municipal wastes are to ensure that the wastes being landfilled do not pose a danger on soil, groundwater, air and climate.
- In practice and because of its significant biodegradable content, residual municipal wastes must be treated (via incineration or other) prior to landfill in order to comply with the landfill criteria; the landfill restrictions have the same effect as would a landfill ban on untreated residual municipal wastes.
- The deadline for total compliance with the landfill ban was set for 2005, thus allowing for an overall transition period of 12 years.
- Despite a slow start, the waste management industry began to invest more actively in additional treatment facilities from 2001, when the landfill restrictions were made legally binding; as a result, the proportion of municipal waste directly sent to landfill (i.e without treatment) went from 39 per cent of total municipal waste in 1997 down to just one per cent in 2006.
- The landfill ban was seconded by specific instruments targeting recycling and composting but there has been no use of economic instruments.
- The landfill ban had a positive impact on separate collection and recycling efforts, especially due to an increased cooperation between the public waste management authorities and DSD, the organisation in charge of collecting waste packaging from households.
- The use of MBT as an alternative to incineration has been strongly encouraged and developed, but with mixed results; in particular MBT may have negatively impacted on composting efforts.
- While some illegal activities may still exist – in particular the practice of exporting untreated wastes to Eastern European countries – it is estimated that on the whole full compliance with the landfill ban has now been reached.

2. Who did we interview?

- Suzanne Hempen, municipal waste and waste incineration unit, Federal Environment Ministry (Referat WA II 4 Siedlungsabfälle, Thermische Behandlung von Abfällen, Bundesministerium für Umwelt, Naturschutz und Reaktorsicherheit)
- Written answers from Dr. Claus-Gerhard Bergs, head of the municipal waste and waste incineration unit, Federal Environment Ministry

3. Landfill bans – policy

i. Definitions

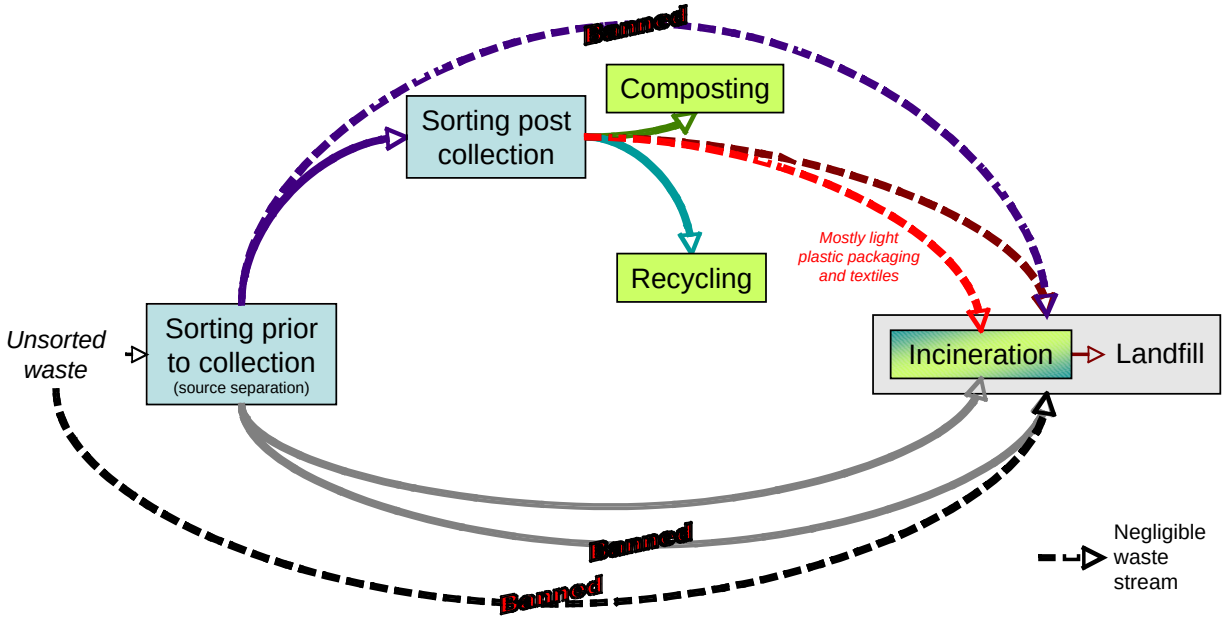
- Municipal waste: very close to the UK's definition, it includes (see appendix for full detail):
  - Waste from private households and similar institutions
  - Municipal waste of commercial origin, which includes
    - Commercial and industrial wastes similar to household wastes (also called 'domestic-type industrial waste')
  - Bulky wastes, market wastes, road sweepings, garden and park wastes
- Wastes that can be managed like municipal waste: waste that, due to its nature or composition, may be managed together with municipal waste, or may be managed like such waste, especially sewage sludges from waste water treatment facilities for treatment of municipal wastewater or of wastewater with similarly low pollutant contamination, faeces, faecal sludge, residues from wastewater facilities, water purification sludges,

building waste and production-specific waste. This shall also include waste from treatment of municipal waste.[1]

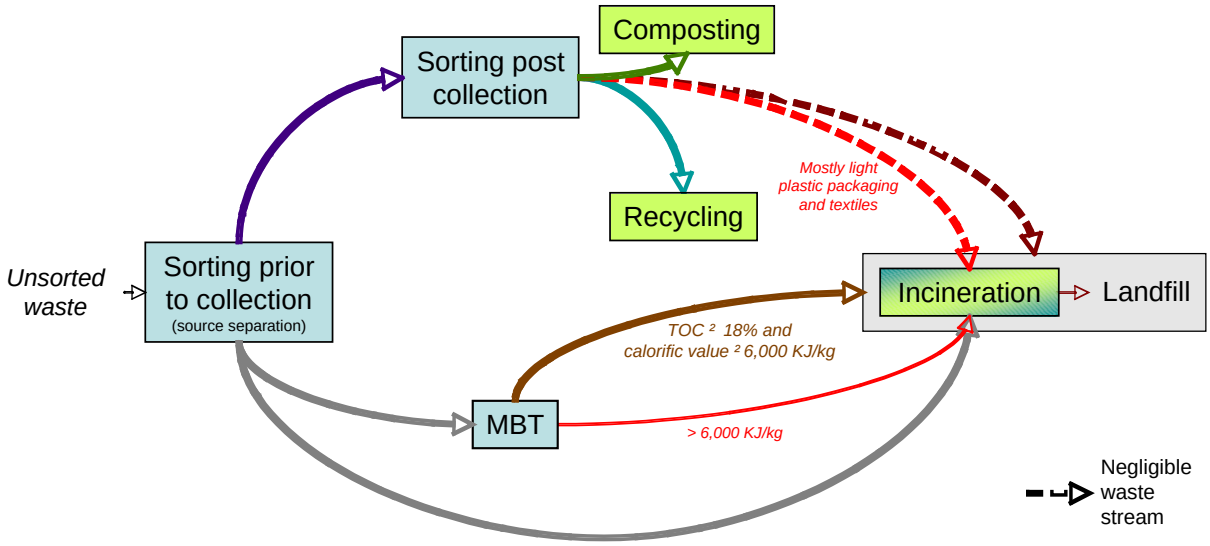
- Separately collected waste materials: this group includes waste materials collected in view of their recovery (recyclates and biowaste) but also waste materials that need special treatment before final disposal (hazardous household waste, WEEE, bulky waste)
  - Recyclates: paper and cardboard, glass, metals, plastics, textiles, WEEE
  - Biowaste: plant waste and food residues (including kitchen and canteen waste)
- Unsorted waste: wastes whose collectable part has not been presented separately and/or kept separate with collection. In statistics, same as waste produced.
- Non-recoverable waste (or waste that cannot be recovered): waste that is left after separately collected waste materials (recyclates and biowaste) have been removed. In statistics, same as residual waste.
- Untreated waste: waste that has not been thermally or biologically treated.
- Mechanical-biological treatment: combines a sorting facility with a form of biological treatment. MBT plants are designed to process mixed household waste as well as commercial and industrial wastes.
  - The sorting component of a MBT facility resembles a materials recovery facility. This component is either configured to recover the individual elements of the waste (metals, plastics, glass) or produce a refuse-derived fuel (high calorific fraction) that can be used for the generation of power. In the event that a refuse-derived fuel is produced as a by-product then a combustion facility would be required.
  - The 'biological' element refers to either to anaerobic digestion, composting, or biodrying

[1] Unfortunately there is no information as to what these building wastes and production-specific wastes may be and how much they represent.

Germany's waste treatment chain prior to introduction of landfill regulations in 1993



Germany's waste treatment chain after 2005, deadline for total compliance



Types of waste streams

Untreated residual waste
Separately collected waste materials (biowaste, recyclates bulky waste, WEEE)
Recyclates (paper and cardboard, glass, metals, plastics, textiles)
Biowaste (food waste, garden waste)
Treated residual waste
High calorific fraction

Types of operations

Disposal
Treatment
Recovery
Treatment and/or Recovery

MBT: mechanical-biological treatment (sorting + composting or anaerobic digestion)

ii. Main provisions of legislation

In Germany, landfill restrictions for municipal waste were introduced in 1993 with the Technical Instructions on Municipal Waste or TASi.[2] It is important to note upfront that these instructions were not legally binding.

The TASi introduce two basic requirements for the landfilling of municipal waste:

- The first is that only wastes that *cannot be recovered* may be allowed to landfill, with the following implications:
    - Separately collected waste materials are de facto banned from landfill;
    - Unsorted wastes are also implicitly banned from landfill, insofar as they may contain recoverable waste materials that should be sorted out prior to collection and further treatment/disposal.
- The second is that these municipal residual wastes must comply with a set of strict limit values in order to qualify for landfill:
    - These limit values are based on strength, TOC (total organic carbon[3]), lipophile substances, and eluate parameters[4];
    - The TOC value of the waste being landfilled must not exceed three per cent by weight[5]; this criterion is used here to address the *natural* organic – or biodegradable – content of the waste going to landfill, rather than the *synthetic* organic content (such as plastics);
    - These limit values can only be reached with adequate pre-treatment.

There are no targets limiting absolute quantities going to landfill.

Claus Bergs: *"(in the TASi) there is no direct obligation for treatment prior to landfill, but implicitly landfilling without pre-treatment of household waste is not possible."*

The TASi provided a transition period of twelve years (1993-2005) to give time for the establishment of new infrastructure. The competent authorities could grant exceptions allowing the landfilling of untreated waste to continue for a maximum of 12 years. The requirements of the TASi were subsequently reintroduced in 2001 with the Waste Storage Ordinance,[6] which made them legally binding.

Claus Bergs: "*These regulations were repeated in our Waste Storage Ordinance. The main reason was that the regulations in an ordinance are stricter than the regulations of technical instructions and some municipalities did not want to meet the provisions of the Technical Instructions on municipal waste."*

The Waste Storage Ordinance covers both municipal waste and 'wastes that can be managed like municipal waste' (see definitions above). This ordinance introduces additional criteria and rules that open the way for the mechanical-biological treatment of residual waste[7].

As well as requiring that biogenic constituents be largely biodegraded, these involve separating off high calorific value constituents (such as plastics) to be used as fuel substitutes (refuse-derived fuels) in high-efficiency power stations and industrial co-combustion plants, instead of being buried in landfills.

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[2] Technische Anleitung zur Verwertung, Behandlung und sonstigen Entsorgung von Siedlungsabfällen

[3] The term organic is to be understood from a chemical and not a biological perspective; a TOC analysis may not be able to distinguish between natural and synthetic organic carbon

[4] Listed in the Annex of the TASi (and Annex of the 2001 Waste Storage Ordinance);

[5] Or even one per cent for technically less equipped landfills (class I landfills)

[6] Ordinance on the Environmentally Compatible Storage of Municipal Waste and on Biological Waste Treatment Facilities ("Abfallablagerungsverordnung")

[7] The TASi did not prescribe the treatment methods to be used. However, their stringent requirements could not be met using the mechanical- biological treatments available in the early 90's; they could only be met using waste incineration.

According to the Waste Storage Ordinance, residual wastes from MBT may only be allowed to landfill if their calorific value is 6,000kJ/kg or less and if their TOC value is limited to 18 per cent by weight.

Suzanne Hempen: *" MBT treatment results in two types of waste materials. One is the high calorific value waste, which is sent to other plants for energy recovery, the other is the residual waste, which can be sent directly to landfill, when its TOC is below or equal to per cent."*

Exemptions

The TASi provided a transition period of twelve years (1993-2005) to give time for the establishment of new infrastructure; the competent authorities were permitted to grant exemptions at the individual request of landfill operators allowing the operators to continue to landfill untreated waste for a maximum of 12 years. With the Waste Storage Ordinance, the conditions for granting such exemptions became much stricter than before and since 2005 there have been no exemptions except for temporary storage of untreated residual municipal waste when treatment capacity was lacking.

iii. Motivation/rationale

The landfill restrictions were motivated by environmental and political reasons, as well as by geographical constraints. Energy policy considerations did not play a significant role.

Claus Bergs: "*The reason for the adoption of these regulations lay in the problems we had with many landfills for household waste and for other waste categories. The problems were the gas emissions (methane) and water contaminations (groundwater and surface water) because of micro-pollutants leaving the landfill. These severe problems, in addition to the fact that traditional landfills need a lot of space, explain why Germany followed the principle – which Switzerland was the first to adopt – to landfill only waste which is inert and thus doesn't cause any harmful emissions to air or underground pollution. These principles are also relevant for the landfilling of hazardous waste: They also have to be treated in such a way that the materials become inert (…) In some regions, there were also strong protests against planned new landfills."*

Suzanne Hempen: *"At the beginning there was no link between the two. Waste policy was essentially concerned with safe disposal of waste. Energy recovery from incineration was simply seen as a by-product. This is however changing with the increase of fuel prices."*

It is interesting to note that landfill taxes have been considered as an alternative to the landfill restrictions in the past but they were never adopted; Germany much prefers using command-and-control instruments to economic ones.

Claus Bergs: "*Traditionally we have more legislative and voluntary instruments in the waste sector than economic instruments. Of course there were discussions for example about a landfill –tax for untreated waste instead of a stringent regulation like our Technical Instructions or the waste-storage ordinance; we think the way with legislative instruments proved to be successful. The restrictions for landfills are one very important element of the overall- concept of our waste-policy: They are flanking the other elements especially for the prior activities of avoiding and recycling waste streams"*

Suzanne Hempen: *"At the time the Technical Instructions were adopted in 1993, it was too early for Germany to introduce economic instruments such as a landfill tax. A tax would have to be set high enough to have any effectiveness, and yet low enough to be politically acceptable, which is strongly dependent on the economic situation. In addition, it would have to be in line with the legal requirements of the EU Treaty. Later, there was a discussion around the adoption of a landfill tax but it was dropped for political reasons. It is essentially the Green Party and environmental NGOs/green fiscal academics who push for economic instruments. Historically, Germany has a strong preference for command and control instruments."*

iv. Reaction of key stakeholders

Claus Bergs: "*Of course there were long and intensive discussions before adopting the regulations of the Technical Instructions. The results were for example that only the rest of the waste which cannot be recycled should be pre-treated and go to a landfill. The regulations for the landfilling of household waste and prior to hazardous waste were developed parallel to some regulations with regard to increase waste recycling and reuse of materials – such as the ordinance on packaging waste."*

Claus Bergs: *"There were broad discussions with all stakeholders and there was a broad agreement about the principles and the preconditions of landfilling waste. All stakeholders agreed that waste which cannot be recycled should be inert or rendered inert before landfilling. Heavy discussions took place only about the question of* how *the waste should be pre-treated i.e. should the waste be pre-treated by incineration or by mechanical-biological treatment. At first the regulations could be met only on the way of incinerating waste – but later on the regulations were revised so that mechanical-biological treatment was possible to meet the standards for landfilling. After this compromise there were no longer discussions about the regulations and the principles of the TASi and the waste storage ordinance."*

4. Landfill bans – practicalities

i. Responsibilities

In Germany, public local waste management authorities are legally responsible for the collection, treatment and disposal of *residual* waste from private households in their area. In addition, many local authorities have introduced the *bio bin* for separate collection of plant waste and food residues.

Duales System Deutschland (DSD) – the organisation which was established following the adoption of the 1991 Packaging Ordinance, is responsible for collecting and recycling the other fractions of waste materials (glass, metals, paper, plastics) from private households and similar institutions.

Since 1996,[8] the private sector (commerce and industry) is obligated to consign the *residual* part of municipal waste it generates to the public local waste management authorities, while assuming full responsibility for its recoverable part.

The public local waste management authorities are allowed to transfer their waste management obligations for this type of waste to third parties or private parties responsible for waste management.

Main components of municipal waste	**Responsibility for the collection and treatment/disposal of:**		
	Recoverable fraction		Residual fraction
	Recycling	Composting	
Private households and similar institutions	• DSD	• Local waste management authority	• Local waste management authority
Municipal waste of commercial origin (domestic-type industrial waste)	• Private sector (producer responsibility)		• Local waste management authority
Other municipal wastes: bulky waste, market wastes, road sweeping, garden and park wastes	• Local waste management authority		• Local waste management authority

Claus Bergs: *"The practical task of collecting and treating (residual) municipal waste is carried out by regional waste management associations. In addition, the principle of producer responsibility has been introduced."*

Suzanne Hempen: *"Since 1996, municipalities are only responsible for the collection, treatment and disposal of residual household waste. The collection and treatment of separated waste materials is done by DSD (Duales System Deutschland), with the exception of the collection of biowaste which is done by the municipalities. Nowadays 77 per cent of municipalities in Germany provide bio bins to residents. We want this participation to increase."*

ii. Compliance and enforcement

The Waste Storage Ordinance of 2001 applies to the operators and owners of landfills, the operators of treatment facilities for municipal waste (MBT facilities and other treatment facilities), and to the owners of municipal waste (municipalities and businesses, but not private households).

[8] This year corresponds to the entry into force of the German Closed Substance Cycle and Waste Management Act (Kreizlaufwirstchafts- und Abfallgesetz, KrW-/AbfG), which established the principle of producer responsibility.

Claus Bergs: *"The landfill operators are directly responsible for complying with the ban; they can only accept waste that meets the standards of the Technical Instructions or the Waste Storage Ordinance."*

Suzanne Hempen: *"Since the Waste Storage Ordinance of 2001, the waste owner (business, commercial operator) – and not only the municipality – needs to show that he knows what happens to his waste. He must sign a record or certificate of proper waste management (Entsorgungsnachweiss) with indication of the volume and type of waste that he consigns to the waste management authority or waste management company. This is now done electronically as well. There is therefore a line of responsibility between the waste producer, the waste manager and the landfill operator."*

Summary of the respective obligations of waste owners and landfill operators pertaining to checks and submission of proofs (from Waste Storage Ordinance):

Waste owner	**Landfill operator**		
	Upon acceptance	If doubt about compliance	After landfilling
• Documentation of compliance of waste with specific landfilling criteria[9] based on results from waste analysis Scope: waste that is regularly delivered from treatment plants and in large amounts (>2000t) Frequency: minimum once a month Recipient of document: landfill operator	• Visual inspection • Determination of mass, type and key of waste • Checking of accompanying documentation Scope: any waste delivered to the landfill Frequency: each waste delivery • Random sample control analyses of compliance	• Control analysis • Notification to competent authority • Temporary storage	• Recording of compliance of landfilling operation itself Scope: landfill operators who accept waste delivered from MBT Frequency: daily
All information is be recorded and kept in the waste owner's or landfill operator's operating journal and submitted to competent authority upon request.			

The waste treatment operators also have to show documents demonstrating their compliance with the standards and rules governing their respective treatment facilities.

Enforcement is carried out at the Länder level. Each Länder has an environmental ministry and a related environmental enforcing agency (Umweltbehörde) who will normally sends its people to monitor the landfills.

[9] Criteria for waste coming from MBT: TOC or upper thermal value, biological degradability of dry residue in original substance, and TOC in eluate;
Criteria for other waste: TOC in eluate. ignition loss or TOC, Ph value of eluate, conductance of eluate, and TOC in eluate

5. Landfill bans – implementation

i. Planning

The Länder are responsible for planning their respective waste treatment capacities but the municipalities are free to choose the type of treatment plant they want to build in order to fulfil the legislation.

Claus Bergs: "*The way how to meet the regulations at the local level is a matter of the decisions of the individual municipality (county or town). That means for example, the municipality can decide which type of treatment plant they want to build to fulfil the regulations being laid down in the law or on which way they collect waste-streams separately."*
Suzanne Hempen: "In Germany the Federal government doesn't get involved in the planning of additional treatment capacity. It leaves it to municipalities and waste managers to decide together and basically relies on market forces to find the best solutions."

ii. Financing

Claus Bergs: "*There were no specific financial programmes on the federal level to realize the necessary investments and as far as we know there were also no specific financial programmes at the regional level either. The infrastructure has been financed by the fees paid by the inhabitants to their municipality for waste management. Municipalities are not allowed to make profits from waste management – the fees are supposed to be at a level that they are equal to the costs of waste-management."*

Suzanne Hempen: *"The number of municipalities using public-private partnership in order to finance new infrastructure is on the increase. It is mostly in East Germany where municipalities can obtain preferential interest rates for the financing of waste management infrastructure. The financial risk is usually perceived as relatively low; the costs are automatically transferred to the inhabitants (through local taxation) and businesses (blanket), and the technology used is well known."*

iii. Supporting instruments

Germany has used a combination of regulatory and voluntary instruments in tackling with municipal and biodegradable waste. Some instruments support the separate collection and material recovery (recycling and composting) of numerous waste fractions:

- **Separate collection and recovery of packaging waste from households.** Packaging waste is regulated by the Packaging Ordinance (VerpackV 1991), which was introduced in 1991.[10] The main concept of the ordinance is the producer responsibility; the producers and retailers of packaged products are obliged to take-back used packages and to contribute to their further management. The objective of the first packaging ordinance of 1991 was primarily to reduce packaging waste arisings and to relieve the municipalities from having to manage high packaging waste quantities.

  The economic agents affected (producers and distributors) have come together to set up a 'Dual Disposal System', which operates alongside the existing public waste disposal arrangements. The Duales System Deutschland GmbH (DSD) organises the curbside collection of waste packaging directly from private households, the sorting of this waste into material groups, and the recycling of these materials. The levying of charges, on a scale related to the type of packaging material used, is documented by the license label, the 'Green Dot', which is printed on products. Since the introduction of the Green Dot System in 1993, more than 20 million tons of used packaging have been brought to recycling and the consumption of packaging per year has been reduced by about 1.3 million tons compared to 1991 levels.

[10] Major amendments were adopted in 1998 and came into force on 1 January 1999.

- **Separate collection and recovery of biowaste from households.** Many German local authorities followed the rules on separate collection and recovery of biowaste that were introduced in the TASi in 1993 and have introduced a 'Bio Bin' for separate collection of plant waste and food residues. This is however not a legally binding regulation, and is therefore not mandatory.

  According to Article 5 of the TASi on separate collection, the responsible waste disposal authorities have to set up separate collection schemes for secondary materials which are not targeted by other pieces of legislation, which is also relevant for biowaste from households. Furthermore, the authorities have to ensure a biological treatment of the separately collected biowaste (TASi 5.2.1.2). Waste from public garden and parks as well as from cemeteries shall be kept separate and shall be recovered from the municipality. The remainder has to be collected separately and must be recovered as far as possible.

  During the 1990s the quantity of separately collected biowaste increased more than seven fold (nearly 70 per cent) - compared with the return rate for waste paper or waste glass. This has considerably reduced the quantities of residual waste from households. Biowaste waste is composted or fermented to obtain fertiliser for horticultural or agricultural use.

  The system has also been regulated by the Biowaste Ordinance[11] since 1998. The objectives of this ordinance are to regulate the quality of compost which is produced for further use, especially the content of pollutants and the sanitisation quality, and regulate the use of composts on soils. This ordinance does not set up any obligation for separate collection or recovery of this waste stream.

- **Take-back and recycling of graphic paper (private households).** In order to avert a legal obligation by means of an ordinance, the graphic paper[12] industry (represented by the association AGRAPA) committed itself to a voluntary agreement in 1994. The objective was to increase the material recovery of graphic paper until 2000. Since then the annual direct recycling quotas set out in the voluntary undertaking (60 per cent) have been not only met, but considerably exceeded (in 2003, by more than 80 per cent).

- **Separate collection and recovery of municipal waste of commercial origin.** According to the Ordinance on the Management of Municipal wastes of Commercial Origin (Commercial Waste Ordinance, GewAbfV 2003), which entered into force in 2003, the following fractions of municipal waste of commercial origin (domestic-type industrial waste), have to be kept separate and have to be consigned to recovery: paper and cardboard; glass; plastic; metals; biowaste (kitchen and canteen waste, park and garden waste, market waste). This also includes packaging waste.

  For each of these materials a recovery quota of 85 per cent has to be reached. The objectives of these obligations were to ensure that as much municipal waste of commercial origin as possible is recovered and that the recovery process is of high quality.

- **Waste Wood Ordinance of 2002 (across all waste categories).** The Waste Wood Ordinance[13] was adopted in August 2002 and entered into force in March 2003. Its objective is the encouragement of an environmentally sound recovery of waste wood and the elimination of hazardous substances out of the economic cycle. For this purpose it is clearly defined which types of waste wood can be treated in which processes, thus defining a common standard of waste wood treatment. Waste wood which cannot be recovered due to its content of pollutants (e.g. painted or impregnated wood) has to be disposed of in authorised incineration facilities. This ordinance does however not set up any mandatory take-back, separate collection or recovery quotas of waste wood.

[11] Ordinance on the Recovery of Biowaste on Soils which are used for Agriculture, Forestry and Market Gardening (BioAbfV 1998)
[12] Newspapers, magazines, office paper, etc. (not packaging paper)
[13] Ordinance on requirements for recovery and disposal of waste wood (AltholzV 2003)

- **Strict standards for waste incinerators since 1990.** The first piece of legislation for reducing the environmental impacts of waste incineration in Germany was the 17th Ordinance for the execution of the Federal Immission Act,[14] which was adopted in 1990.

  The ordinance aimed at reducing harmful emissions into the air during waste incineration by introducing strict standards for air pollution control.[15] Another important topic was the legalising of co-incineration.

  The ordinance was amended in 2003 and adjusted in order to comply with the EU Incineration Directive, which had come in force in 2000. The main revisions dealt with the co-incineration of waste in industrial facilities.

- **Quality standards for mechanical-biological treatment of waste (MBT) since 2001.** In 1999, the German Ministry for Environment accepted MBT as pre-treatment method for residual municipal waste prior to landfilling and implemented this decision in the Waste Storage Ordinance. The prerequisite for this decision was that only facilities with a high technical standard should be allowed to operate. Such standards were established with the Ordinance on Facilities for the Biological Treatment of Waste adopted in 2001.

[14] Ordinance on Incineration Facilities for Waste and similar combustible Materials, 17th BImSchV 1990
[15] Provision of limit values for the emission of hazardous substances and of dioxins

6. Results

i. How successful the ban has been in achieving its objectives

The proportion of municipal waste directly sent to landfill (i.e without treatment) went from 39 per cent (17.7Mt) of total municipal waste in 1997 down to just one per cent (or 0.3Mt) in 2006.

The number of landfills for municipal waste was consequently greatly reduced, as shown in the following table.

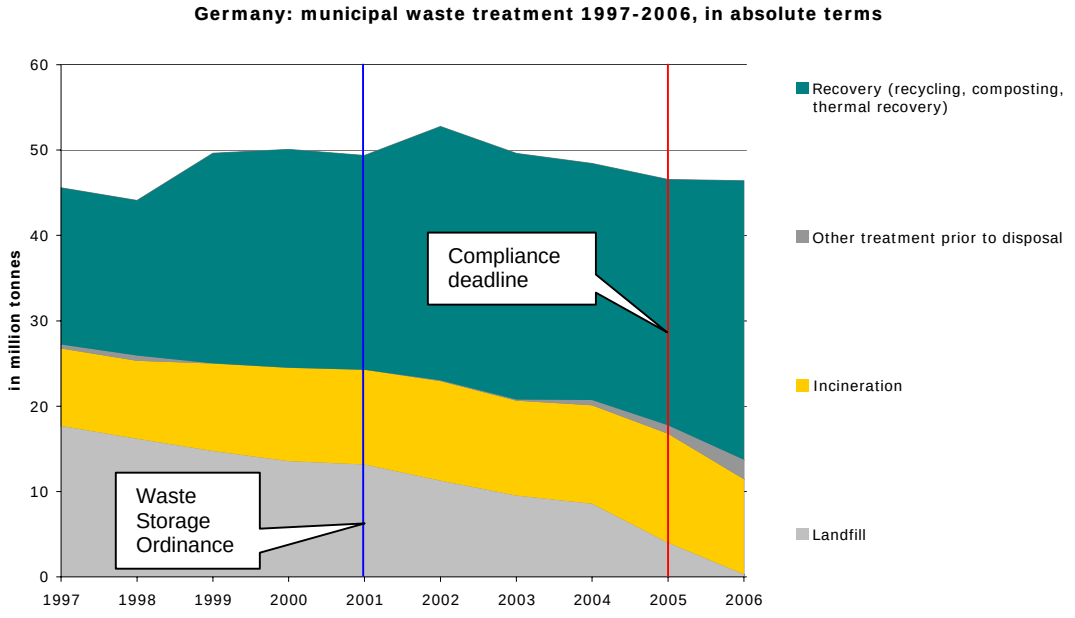
Number of municipal solid waste landfills 1990-2004

	1990	1991	1993	1995	1997	1999	2000	2004	2005	2006
Total landfills	8,273	1,590	562	472	372	376	333	297	160	27-11
Landfills in Eastern Germany	7,983	NA	292	202	139	179	137	91	N/A	N/A

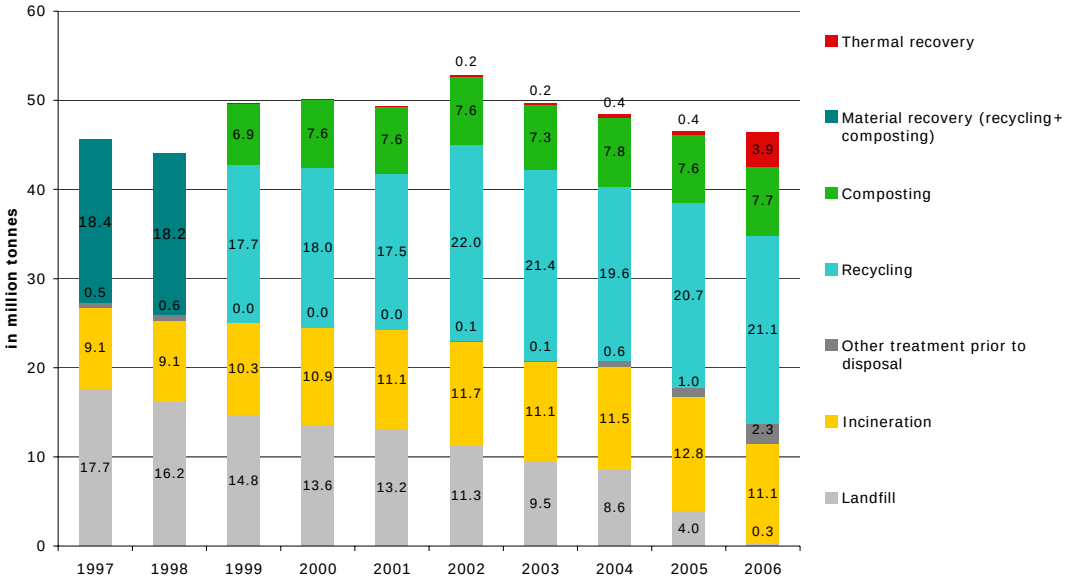
Source: Bundesumweltministerium (BDE)

Claus Bergs: *"Methods for pre-treatment are waste incineration and mechanical – biological treatment. Both methods have resulted in reducing the amount of waste sent to landfill by 90 per cent or more."*

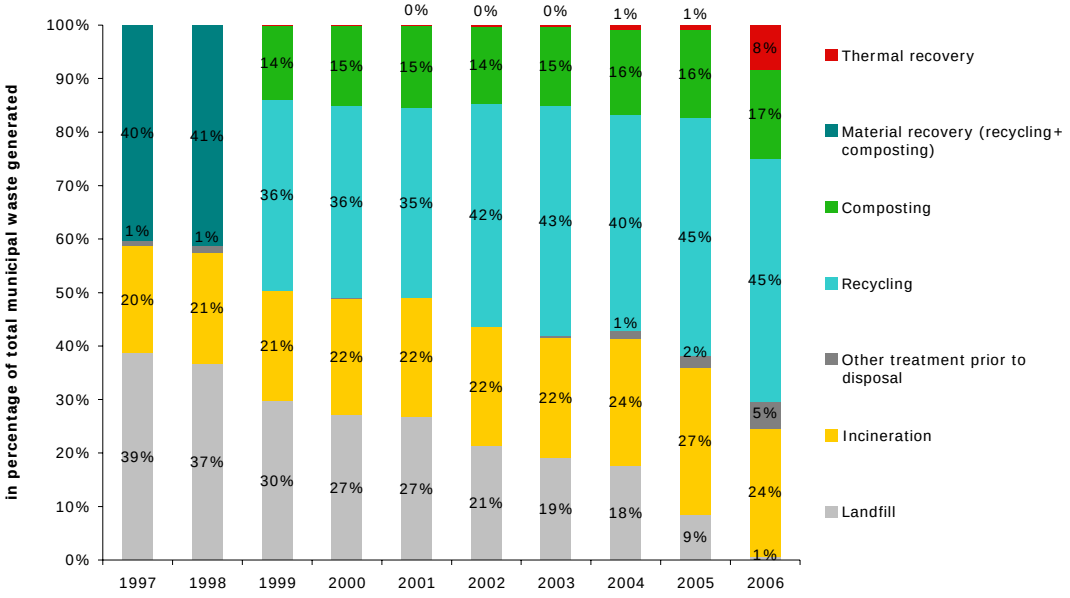
Figure i-iii: Municipal waste



Germany: municipal waste treatment 1997-2006, in absolute terms



Germany: municipal waste treatment 1997-2006, in relative terms



Source: Destatis (Statistisches Bundesamt)

ii. Where the wastes have been redirected

Incineration has been the only way of treating residual wastes until 2001 when mechanical-biological treatment was allowed. Treatment capacities are nowadays about 18 million tonnes per year for incineration (72 facilities) and 7 million tonnes per year for MBT (66 facilities).

Claus Bergs: *"As far as we know all waste incinerators are recovering energy – this doesn´t depend from the Technical Instructions; our federal law for emission standards says that energy of waste-incinerators has to be recovered whenever possible."*

Suzanne Hempen: *"All waste incineration plants for municipal waste have energy recovery, but not all also recover heat. There is an aspiration to increase the levels of heat recovery from energy from waste plants."*
Suzanne Hempen: *"MBT was introduced as a political offer to the green party. 30 per cent of the household waste now goes through this treatment route."*

Capacity shortages and temporary solutions

Suzanne Hempen: *"A couple of years ago (2005-2006) there was some uncertainty as to whether the required capacity would come on stream, but the situation seems to have resolved itself. "*

Temporary solutions are mostly short-term storage in landfills.

Claus Bergs: "Because of some technical problems some municipalities were not able to treat the waste according to the federal regulations: they got the permission to store the waste in temporary waste-storage dumps. The quantity of such dumps reached less than 1.5 million tons of waste at its maximum – to compare to the 25 million tonnes of household and similar wastes which are treated today in compliance with the regulations. The quantity of the untreated wastes is decreasing because new treatment plants started to work after 2005 and the problems of some already existing plants became smaller."

Impact of the ban on waste prevention, recycling and composting

There has been a positive impact on recycling, but other instruments played a significant role as well

Claus Bergs: *We are convinced that the landfill ban on untreated waste had a positive effect on separate collection: a study showed for example that waste incineration is more expensive than separate collection of biowaste and composting the bio-waste. This demonstrates that the landfill ban is not in contradiction with other principles such as recycling."*

Suzanne Hempen: *"In Germany we were lucky to introduce the landfill restrictions at the same time as recycling policy. We don't believe that the landfill restriction promoted incineration/MBT at the expense of recycling. It was a two-pronged attack on waste to landfill."*

The impact on composting has been less positive: Suzanne Hempen remarked that mechanical-biological treatment may have diverted some of the biowaste that could have otherwise been composted.

Overall economic impact of the ban

A 2005 study on the impact the Technical Instruction and the Waste Storage Ordinance commissioned by the Federal Environment Agency concluded that 20 billion euros had been invested in modern waste treatment and recycling plants since 1993 and up 15,000 permanent jobs had been created, taking into account some 6,350 jobs lost as a result of landfill shutdowns begun in 1993 and policy changes after 1 June 2005.

7. Key success factors

- Strong enforcement of the landfill ban since 2005

Suzanne Hempel: *"They are still some illegal activities but overall the landfill restrictions are now rigorously enforced. There is not much room for non-compliance."*

Bergs Claus: "*As far as the federal government knows, all landfills now comply with the technical standards laid down in the Technical Instructions and the waste that is sent to landfill meets the quality criteria of the Technical Instructions. There have been problems of non-compliance with landfill standards in the past but this is no longer the case. One remaining compliance issue may be the occasional illegal shipment of (untreated) waste to other countries or in some cases the storage of mechanically and biologically treated waste under the label of "waste for recycling" in places other than the official landfills. Those who are acting illegally can be punished to pay a fine or may even be imprisoned".*

- Absence of legal prescription as to which technology to use

This left the municipalities the freedom to decide on the technology that would best suit their interests.

Claus Bergs: "*The risk that costs could increase to an unacceptable level was low because the Technical Instructions didn't regulate totally new standards but progressive standards which already proved to be a progressive state of the art in some municipalities in Germany or in other countries. As a result many new waste incinerators with "traditional" technique and mechanical- biological treatment were erected. Some municipalities discussed the erection of totally new techniques (High-temperature – incineration, Pyrolysis, Thermo-select – technique), but finally the municipalities used the more traditional techniques to treat waste. In this context I want to stress the remark that the Technical Instructions contain only standards for the quality of the material which is supposed to be landfilled – the way* ***how*** *these limit values are met is absolutely open; in other words the municipalities were free to use any type of technique to meet the limit values for landfilling. Though this concept is more expensive than the concept of traditional landfilling in the short run, you have to consider that you save money in the long run for the sanitisation of old landfills and that you save space."*

- Higher technical standards and communication efforts on incineration and MBT

Suzanne Hempen: *"Technical requirements on incineration (and MBT) were subsequently tightened which contributed to building trust and get this treatment more accepted by the public."*

Communication efforts on the part of operators of waste incinerators and MBT facilities have helped gain better acceptance for these treatments among the public.

Suzanne Hempen: *"Proposed sites for new incineration and MBT plants were aggressively discussed at the beginning but it is now becoming easier. There is an effort of communication to the general public from the plants operators, for instance public displays on emissions and other environmental aspects of the plants being constructed. Building more CHP would certainly help building more trust among the public. Protests were useful in that they generated political pressure to increase emissions standards."*

- Role of DSD

DSD and the municipalities have intensified their cooperation after the landfill restrictions were adopted. As a consequence, there was an increase in source separation efforts (led by DSD and supported by local authorities), resulting in both the increase in the amount of separately collected waste materials going for recycling and the decrease in quantities of residual wastes having to go through treatment prior to final disposal.

Suzanne Hempen: *"DSD and municipalities have been working even more closely since the landfill ban. The municipalities indeed want to decrease as much as possible the amount of waste that has to be disposed of (and pre-treated) and the most obvious solution is to increase source separation and recycling. On the other hand, DSD has always needed to access the citizens and get them to source-separate as much as possible. Now the interests of both DSD and municipalities are in alignment."*

- Role of MBT in facilitating the implementation of the landfill ban

Although she willingly admits that MBT may not be the best option of all, Suzanne Hempen also recognises that allowing another treatment beside incineration was very important to the success of the landfill ban implementation: "At the beginning, waste incineration was viewed as the only solution to the landfill restrictions. However allowing MBT as a treatment option in 2001 was essential for success."

8. Key challenges

The question of the transition period and lack of legal certainty in the 90s

Claus Berg suggests that the 12-year transition time was too long and not necessary: "*There was a transition period of 12 years which was laid down in the Technical Instructions. These 12 years (1993 till 2005) were the result of discussions about financing the corresponding infrastructure and it was the result of the discussions with the Länder and municipalities. The proposal of the federal government was a transition period of only 8 years; this would have given enough time to plan and realize the relevant infrastructure."*

Suzanne Hempen suggests instead that it was necessary but not sufficient: *"There was a very long transition time (12 years) between the adoption of the landfill restriction and its enforcement, but it was necessary in order to allow for the establishment of new infrastructure. It would have been better to adopt a step-by-step approach to the tightening of landfill standards. The legislators were perhaps naive to believe that 12 years would be enough and that things would move smoothly according to the timeline. But it was not that easy a task and they were many compliance problems and legal fights. More supporting pressures and measures were needed."*

This problem was largely overcome with the 2001 Waste Storage Ordinance, which made the landfill restrictions legally binding.

Problems with municipal wastes of commercial origin

The practice of "false declaration" with municipal waste of commercial origin emerged in 1996 when the private sector (C&I) was required to consign (against payment) its *residual* wastes (domestic-type industrial wastes) to the local waste management authorities. A part of these wastes indeed escaped the local waste management system and were sent instead to cheaper unregulated landfill sites under the pretext of "recovery". This resulted in planning difficulties for the local authorities where theses wastes originated and led to significant capacity shortages in 2005 when the landfill restrictions became strictly enforced; the *residual* wastes that had previously been "recovered" somewhere else returned to the local waste management authority, only to find they could not be accepted because of a lack of capacity.

Suzanne Hempen: *"In 2005, commercial waste was a black box number because of the practice of 'false declaration' in the past. A lot of waste producers would declare their waste for disposal as waste for recovery in order to escape the disposal fees and dump their waste somewhere cheaper (East Germany usually). The problem was however resolved once the businesses were made legally obligated to pre-treat their waste, and this immediately increased demand for waste treatment capacity. 3.5Mt of this commercial waste is now consigned to municipalities where 50 per cent is recycled and the rest goes to incineration."*

Particular issues with mechanical biological treatment

- MBT pushing out composting and anaerobic digestion

Suzanne Hempen: *"The quality of the high calorific value waste resulting from MBT treatment increased following the adoption of voluntary standards by the waste management industry, so this type of waste has now found better acceptance with the power stations and industrial co-combustion plants."*

Suzanne Hempen: *"The MBT operators tend to accept a lot of biowaste. Too much emphasis on MBT means that biowaste gets sucked into MBT, rather than being treated through composting or digestion, both of which are environmentally preferable."*

- Large scale waste 'recovery': legal or not?

Suzanne Hempen: *"Large scale recovery (of household waste) happens mostly in East Germany where waste is used to fill up old mines. From a waste legislation point of view, using (mixed) household waste for this purpose is illegal, but this may not be interpreted as such by the legislation governing mining. There is considerable uncertainty about which piece of legislation applies."*

9. The future

Claus Bergs: "*The landfill ban on untreated waste covers all types of waste streams which are not already inert- including hazardous waste. From this view it is not necessary to tighten the standards for landfilling of the different types of waste streams. We think the municipalities will soon overcome the small shortage in capacities – if there is still a shortage – because new treatment plants start to operate and the quantity of stored untreated waste hasn't increased since the situation we had two or three years ago.*"

10. Lessons for the UK

Claus Bergs: "*The regulations for treating waste before landfilling are generally accepted in our country and the provisions work.*"

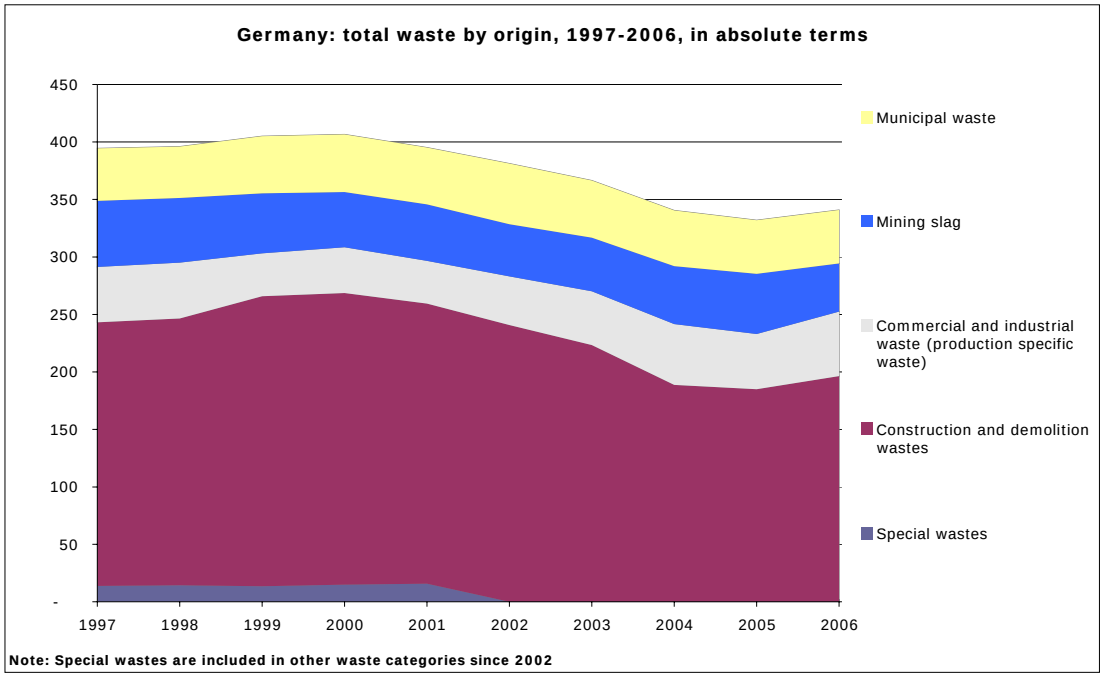
Suzanne Hempen: "*1. It is most important not to forget the recycling bit. There is a lot of resistance to incineration/MBT, but trust and acceptance are most likely to be built up in a system where people know for sure that only waste that cannot be recycled is incinerated. But at present, most waste operators would like to have more waste than less, to earn as much as possible. The ideal would be a system where only the waste that cannot be recycled gets to be incinerated; resources will become increasingly important in the future, and we can't afford to just burn everything. 2. You also have to be very careful with MBT. Some of the plants take biowaste while this waste fraction should normally be composted. In addition, it is as expensive as incineration if you consider that a good fraction of its output has to be incinerated anyway. It can in fact be twice as expensive. I believe it is better to use MBT in rural countries like in Turkey where there is not a lot of money for more sophisticated systems and technologies."*

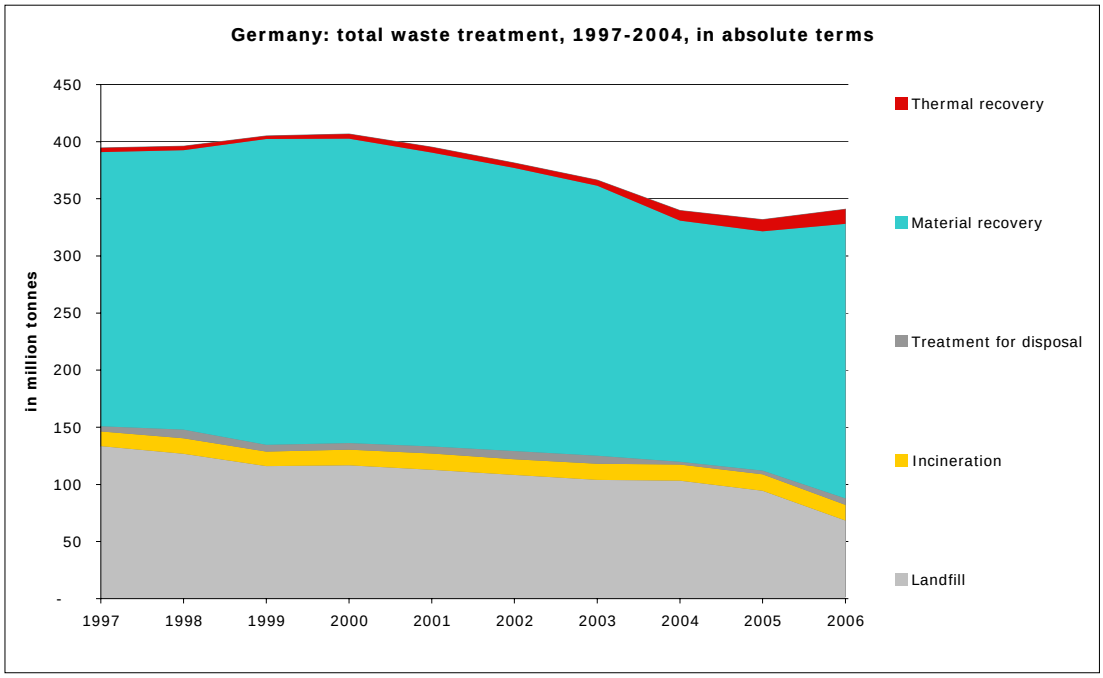
Appendix

1. Waste statistics

Overview of waste situation

There are four categories of wastes in German waste statistics (solid waste): construction and demolition waste, mining waste, commercial and industrial waste or "production" waste and municipal or "urban" waste.





Source: Destatis (Statistisches Bundesamt)

- **Construction and demolition wastes**: building rubble, excavated material, waste road material and construction site waste. Some 196 million tonnes were generated in 2006. Most of this group is due to excavated material, which is largely reused. A large proportion of the remaining mineral construction waste is also reused/recycled. All

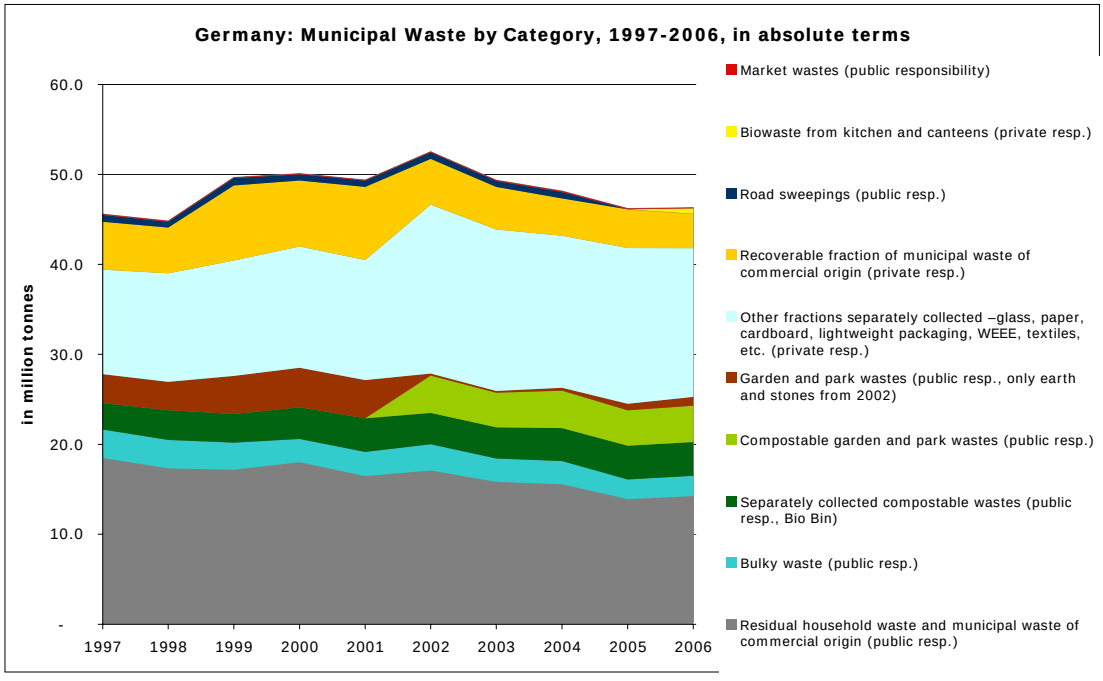
together there is a recycling proportion of more than 86 per cent. The waste often comprises a mixture of mineral waste, woods, metals, paper and plastic, some of which may be contaminated with hazardous substances. In a voluntary commitment of 1996, the German construction industry promised the Federal Environment Ministry that it would "halve the quantity of recyclable construction waste currently being landfilled by the year 2005". At the present time, around 87per cent of the excavated material and 70 per cent of construction in Germany is recovered.

- **Commercial and industrial waste (or "production" waste)**: this is waste from trade and industry and from agriculture and forestry (about 56.1 million tonnes in 2006). The producer of the waste has individual responsibility for it (producer responsibility). He must see to its sorting, recovery (material or thermal) and disposal himself or hand it over to expert private-sector waste management enterprises. If such waste contains contaminants that may involve risks for man and the environment, it must be collected and managed separately.

- **Mining waste**: debris from mining, largely due to coal mining operations. In view of the marked reduction in the quantities mined, the volume of mining is about 41.9 million tonnes in 2006. The bulk of the mining debris is deposited on tips.

- **Municipal waste ('urban' waste)**:
  - Waste from private households and similar institutions: wastes which are produced in private households in the course of private living, as well as in other comparable places of production such as homes or assisted living facilities[16]
  - Municipal waste of commercial origin, which includes both:
    - Commercial and industrial wastes which are similar to household wastes on the grounds of their nature or composition (also called "domestic-type industrial waste");
    - Wastes from private and public institutions, with the exception of wastes which are produced in private households and similar institutions
  - Bulky wastes, market wastes, road sweepings, garden and park wastes.

This includes wastes that are separately collected in view of their composting or recycling. About 46.4 million tonnes of municipal wastes arose in 2006.



Source: Destatis (Statistisches Bundesamt

[16] No particular detail is given as to which institutions are covered. This is however likely to comprise residences for retired persons, hotels, hospitals, etc.

2. Competent waste authorities

In Germany, both the Federal Government and the Federal States or Länder have legislative responsibilities; the Federal Government is responsible for developing national legislation relating to waste while each of the 16 Federal States or Bundesländer is effectively the regional tier of government responsible for passing waste legislation not already covered by Federal law.

Each Länder prepares a waste management plan as well as yearly waste balance reports. The plans are usually updated every five year. Similarly to the Länder, the municipalities produce a waste management plan, which identifies, at the local level, the future waste infrastructure capacity across all waste streams (MSW, commercial and industrial wastes) and for all waste facility types (waste incineration, MBT, composting). Public waste management authorities are the principal agent for delivery of waste management infrastructure.

Claus Bergs: *"Due to historical reasons Germany has a strong federal character. The Bundesländer have the possibility to take influence on the development of national legislation and also to issue their own legislation in selected fields of waste management. Furthermore, they are responsible for the implementation of national waste legislation. Other stakeholders may present their opinions in the frame of the hearing procedure during the drafting of the legislation."*

Suzanne Hempen: *"Each Länder publishes a waste management plan every 4-5 years but this may have changed with the new European directive. The municipalities do not have to publish a waste management plan."*

3. Main government waste/resource policy objectives

The main piece of German waste legislation is the *Act on the encouragement of a closed loop recycling management and the environmentally sound disposal of waste* (KrW-/AbfG 1996). The objective of the law is to foster a closed loop waste management system for the purpose of saving the natural resources and to ensure an environmentally sound recovery and disposal of waste.
Among the main principles which are defined by this act is the waste hierarchy, formulated in Article 4 in the following way:

Wastes
1. Primarily have to be prevented, especially by reduction of their quantity and hazardousness
2. In the second instance have to be
   a) recovered as material
   b) used for the production of energy

Article 10 adds that wastes which are not recovered have to be excluded permanently from the closed loop recycling management and have to be disposed of for ensuring the collective good.

Regarding waste prevention the German waste act (KrW-/AbfG 1996) lists a number of potential waste prevention instruments, which have to be implemented for specific waste streams by an ordinance. Examples for ordinances with waste prevention aspects are the Packaging Ordinance and the Batteries Ordinance.

More specifically, the German provinces (Bundesländer) introduce waste prevention instruments as part of their responsibilities. Main instruments, covered by provincial legislation as well as provincial waste management plans, refer to the prevention of packaging waste and on home composting.

The implementation of instruments to encourage home composting is the task of the municipalities. In a survey covering 240 municipalities the following instruments have been identified (Fricke 2003):

- Public campaigns, including advice on home composting
- Exemption from the obligatory collection of biowaste, mostly including reduction of waste collection fees
- Subvention for composting devices
- Cutting service for wood, used for home composting.

At the moment Germany is developing a strategy to phase out landfilling of primary municipal waste until 2020. This strategy, however, focuses on technical methods to divert away waste from landfills. Waste prevention is only mentioned as a general obligation, but is not connected with specific activities.

Sources and references

- 2001 Waste Storage Ordinance “Ordinance on Environmentally Compatible Storage of Waste from Human Settlements” (Abfallablagerungsverordnung – AbfAblV): http://www.bmu.de/english/waste_management/downloads/doc/3371.php
- Press Release 036/2005 Sustainable waste management: Billions in investment and thousands of new jobs thanks to waste legislation Umweltbundesamt http://www.umweltbundesamt.de/uba-info-presse-e/2005/pe05-036.htm
- Bundesumweltministerium (Federal Environment Ministry Germany), 2006 Municipal Solid Waste Management Report