Country fact sheet

Municipal waste management

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Germany

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European Environment Agency
European Topic Centre on Waste and
Materials in a Green Economy

Context

This country profile was prepared within the EEA's work on municipal waste, resulting in the following outcomes:

- 32 country profiles (this document) – The country profiles were originally produced by the ETC/SCP and were published by the EEA in 2013. The ETC/WMGE updated them for the EEA under its 2015 and 2016 work programme.

- An EEA briefing on Municipal waste management across European countries

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Related country profiles

Country information on waste prevention programmes can be found at:
http://www.eea.europa.eu/publications/waste-prevention-in-europe-2015

For country profiles on material resource efficiency policies, please visit:
http://www.eea.europa.eu/publications/more-from-less/

Contents

Highlights

- Recycling has increased from 52 % of municipal waste (MSW) generated in 2001 to 64 % in 2014. The EU target of 50 % recycling by 2020 has therefore already been met.
- The 2016 target for biodegradable municipal waste sent to landfill was met in 2006.
- There is a long tradition of national waste strategies and waste management plans in the federal states.
- A ban on landfilling un-pretreated MSW, producer responsibility and a focus on separate collection have proved to be important policy initiatives.
- The latest initiatives are the introduction of the so-called recycling bin – to be adopted by the municipalities on a voluntary basis – that aims to increase recycling of plastics and metals from households, and the mandatory separate collection of bio-waste from 2015.

1 Introduction

1.1 Objective

Based on historical municipal waste (MSW) data for Germany, and EU targets linked to municipal waste (MSW) in the Waste Framework Directive (WFD), the Landfill and the Packaging Directives, the analysis undertaken includes:

- historical MSW management performance based on a set of indicators;
- uncertainties that might explain differences in country performance, which may relate more to variations in reporting methodology than to management performance;
- indicators relating to the country's most important initiatives for improving MSW management;
- possible future trends.

2 Germany's municipal waste management performance

The Federal Republic Germany consists of 16 Federal States (*Bundesländer*). Responsibility for waste management and environmental protection is shared between the national government, the Federal States and local authorities. The National Ministry of Environment sets priorities, participates in the enactment of laws, oversees strategic planning, information and public relations and defines requirements for waste facilities. Federal States and local authorities are responsible for implementing legal requirements set by the EU and national law. Each Federal State adopts its own waste management act containing supplementary regulations to the national law, for example concerning regional waste management concepts and rules on requirements for disposal. There is no national waste management planning in Germany, rather each Federal State develops its own waste management plan. (EEA, 2009)

For waste generated by households, the Recycling Management and Waste Act of 1996 assigns responsibility to the local public waste disposal authorities – in most Federal States these are districts and towns. Their responsibility covers collecting and transporting waste, measures to promote waste prevention and recovery, and planning, constructing and operating waste disposal facilities in line with national and regional legislation. Municipalities have more practical tasks such as providing sites for waste collection (Arcadis, 2014; EEA, 2009)

The German Circular Economy Act (*Kreislaufwirtschaftsgesetz* or KrWG) (Germany, 2012) adopted in 2012 incorporated the requirements of the WFD into German legislation. The Act has been complemented by separate regulations based on specific waste streams. (BiPro and CRI, 2015)

Germany was the first country in the EU to introduce producer responsibility with a packaging waste regulation in 1991. According to this, which is a core tenet of German waste legislation, the producer of a product is generally responsible for the product when it becomes waste. The principle has been implemented for a number of product types such as packaging, electric and electronic equipment, vehicles, solvents, oil and batteries.

For packaging waste, the extended producer responsibility (EPR) only applies to household packaging waste whereas in most other European countries commercial and industrial packaging waste are included. Today there are 10 competing producer responsibility organisations in place for packaging in Germany, with one organisation accounting for around 50 % of the market. Overall, the system

reportedly covers all the costs of collection and treatment for the relevant waste streams, and achieves high recovery, recycling and re-use rates (EC, 2014).

German households are serviced by door-to-door collection of residual waste. In urban areas recyclables are usually also collected door-to-door whereas in rural areas collection points are the main collection method for recyclables, although many different collection systems exist. Door-to-door collection of recyclables can be organised as separate collections in dedicated bins or sacks or as co-mingled collections of several waste materials.

Since 2015, separate collection of bio-waste is mandatory. Yellow bins or sacks are used for the co-mingled collection of packaging wastes – plastics and metals. The Federal Government plans to provide for a nationwide, extension of the use of packaging collection bins to other products made of the same materials (recycling bins). All households are served by formal waste collection systems. The commercial waste similar to household waste is collected in the same way as household waste. (BiPro and CRI, 2015; Gibbs *et al*., 2014a)

There is also a deposit refund system in place in Germany, for both single-use and refillable containers. All drink containers excluding wine, fruit juice, milk, sparkling wine or spirits have a deposit fee (Gibbs *et al.*, 2014a).

The collection services for residual and bulky household waste as well as bio-waste are funded through a fee paid by citizens and defined by each municipality. There is typically a fixed fee as well as a variable tariff. Collection of packaging waste, either door-to-door or through collection points is free of charge for citizens and is funded by EPR schemes although collection points are partly paid for by municipalities (Gibbs *et al.*, 2014a).

In 2012, for the treatment of residual waste, 94 waste incineration plants were operating in Germany, not all of them only for municipal waste incineration; several plants using refuse derived fuel and 60 mechanical biological treatment (MBT) plants of various types and configurations (Federal Statistical Office, 2015a).

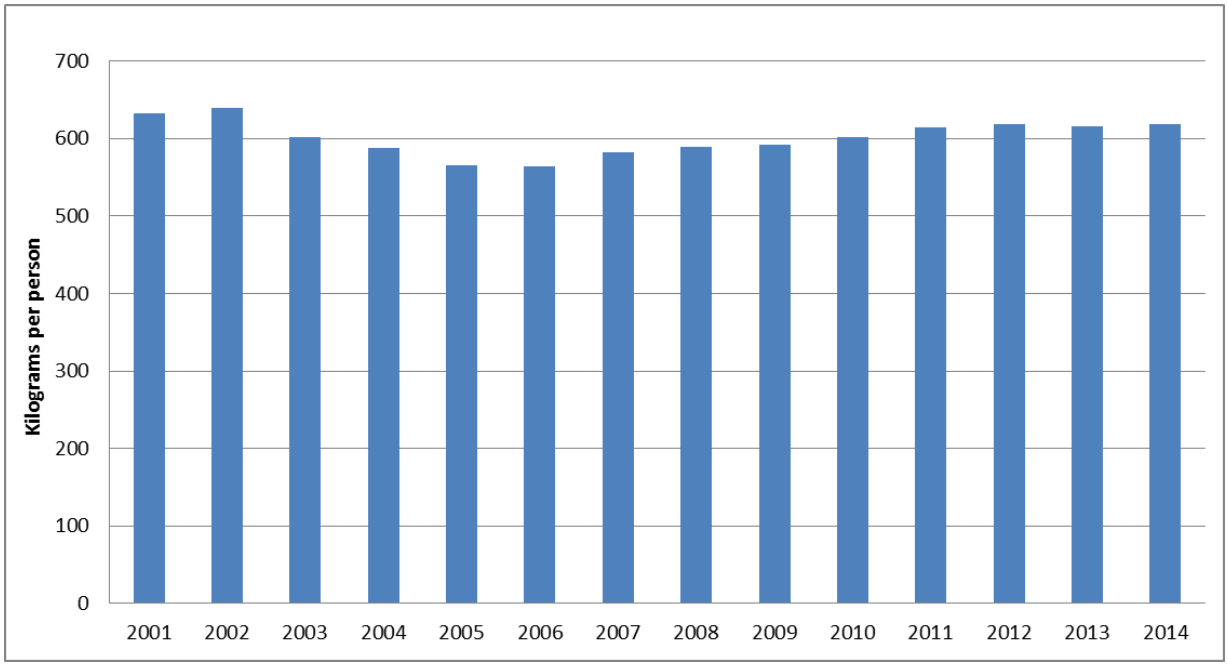
The generation of MSW in Germany peaked in 2002, reaching 52.8 million tonnes. In the following years its generation decreased, falling to 50.1 million tonnes in 2014. All generated waste reported to Eurostat is sent into treatment operations (Eurostat, 2016).

2.1 Municipal waste indicators

The following indicators illustrate the development of German MSW generation and management in 2001–2014. All percentage figures have been calculated as proportions of generated waste, rather than managed waste.

Figure 2.0 shows the development of MSW generation per person in Germany for 2001–2014. Generation decreased from 632 kilograms per person in 2001 to 564 kilograms in 2006, but then increased steadily to 618 kilogram per person in 2014.

Figure 2.0 Germany, municipal waste generation per person, 2001–2014



Source: Eurostat, 2016.

Germany was among the first European countries to introduce policies to limit landfilling in the 1990s. Measures included schemes for collecting packaging waste, bio-waste and waste paper separately. The result of this was that by 2001 Germany already recycled 52 % of municipal waste, whereas approximately 26 % was landfilled and 22 % was incinerated. In 2014, the level of recycling had increased to 64 %, landfilling was as low as 1 % and incineration had increased to 35 %. (Eurostat, 2016)

2.1.1 Municipal waste recycling, 2001–2014

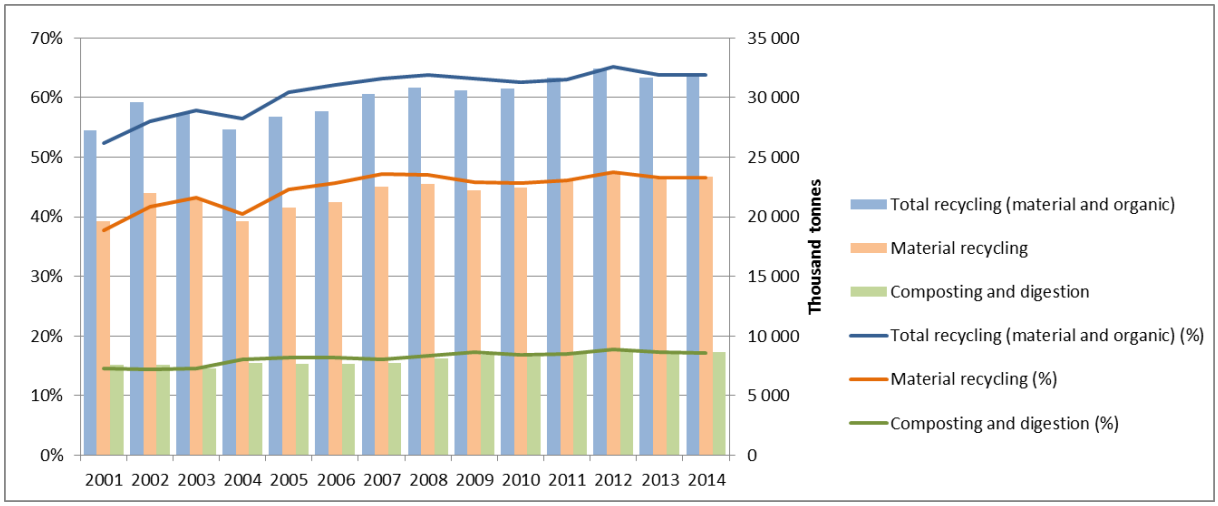
Figure 2.1 shows the development of recycling of MSW in Germany related to total recycling, material recycling and organic recycling – composting and other biological treatment.

Germany had already a high level of recycling of MSW in 2001, and the total recycling continued to increase steadily from 52 % in 2001 to 64 % in 2014.

The reported amounts of MSW generated in Germany decreased 12 % between 2002 and 2006, and therefore the percentage increase of recycling in the same period is not due to an increase in the recycled amounts as such, rather it is due to the fact that the decrease of MSW generation in is larger than the increase in recycling.

Nevertheless, the total and consistent increase of MSW recycling covers different trends in material and organic recycling. The amount of material recycling increased during the period from 19.6 million tonnes, 38 %, in 2001 to 23.3 million tonnes, 47 %, in 2014. However, this development has been very uneven. In 2001–2014 organic recycling increased very little, from 15 % to 17 %, equivalent to an increase from 7.6 million tonnes to 8.6 million tonnes.

Figure 2.1 Germany, recycling of municipal waste, 2001–2014, per cent and tonnes



Source: Eurostat, 2016.

The composition of recycled municipal waste and its development from 2006 to 2013 is shown in Table 2.1.

Table 2.1 Germany, composition of separately collected municipal waste, 2006– 2013, in '000 tonnes

	2006	2007	2008	2009	2010	2011	2012	2013
Glass	1 924	2 231	2 479	2 432	2 522	2 594	2 390	2 343
Paper and cardboard	8 042	8 085	8 458	8 020	7 930	8 074	8 043	7 533
Mixed packaging waste/recyclables	4 015	4 370	4 237	4 225	4 219	4 330	4 400	4 461
Waste electrical and electronic equipment (WEEE)	405	396	468	604	584	590	621	596
Metal, textiles, etc.	1 090	1 242	1 545	1 348	1 378	1 264	1 383	1 471
Green kitchen waste from households	3 750	3 724	3 876	3 881	3 745	3 973	3 933	4 029
Organic food waste from canteens etc.	587	649	514	629	679	683	621	585
Garden and park waste	3 956	4 403	4 314	4 486	4 801	4 782	5 017	4 816
Bulky waste	1 272	1 350	1 399	1 321	1 283	1 306	1 377	1 324
Mixed household waste and similar commercial waste collected together with household waste	1 583	1 571	1 570	1 525	1 119	1 282	2 162	2 064

Source: The Federal Statistical Office, 2015b

Table 2.1 shows that paper and cardboard, mixed packaging waste/recyclables, followed by green kitchen waste as well as garden and park waste comprise the largest amounts of recycled municipal waste. For the individual waste streams, there have been some fluctuations in the recycled amounts during the period. The recycled amounts for most waste fractions, however, show an increase from 2006 to 2013, except for paper and cardboard where there has been a slight decrease.

The EU's 2008 WFD includes a target for certain fractions of MSW: 'by 2020, the preparing for re-use and the recycling of waste materials such as at least paper, metal, plastic and glass from

households and possibly from other origins as far as these waste streams are similar to waste from households shall be increased to a minimum of overall 50 % by weight'. EU Member States may choose between four different methodologies to calculate compliance with the target[1]. Germany has chosen calculation method 4 (Gibbs *et al.*, 2014a). The recycling rates shown in this paper also correspond to method 4, the only method for which time series data exist. It is clear from Figure 2.3 that Germany will fulfil the EU recycling target of 50 % by 2020 if the recycling rate continues previous years' trends. In 2015, the European Commission proposed new targets for municipal waste of 60 % recycling and preparing for reuse by 2025 and 65 % by 2030, based on only one calculation method, and with the option of time derogations for some countries (EC, 2015).

2.1.2 Landfill of biodegradable municipal waste

It is a general requirement of the EU Landfill Directive that all Member States have to reduce the amount of biodegradable municipal waste (BMW) landfilled by a certain percentage by 2006, 2009 and 2016. The targets are related to the amount of BMW generated in 1995 – 28.4 million tonnes in Germany.

Germany has reported to the Commission that zero tonnes of BMW were landfilled in 2006–2012 (Figure 2.3) (EC, forthcoming; EC, 2012). This is due to the fact that Germany introduced a ban on the landfilling of non-pretreated MSW. It was introduced in two steps using three pieces of legislation because the initial statute contained severe loopholes. The first step was an administrative regulation (TASi) in 1993, which limited the organic content in waste going to landfills to less than 3 % total organic carbon (TOC) supplemented by a transition period until 1 June 2005 (EEA, 2009). The second step was two ordinances in 2001 and 2002 that aimed at closing some of the loopholes within the 1993 administrative regulation (EEA, 2009) and setting the following requirements (ETC/SCP, 2009):

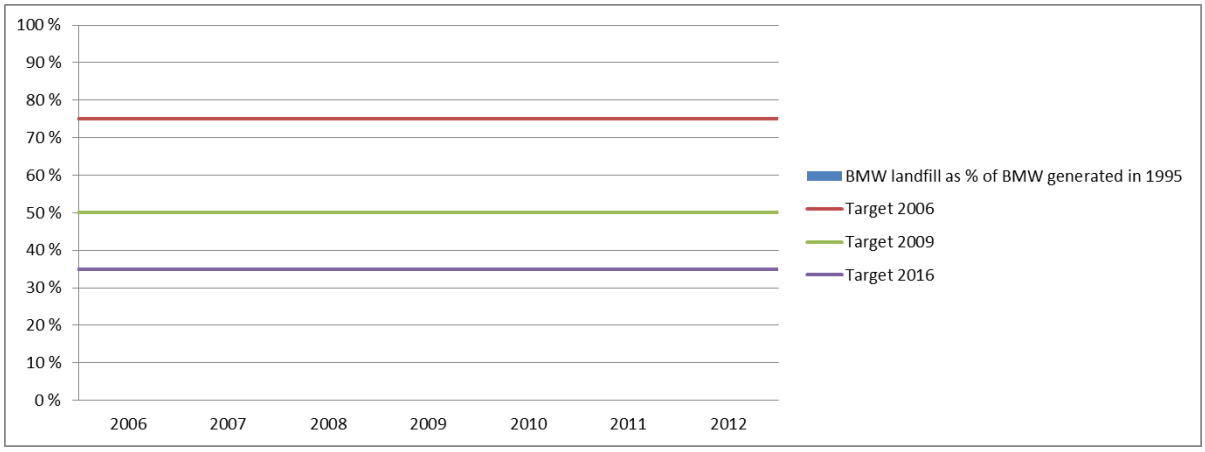
- municipal waste after 1 June 2005: a maximum of 5 % TOC content in waste direct landfilled;
- municipal waste, which has been mechanically/biologically pretreated: a maximum of 18 % TOC content and very low content of biodegradable organic carbon in waste landfilled measured with degradation tests.

With the implementation of these initiatives, Germany fulfilled by 2006 the requirements for 2006, 2009 and 2013 by 2006 (Figure 2.3).

[1] Commission Decision 2011/753/EU allows countries to choose between four different calculation methods to report compliance with this target. Member States have the option of considering four alternative waste streams and fractions:

1. paper, metal, plastic and glass household waste;
2. paper, metal, plastic, glass household waste and other single types of household waste or of similar waste from other origins;
3. household waste;
4. municipal waste (the method used in this document).

Figure 2.3 Germany, landfill of biodegradable municipal waste in Germany, 2006–2012, % of biodegradable municipal waste generated in 1995



Source: EC, forthcoming

2.1.3 Regional differences in municipal waste recycling, 2001–2013

German regions (NUTS2-level) report data only on an aggregated level for recycling and energy recovery. Regional differences for recycling can therefore not be shown here.

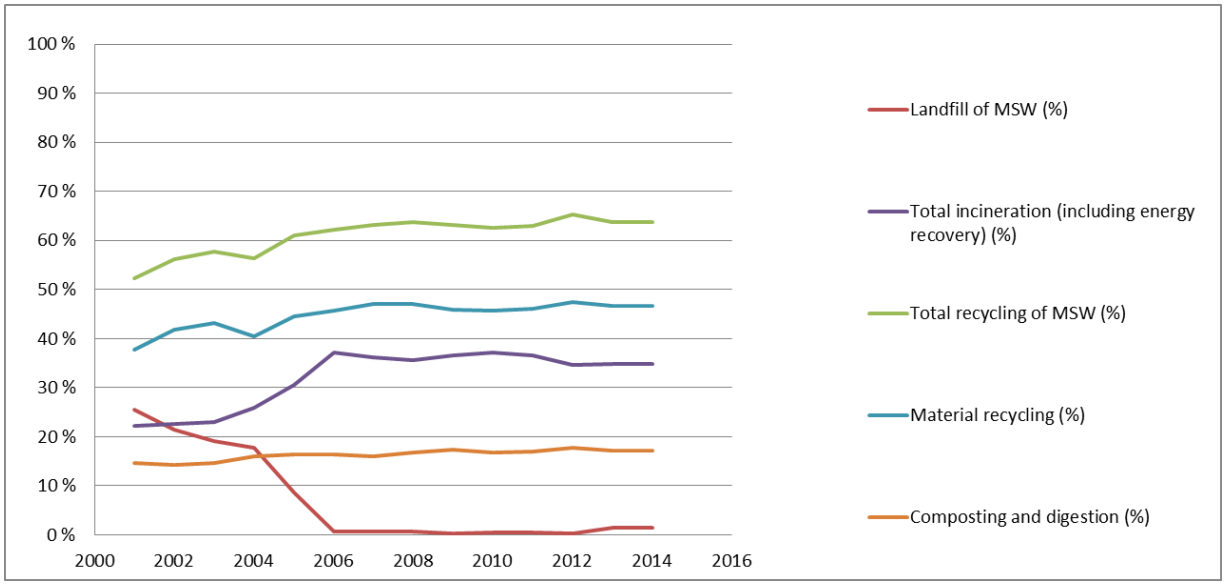
2.1.4 Recycling and landfill taxes

Germany has not introduced a landfill tax but opted for a ban of non-pretreated waste in order to divert waste from landfill. The requirement of pre-treatment of MSW before it can be landfilled combined with other waste management activities, such as the introduction of separate collection and producer responsibility, have been strong drivers in diverting MSW away from landfills and towards recycling.

Figure 2.4 shows that the ban on non-pretreated waste, fully enforced in 2005, has had a huge impact on the amount of MSW landfilled. The figure also shows that although the total amount of MSW for recycling has increased from 2005, it is primarily the amount of MSW sent to incineration that has increased, from 14.2 million tonnes in 2005 to 17.4 million in 2014. However, this increase in incineration does not necessarily reflect the actual amount of MSW incinerated. According to the German reporting to Eurostat, 'incineration of MSW (without energy recovery) includes "treatment for disposal", mostly reflecting mechanical biological treatment', with the amounts ranging from 89 000 tonnes in 2002 to 2.3 million tonnes in 2006 (Eurostat, 2015).

Furthermore, the waste generated during pre-treatment processes such as sorting or MBT also includes waste ending up partly in incinerators and partly in landfills, with the latter part not necessarily reported as landfilled but as incinerated (see above). According to a study on the flows from MBT in Germany, 22 % of the input of approximately 6.4 million tonnes into MBT plants ended up in landfills in 2007 (Thiel and Thomé-Kozmiensky, 2011).

Figure 2.4 Germany, development of recycling, landfill and incineration of municipal waste, 2001–2014, per cent



Source: Eurostat, 2016

Germany has increased its incineration capacities substantially since the late 1990s – several studies forecast different amounts of incineration overcapacity. According to the German Federal Environmental Agency, the studies overestimate the possible surplus because they include the incineration capacity that has already been or soon will be withdrawn (Federal Environment Agency, 2012). An overcapacity could, however, potentially offer economic incentives for incinerating MSW, because the incineration plants may have to lower their prices in order to operate competitively.

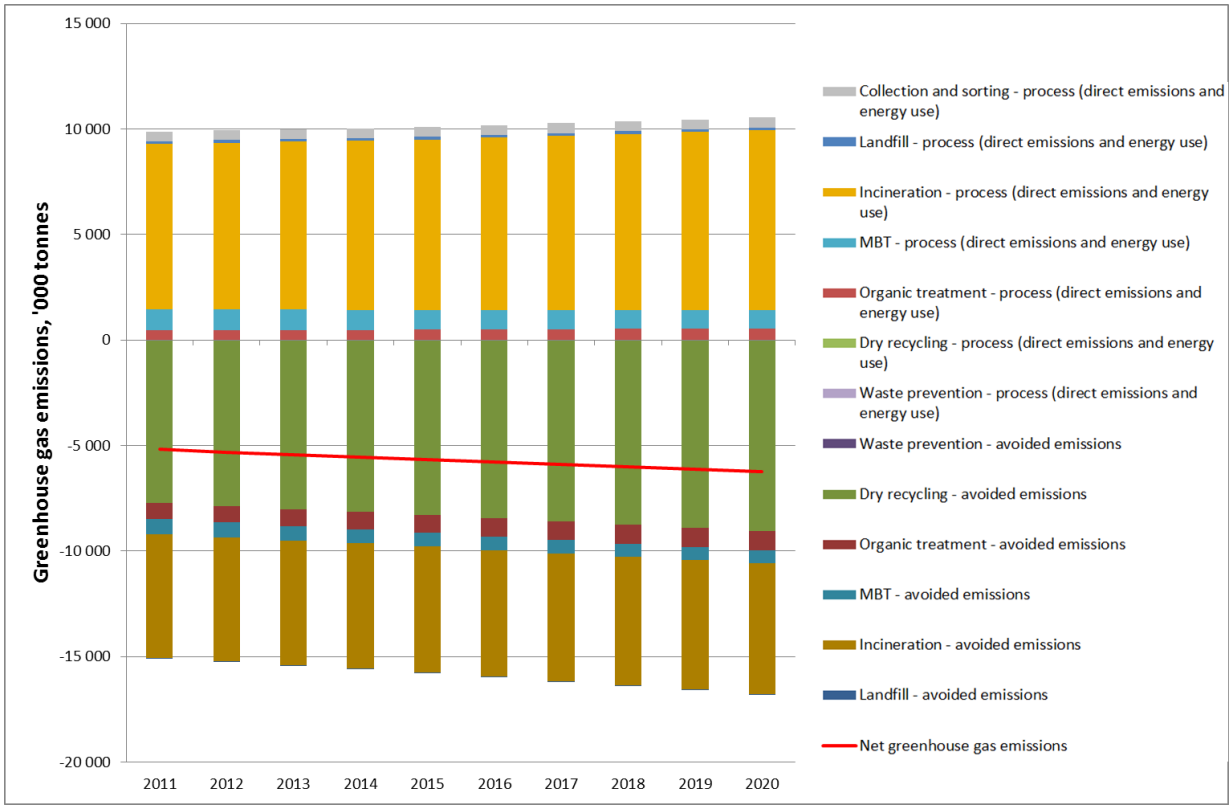
2.1.5 Environmental benefits of better municipal waste management

Figure 2.5 shows a scenario for greenhouse gas emissions from MSW management in Germany. The scenario assumes a yearly decrease of 0.1 % for municipal waste generation for the years 2011–2015 and a yearly increase of 0.2 % for the years 2015–2020. The scenario also assumes that EU targets for municipal waste are fully met. However, as Germany has already met the targets of the WFD for recycling of MSW and the targets of the Landfill Directive to divert BMW from landfill, the scenario does not assume major changes in MSW management. The calculation of emissions is based on data and assumptions in the European Reference Model on Municipal Waste Generation and Management. The approach taken in the model is rooted in life-cycle thinking, in that it considers not only direct emissions, but also avoided emissions associated with the recycling of materials, and the generation of energy from waste management processes. The more detailed methodology is described in Gibbs *et al.* (2014b). The level of emissions depends on the amount of waste generated and the treatment it undergoes each year.

Figure 2.5 shows direct emissions, avoided emissions and net emissions resulting from the management of MSW. All the emissions (positive values) represent direct operating emissions for each waste management option. The phases of the waste management chain covered include waste prevention; material recycling; composting and anaerobic digestion; MBT and related technologies; collection and sorting; incineration and landfill.

For avoided emissions (negative values), the calculations integrate the benefits associated with energy recovery and material recycling of paper, glass, metals, plastics, textiles and wood, and bio-treatment of food and garden waste from MSW. (Gibbs *et al.*, 2014c)

Figure 2.5 Germany, scenario for greenhouse gas emissions from municipal waste management in, 2011–2020



Source: ETC/WMGE, calculation based on the European Reference Model on Waste

Note: Results presented in this figure should not be used for the compilation of greenhouse gas reporting for the Intergovernmental Panel on Climate Change (IPCC) national inventory report, or be compared with IPCC figures, as the methodology employed here relies on life-cycle thinking and, by definition, differs substantially from the IPCC methodology.

MBT means mechanical-biological treatment.

In countries with a low landfill share and high recycling rates, waste treatment can have an overall positive impact on greenhouse gas emissions, reducing emissions from the economy as a whole. Germany is one of these countries. Based on the modelled scenario with full policy implementation, net emissions from the management of municipal waste in Germany are negative and expected to decrease over the period 2011–2020. Throughout the modelled time period direct greenhouse gas emissions related to municipal waste management are almost exclusively from incineration.

2.2 Uncertainties in the reporting

Some uncertainties or differences in how countries report MSW recycling can result in different recycling levels. This applies, for example, to the following issues:

- the extent of packaging waste from households and similar packaging from other sources included or not included in the MSW recycling reported;

- the definition of municipal waste used by the country, such as the inclusion or exclusion of home composting;
- the methodology used to report the inputs and outputs of MBT and sorting plants.

Municipal waste includes household and similar commercial and industrial wastes and institutional wastes including separately collected fractions as well as packaging – including separately collected, municipal packaging waste (waste group 15 01). Thus, packaging waste is included in the reporting of municipal waste to Eurostat (The Federal Statistical Office, 2014).

In Germany, a significant amount of MSW is treated in MBT plants as mentioned in section 2.1.4. According to the reporting to Eurostat, this amount is not registered as MSW recycled but as MSW incinerated (Eurostat, 2015). It therefore seems that the recycling of MSW is not overestimated due to MBT. However, the real amount of incinerated MSW might be overestimated due to the fact that landfilled MBT outputs are not reported as landfilled MSW, but as incinerated.

According to the Federal Statistical Office (2014) the reporting of waste undergoing sorting processes is based on inputs and thus, rejects from sorting are currently not subtracted from the collected amounts. The numbers presented in this paper therefore show separately collected waste, not final recycled waste.

2.3 Important initiatives for improving municipal waste management

As mentioned earlier, for more than 20 years Germany has had a strategy for diverting MSW from landfills and increasing recycling. The following are the most important initiatives taken to increase MSW recycling.

- A long tradition of developing waste strategies at a national level, and developing waste management plans in the Federal States and municipalities.
- Introducing producer responsibility for packaging waste in 1991 (EEA, 2009).
- In 1999, the German government committed itself to recovering all municipal waste by 2020, so that landfilling of municipal waste and waste treatment residues would no longer be necessary. This is an ambitious objective and includes, for example, recovering waste incineration residues and further developing treatment technologies such as sorting and MBT (EEA, 2009).
- A ban on landfilling un-pretreated MSW by defining requirements for the organic content of waste that to be landfilled (a maximum 5 % TOC content 18 % if the waste has been pretreated by MBT). The first initiatives in relation to this ban were taken in 1993, followed up in 2001 and 2002 and fully implemented in 2005 (EEA, 2009 and ETC/SCP, 2009).
- A focus on separate collection and recycling of secondary raw materials (paper and bio-waste), pre-treatment of mixed household waste in MBT plants and dedicated incineration with energy recovery of mixed household waste (EEA, 2009).
- The latest initiative is a proposal of the Ministry of the Environment for a new Packaging law, further developing the Packaging Waste Ordinance. It aims to improve the separate collection of recyclables from households – both packaging and non-packaging recyclables –, including through combined collection of packaging waste and non-packaging made of the same materials. Moreover, it increases recycling targets for packaging waste by material, and requires producer responsibility organisations to better align fees for packaging with their recyclability (BMUB, 2016).

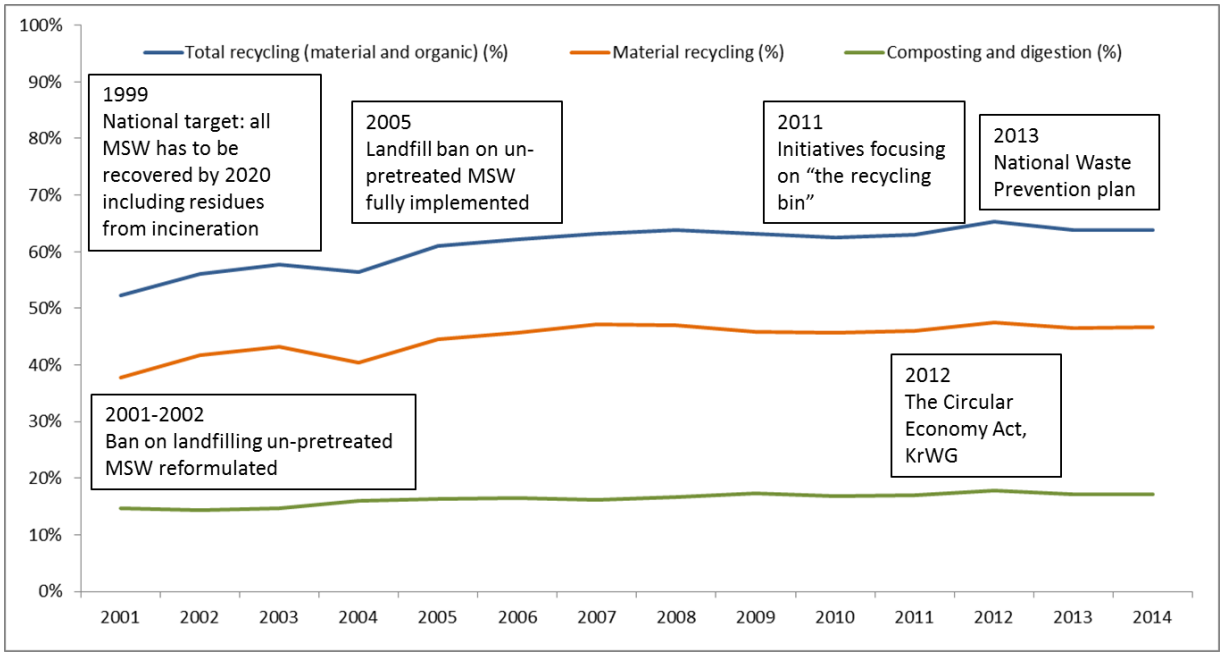
The Circular Economy Act (Germany, 2012) stipulated separate bio-waste collection as mandatory from January 2012. The separate collection requirement also applies to paper, metal, plastic and glass

waste. The Act defines a recycling rate of 65 % by 2020 for municipal waste, thus surpassing the WFD requirements.

The regional targets and objectives, as well as implemented policies for municipal waste management, are specific to each Federal State's waste management plan (Gibbs *et al.*, 2014a). The compliance of the Federal States' waste plans with the WFD was analysed in 2012 and it was concluded that the plans of six Federal States were partially non-compliant or lacked some information (Arcadis, 2014).

A national waste prevention plan has been in place since 2013 (EEA, 2015).

Figure 2.6 Germany, recycling of municipal waste in and important policy initiatives, 2001–2014



2.4 Possible future trends

Germany has had a MSW recycling level higher than 50 % for many years. As discussed in section 2.1.1, Germany will most likely continue fulfilling the EU recycling target of 50 % by 2020.

The question is more whether Germany will be in the position to further increase its recycling level and by how much. Germany's own 1999 target – by 2020, all municipal waste including waste treatment residues to be completely recovered – is ambitious and it is likely to increase the recycling percentage of MSW.

However, Germany may experience a surplus of incineration capacity in the coming years. This might imply lower prices for incineration, which may well be the strongest challenge to increasing the recycling of MSW. A first indication of this development is that there has recently been a very slight decrease in the recycling of MSW.

The Circular Economy Act (Germany, 2012) made the separate collection of bio-waste mandatory from the beginning of 2015. This may have an effect on the running of MBT plants because biodegradable material might be redirected from MBTs to fermentation and composting plants for the

production of bio-gas. In the mid- and long term it is possible that both MBT plants and composting plants will have to be closed (Federal Environment Agency, 2012).

Further changes in the collection schemes may arise if the recycling bin for packaging and non-packaging recyclables is introduced by national legislation.

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