

Municipal waste management in Sweden



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February 2013

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Context

The Topic Centre has prepared this working paper for the European Environment Agency (EEA) under its 2012 work programme as a contribution to the EEA's work on waste implementation.

Disclaimer

This **ETC/SCP working paper** has been subjected to European Environment Agency (EEA) member country review. Please note that the contents of the working paper do not necessarily reflect the views of the EEA.

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Highlights

- The overall treatment of MSW in Sweden is characterised by an equal share of recycling and incineration (49 %) while landfilling has been diminished to around 1 % of generated MSW in 2010.
- Recycling rates have been already high in 2001 at 40 % and by 2010 Sweden had reached 49 %, just 1 % less than the target of 50 % set out in the Waste Framework Directive. Sweden will most likely be able to fulfil the target by 2020.
- The landfill tax which came into force on 1 January 2000 played a vital role in the diversion of MSW from landfill in favour of recycling and incineration. Consecutive increases in taxation level in 2002, 2003 and finally in 2006 instigated a continuous increase in material recycling of MSW.
- The landfill ban on sorted combustible waste in 2002 and the landfill ban on organic waste in 2005 were catalysts for the diversion of MSW from landfills.
- The environmental objectives set by the Swedish government in 2005 include, among others, the target of 50 % recycling of household waste by 2010.
- A tax on incineration was introduced in 2006 in order to boost further material and organic recycling but was repealed in 2010.

1 Introduction

1.1 Objective

Based on historical MSW data for Sweden and EU targets linked to MSW the analysis undertaken includes:

- The historical performance on MSW management based on a set of indicators;
- Uncertainties that might explain differences between the countries' performance which are more linked to differences of what the reporting includes than differences in management performance;
- Relation of the indicators to the most important initiatives taken to improve MSW management in the country; and
- Assessment of the future possible trends and achieving of the future EU targets on MSW by 2020.

2 Sweden's MSW management performance

Historically, Sweden has shown strong commitment to environmental protection initiatives and policies, particularly in the area of waste. Already by 1969, The Environment Protection Act imposed far-reaching environmental obligations on new waste treatment facilities. Several regulations came into force during the 1990s, including the increasing importance of producer responsibility and a concentrated effort on measures to reduce the landfilling of waste. The Environmental code of 1999, replacing the previous Environmental Protection Act, integrated 15 previously existing environmental laws and formed an umbrella legislation governing all environmental impacts within the framework of a sound sustainable development for Sweden. In 2005, Sweden's Waste Plan 'A Strategy for Sustainable Waste Management' laid down the future direction of waste management and set distinctive targets to be met by 2010, based on the Swedish Environmental Objectives which were enacted by the Swedish government in the same year (SEPA, 2005).

Swedish MSW management is characterised by a clear division of responsibilities for all involved actors. Municipalities are obliged to have a waste management plan and bear the responsibility of collecting and disposing household waste, except for the product categories covered by producer responsibility. Municipalities may issue local regulations regarding the management of household waste, including fees (ETC/SCP, 2009). Households are responsible for separating and depositing waste at the various available collection points maintained by the municipalities. Households are also responsible for complying with municipal waste management regulations. Lastly, producers are obliged to take care of waste arising from their products (Avfall Sverige, 2011). In Sweden, producer responsibility for end-of-life packaging, cars, tyres, recycled paper, batteries and electrical and electronic products are in place (SEPA, 2005).

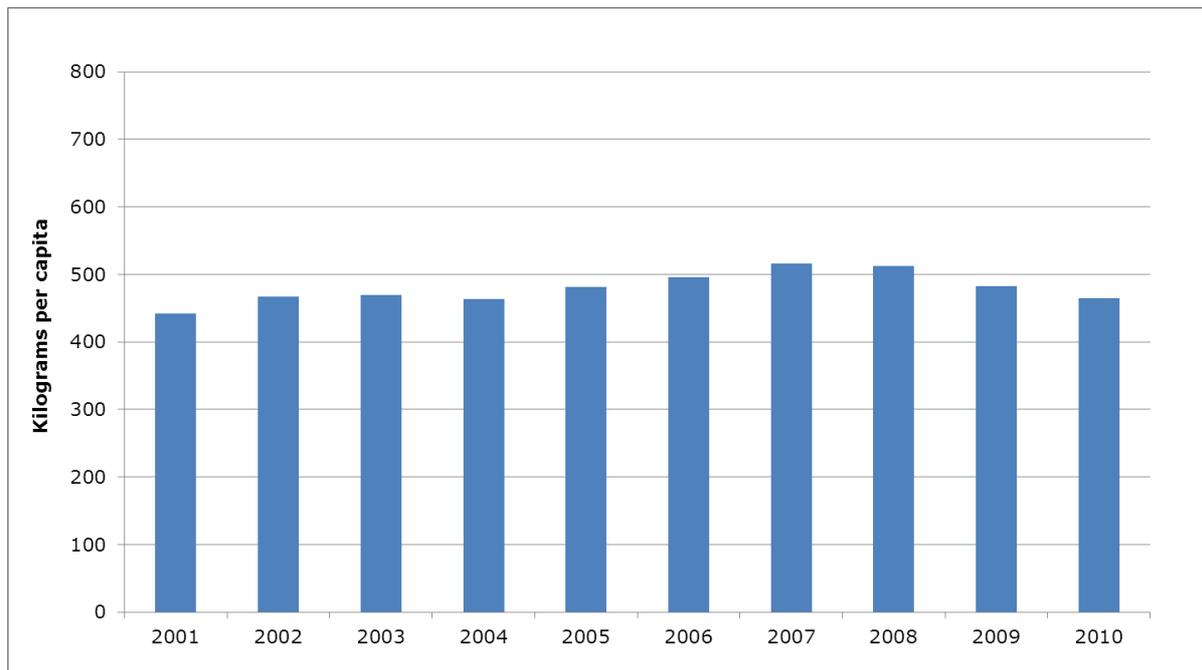
Swedish MSW management is governed by the principle of waste minimisation as a top priority in accordance to the waste hierarchy found in the Waste Framework Directive (2008/98/EC). The generation of MSW in Sweden peaked in 2008, reaching 4.73 million tonnes. In the following two years the generation of MSW fell to 4.36 million tonnes in 2010, which is around the same amount as in 2005 with 4.35 million tonnes. One possible explanation for the reduced quantities of waste has been argued to be the economic recession, as reduced consumption inevitably leads to reduced waste quantities (Avfall Sverige, 2009).

2.1 MSW Indicators

Figure 2.0 shows the development of MSW generation per capita in Sweden from 2001 to 2010. There has been a gradual increase between the years 2001-2007, where MSW generation peaked at

516 kg per capita. From 2008 and onwards there is a steady decrease, dropping to 465 kg per capita in 2010. As discussed above, a possible explanation for this decrease might be the economic recession.

Figure 2.0 MSW generation per capita in Sweden



Source: Eurostat, 2012

The preferred waste management options in Sweden are incineration and recycling. MSW quantities have been almost equally diverted between these two waste treatment paths with a slight preference to incineration. Only in the years 2006 and 2007 was the share of recycling of MSW higher than the share of incineration due to an incineration tax imposed by the Swedish government in order to boost recycling, among other reasons. But soon after, incineration again increased its share. The tax was abolished in 2010. Sweden has been drastically reducing the amount of waste going to landfill from around 22 % of MSW in 2001 to 1 % in 2010, which translates to only 42 000 tonnes ending up in landfill in 2010 compared to 880 000 tonnes in 2001.

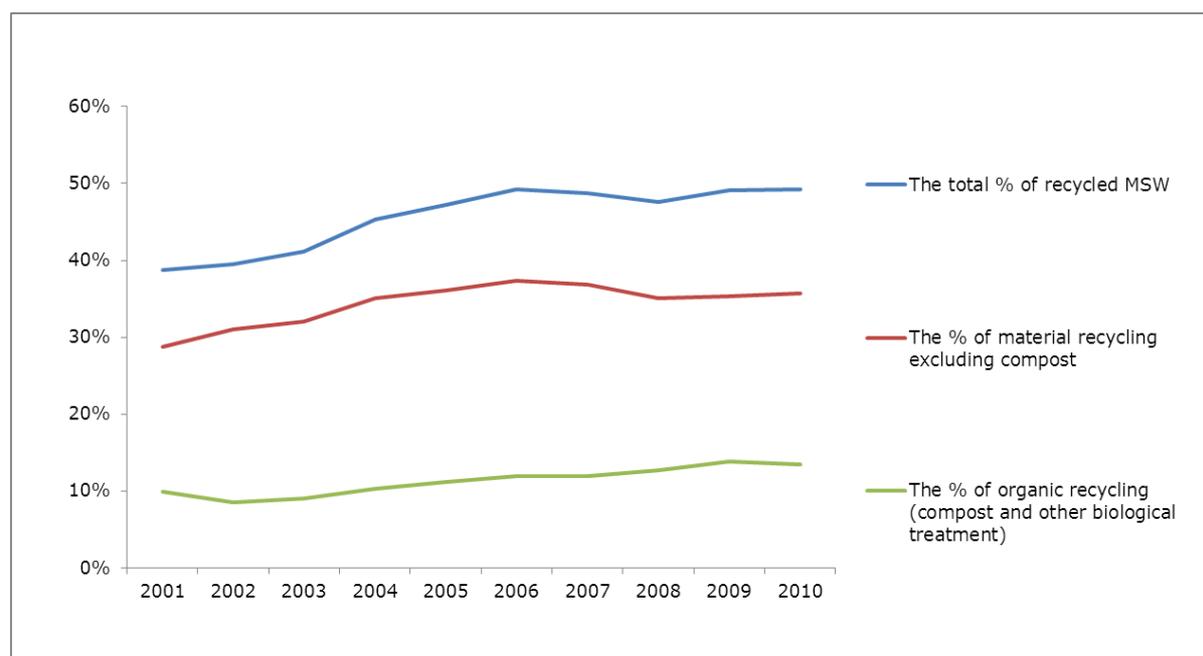
The following indicators illustrate the development of the Swedish MSW management between the years 2001-2010.

2.1.1 The recycling of MSW from 2001 to 2010

Figure 2.1 shows the development of recycling of MSW in Sweden related to total recycling, material recycling and organic recycling (compost and other biological treatment).

In Figure 2.1 it can be observed that total recycling of MSW in Sweden was already high in 2001, at around 40 % of the generated MSW. From 2001 it is evolving steadily, with some ups and downs, and finally reaching an increase of 10 percentage points between the years 2001 and 2010. Material recycling rates have been considerably high due to efforts made in the previous years establishing well organised and operational producer responsibility schemes for different products. Although recycling in total is increasing steadily, material recycling shows a slight decrease in 2008 and onwards. The continuous growth of the MSW recycling rate is mainly due to organic recycling which since 2002 had been increasing by 1 % each year on average until 2009. Organic recycling remains relatively low compared to material recycling, but waste quantities with organic content are diverted also to incineration, directly competing with composting and other biological treatment.

Figure 2.1 Recycling of MSW in Sweden



Source: Eurostat, 2012

Note: The percentages are calculated as % of generated MSW

The following table shows the composition of material recycling as reported by various producer responsibility schemes for the years 2006-2010. Although the amounts of packaging are not presented below, their quantity has been included in the final calculation of the total material recycling. Statistics for packaging and paper recycling for 2010 will not be reported until 2012 because the method for reporting statistics is currently under review (Avfall Sverige, 2011). In Table 2.1 the total amount of biologically treated waste is also presented.

Table 2.1 Composition of recycled municipal waste in Sweden between 2002 and 2010, in 1000 tonnes

Recycling of MSW	2002	2003	2004	2005	2006	2007	2008	2009	2010
Newspapers	435	424	448	483	483	474	459	420	-
Office paper	123	129	128	135	153	164	156	118	132
Cardboard packages	346	361	375	380	487	504	482	480	-
Metal packages	33	32	34	34	34	35	33	33	-
Plastic packages	24	26	29	31	42	49	50	44	-
Glass packages	149	151	152	155	159	171	174	177	-
WEEE	74	80	87	102	122	128	123	118	117
Refrigeration units	27	24	22	25	28	30	29	26	28
Metals from household waste	84	96	110	130	150	180	152	170	159
Total material recycling	1 295	1 314	1 385	1 474	1 658	1 738	1 658	1 587	1 559
Total household waste treated biologically	354	403	434	454	469	561	597	618	587*
TOTAL RECYCLING	1 649	1 717	1 819	1 928	2 127	2 299	2 255	2 205	2 146

Source: Avfall Sverige, 2007, 2010, 2011

Note: * includes 60 000 tonnes of home compost

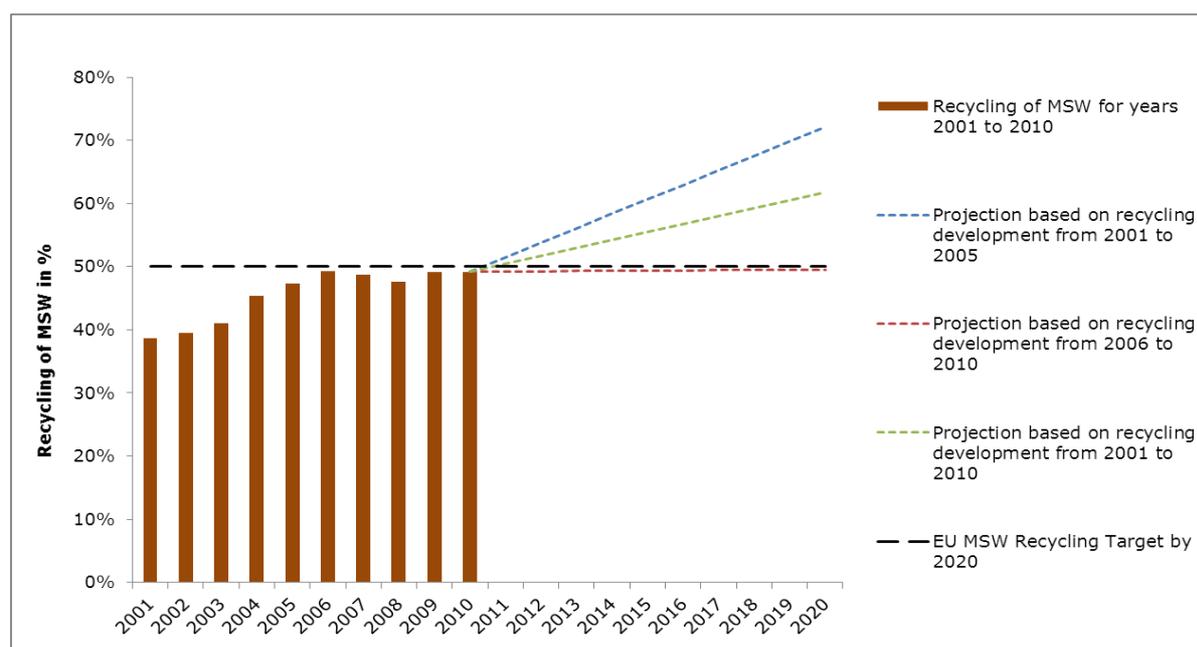
2.1.2 The yearly increase rate of recycling of MSW

In order to assess the prospects for Sweden to meet the 50 % recycling target by 2020 as required by the Waste Framework Directive (2008/98/EC)¹, three scenarios have been calculated. The scenarios assume that recycling in the period 2010 to 2020 develops with the increase rates of recycling in the periods 2001-2005, 2006-2010 and 2001-2010 (Figure 2.2)

It is obvious in Figure 2.2 that Sweden is already very close to the target and all projections show that the target will be fulfilled by 2020. Nevertheless, the development of recycling in the last 5 years has been sluggish and as a matter of fact no further major improvements have been achieved recently. The Swedish government had already in 2005 set a special target for at least 50 per cent of household waste to be recycled by recovery of materials, including biological treatment by 2010 (Sweden, 2004). Indeed, between the years 2004 and 2006 recycling rates developed in a dynamic way increasing by 2 % per year, but then stagnated at around 49 % of the MSW generated, and Sweden just missed the target. Although Sweden has yet another 10 years (from 2010) to reach the target of the Waste Framework Directive, Sweden would only marginally be able to reach the target by 2020 if the recycling rate continues to follow the trend of the past 5 years.

If Sweden would continue to increase its MSW recycling rate with the same average pace as in 2001-2010, it would reach up to 62% recycling of MSW in 2020.

Figure 2.2 Future recycling of MSW in Sweden



Source: Calculation done by Copenhagen Resource Institute (CRI) based on Eurostat, 2012

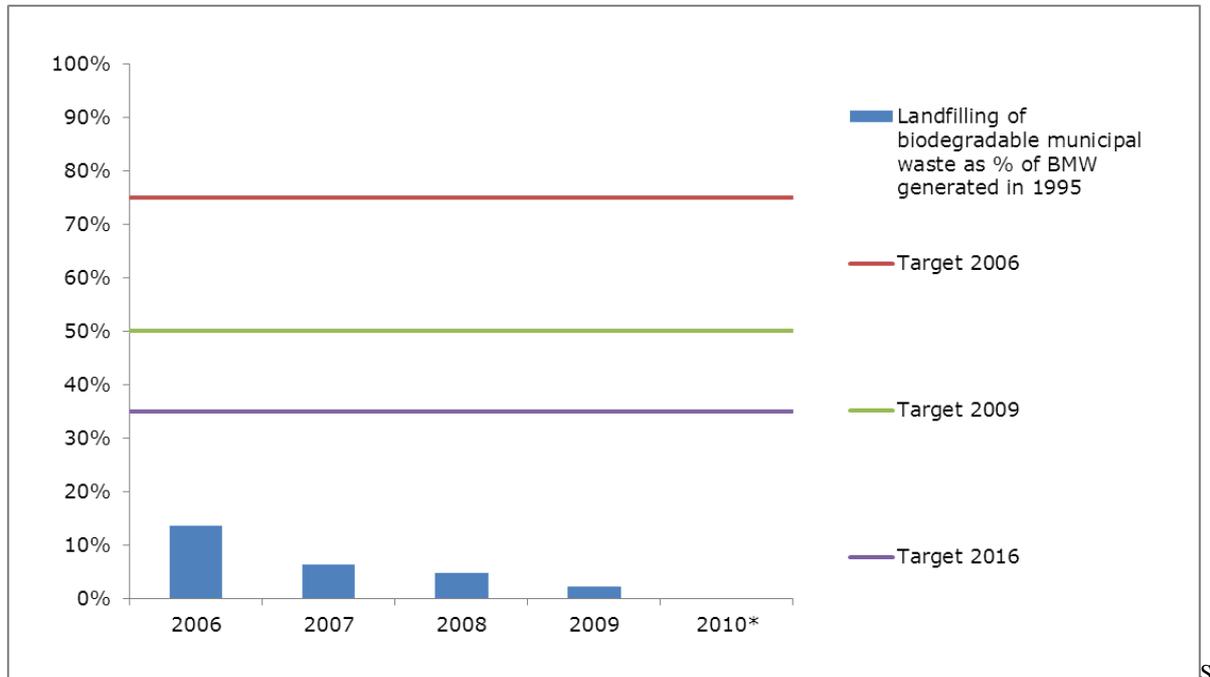
Please note that these three scenarios are very simplistic and do not take into account any planned policy measures. In addition, they are based on one calculation methodology for recycling of municipal waste (MSW recycled/MSW generated, using data reported to Eurostat), whereas countries may choose to use another methodology to calculate compliance with the 50 % recycling target of the Waste Framework Directive. The scenarios in Figure 2.2 should therefore be interpreted only as to give some rough indications and assessment of the risk of missing the target.

¹ EU's revised Waste Framework Directive from 2008 (EU, 2008) includes a new 50 % recycling target for waste from households, to be fulfilled by 2020. In 2011, the European Commission decided that countries can choose between four different calculation methods to report compliance with this target. One of these methods is to calculate the recycling rate of MSW as reported to Eurostat (EC, 2011).

2.1.3 Landfilling of biodegradable municipal waste

According to the EU Landfill Directive, Member States have to reduce the amount of biodegradable municipal waste landfilled (BMW) with a certain percentage by 2006, 2009 and 2016. The targets are related to a generated amount of BMW in 1995, in which Sweden generated 2 242 000 tonnes of BMW.

Figure 2.3 Landfilling of biodegradable MSW in Sweden



Source: EC, 2012 and CRI calculation. *Data missing

In 2001, The Swedish government issued the waste ordinance (2001:512) on landfilling which prescribed a set of measures to apply in the following years, by banning the landfilling of combustible waste (from 2001) and all organic waste (from 2005) with only certain exceptions (ETC/SCP, 2009). Therefore, Sweden should have eliminated the landfilling of BMW since 2005 or at least minimise it to the absolute necessary for waste that cannot be treated otherwise. Nevertheless, in the case that a region in Sweden is lacking the capacity to appropriately manage the treatment of the arising BMW, the County Administrative Board has the right to grant a certain exemption from the landfill ban to that specific region (SEPA, 2006).

Sweden has reported the landfilled amount of BMW to the Commission for the years 2007, 2008 and 2009 (EC, 2012). According to these data (Figure 2.3) the landfilling of BMW is steadily decreasing and in 2009 only 2 % (related to the generated amount of BMW in 1995) was going to landfill. Sweden has already reached all diversion targets of the Landfill Directive and no further effort is required.

Data is missing for 2010. Whereas for other countries, we have estimated the missing data by subtracting the increase in amount of MSW going to biological treatment from 2009 to 2010 from the amounts of BMW being landfilled in 2009, this method is not valid in the case of Sweden, because the BMW that is still landfilled originates from Swedish regions where the waste management capacity is significantly underdeveloped and organic waste could end up in landfill using an exemption of the landfill ban.

We therefore assume that the amount of BMW landfilled has not changed significantly between 2009 and 2010 and ranges at around 2 % (related to BMW generated in 1995).

2.1.4 Regional differences of MSW recycling from 2001 to 2010

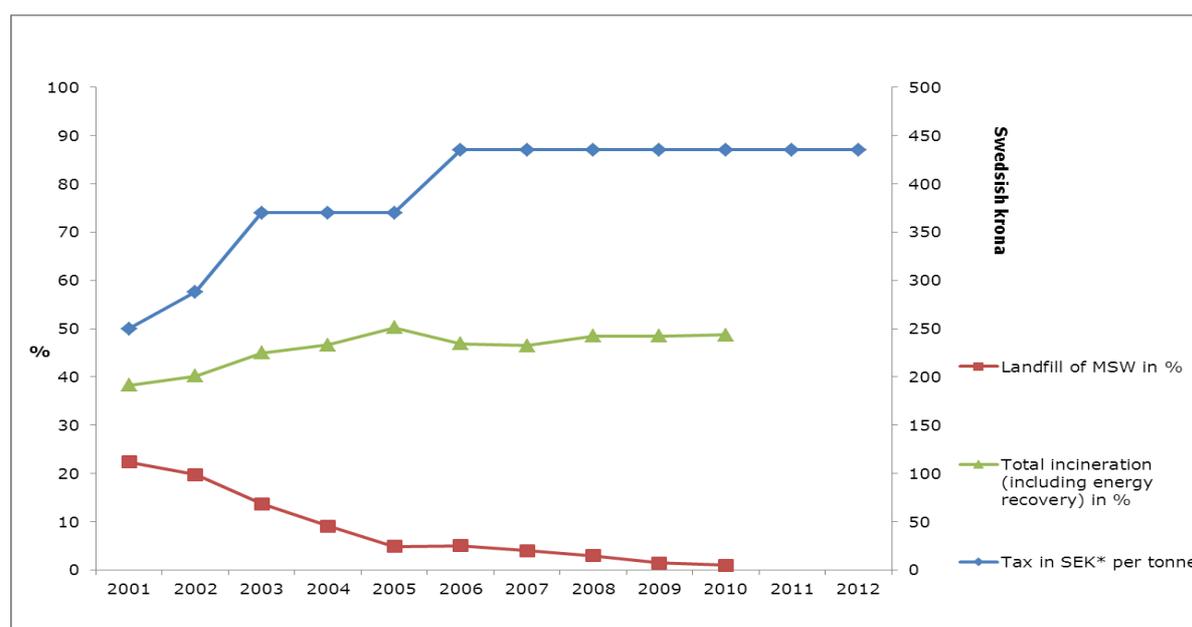
There is no regional data for recycling reported to Eurostat by Sweden.

2.1.5 The relation between landfill tax level and recycling level of MSW

The Law (1999:673) on waste tax of 1999 introduced the landfill tax, which was put into effect in the beginning of 2000 and was equal to 250 Swedish Kronor (SEK) per tonne of waste landfilled. The level of the tax was subsequently increased to 288 SEK/tonne (approx. EUR 31.7) in 2002, to 370 SEK/tonne (approx. EUR 40.7) in 2003 and reached 435 SEK/tonne (approx. EUR 47.9) in 2006, resulting in an overall increase of 74 % since its introduction in 2000 (SEPA, 2010). Under the Law on waste tax, all material entering landfill facilities is taxed, while material removed from the facility qualifies for a deduction. The tax is paid by the owner of the landfill on the basis of weight. If the amount of waste coming into a landfill is of a low quantity, it is possible to decide upon the tax based on other categories (Sweden, 1999).

In Figure 2.5 it is obvious that the landfill tax had a significant impact on the amounts of MSW landfilled and has led to a steady decrease of landfilling from 22 % in 2001 to just 1 % in 2010. In this period the tax increased by 74 %. The observed reduction in landfilling cannot be attributed solely to taxation though, because at the same time additional measures were introduced in order to maximise MSW landfill diversion. The landfill tax from 2000 was coupled one year later with a landfill ban on combustible waste and a further increase in the level of the tax in 2002 and 2003. Between 2001 and 2004 landfilling dropped more than 12 percentage points of MSW generated. In 2005, a new landfill ban on organic waste was introduced and one year later the landfill tax rose to 435 SEK/tonne (approx. EUR 47.9). The combined measures were enough to halve the amount of landfilling from the already low rates which have been achieved until 2004. Nevertheless, without additional measures in the following years, the level of landfilling decreased modestly with 1 percentage point each year until 2008, when it reached 3% of total MSW. In 2009, all landfill sites not complying with the requirements of the Ordinance (2001:512) on landfilling were closed down and as a result the number of operating landfills was almost halved (SEPA, 2010). This fact is reflected in Figure 2.5 showing that landfilling was reduced by 50 % between the years 2008-2009.

Figure 2.5 Development of landfilling and incineration of MSW and landfill in Sweden

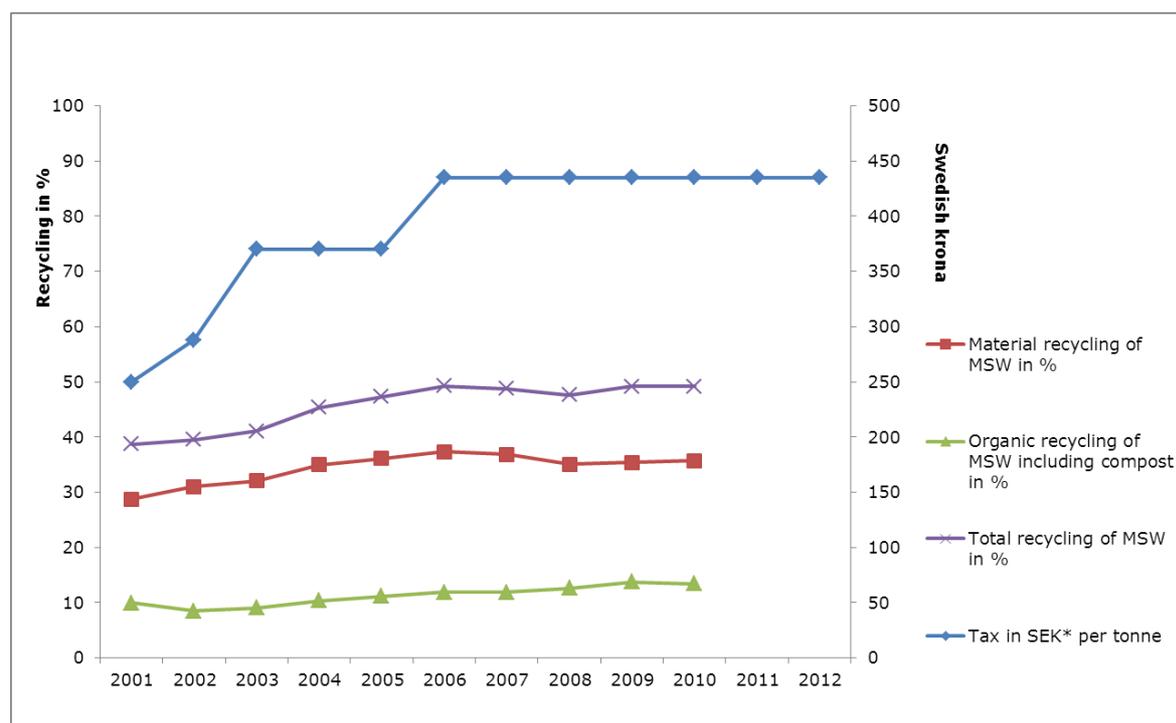


Source: ETC/SCP, 2012 and Eurostat, 2012.

Note: * EUR 1 = SEK 9.03 (2011 annual average currency exchange rate)

Figure 2.6 shows the development of recycling during the period 2001-2010 and the effect of the landfill tax on its evolution. The steep rise of the landfill tax in 2003 significantly affected the recycling rates, both material and organic, showing a high increase in the amounts of recycled MSW. The amount of MSW going for material recycling has increased 19 % from 2004 to 2007 and organic recycling with 30 %, in a period when the generation of MSW in Sweden reached a 13 % increase. In 2006 a further rise in the landfill tax coupled with the introduction of the incineration tax (ETC/SCP, 2009) pushed further up the rise of recycling rates, which in that year reached a peak of 49 % of MSW generated. Without new measures in the following years, total recycling remained stable. Organic recycling continued to grow mainly due to the landfill ban of 2005.

Figure 2.6 Development of MSW recycling and landfill tax in Sweden



Source: ETC/SCP, 2012 and Eurostat, 2012.

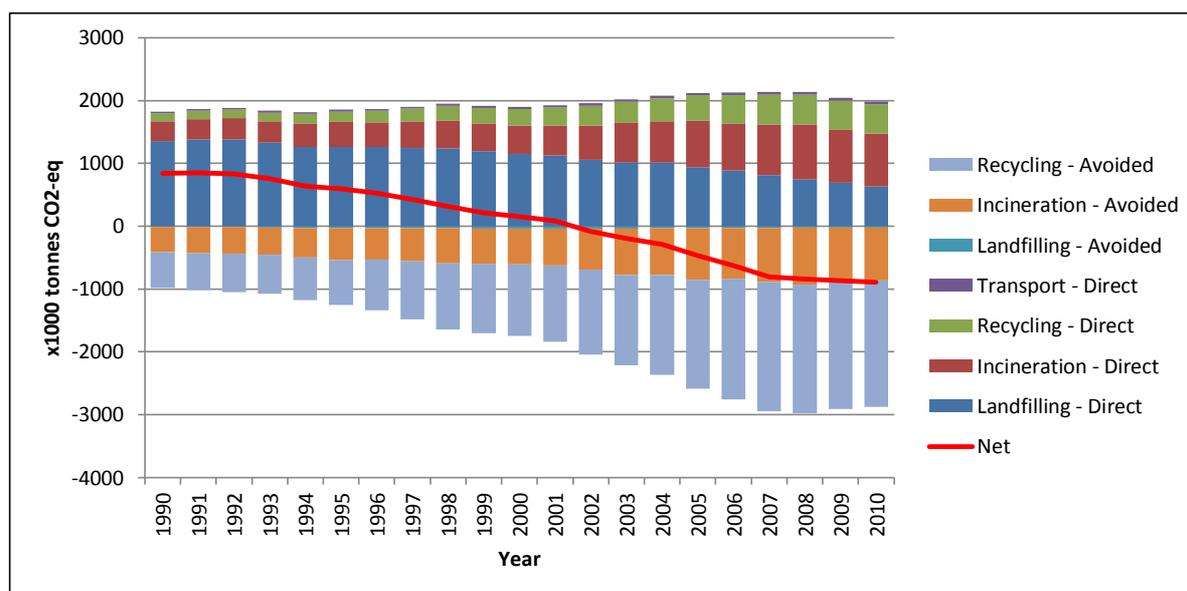
Note: *EUR 1 = SEK 9.03 (2011 annual average currency exchange rate)

2.1.6 Environmental benefits of better MSW management

Figure 2.7 shows the development of GHG emissions from MSW management, calculated by using a life-cycle approach. The graph shows the direct emissions, the avoided emissions and the net emissions of the MSW management. Figure 2.7 shows a steady decrease of the net GHGs of municipal waste management in Sweden. From 2002, when the first landfill ban in Sweden was introduced, waste management activities showed a net benefit (higher avoided emissions than direct emissions). A major driver behind this reduction is the increasing avoided emissions due to recycling and, to a lesser extent, incineration (although the shares of incineration and recycling in MSW management are nearly similar). Also since 2005, when the landfill ban of organic waste was introduced, the direct emissions from landfills have been decreasing steadily. Nevertheless, accumulated amounts of BMW landfilled in the previous years continue to emit substantial quantities of greenhouse gases in the following years. Avoided emissions from incineration have also contributed drastically to the sharp decline of net emissions since 2004.

In the last four years, the net GHG emissions remained practically unchanged.

Figure 2.7 GHG emissions from MSW management in Sweden



Results presented in this figure should not be used for the compilation of GHG reporting (national inventory report of the IPCC) or compared with IPCC figures, as the methodology employed here relies on life cycle thinking and, by definition, differs from the IPCC methodology.

Assumptions concerning the production of Figure 2.7

All the GHG emissions (positive values) represent the direct operating emissions for each waste management option. These direct operating emissions have been calculated with the use of the IPCC methodology for landfills and incineration and life cycle modelling for the other technologies (recycling, biotreatment and transport).

For the indirect avoided emissions (negative values), the calculations integrate the benefits associated with the recovery of energy (heat and electricity generated by incinerators, electricity generated by the combustion of landfill gas or methane from anaerobic digestion). Other avoided emissions include the benefits of recycling of food and garden waste, paper, glass, metals, plastics, textiles and wood in the municipal solid waste. Recycling is here assumed to include material recycling and biotreatment. Avoided emissions of biotreatment include fertilizer substitution. All processes generating electricity are assumed to substitute electricity mix of Sweden in 2009. Processes generating heat are assumed to substitute average heat mix for the EU-25 in 2002. The electricity mix and heat mix are assumed to remain constant throughout the whole time series. The compositions of the MSW disposed in landfills, incinerated or recycled respectively are based on ETC/SCP (2011). In an Eionet consultation process, initiated by the EEA in 2012, Sweden updated the compositions of the incinerated and recycled MSW for 2010. The complete methodology is available from ETC/SCP (2011).

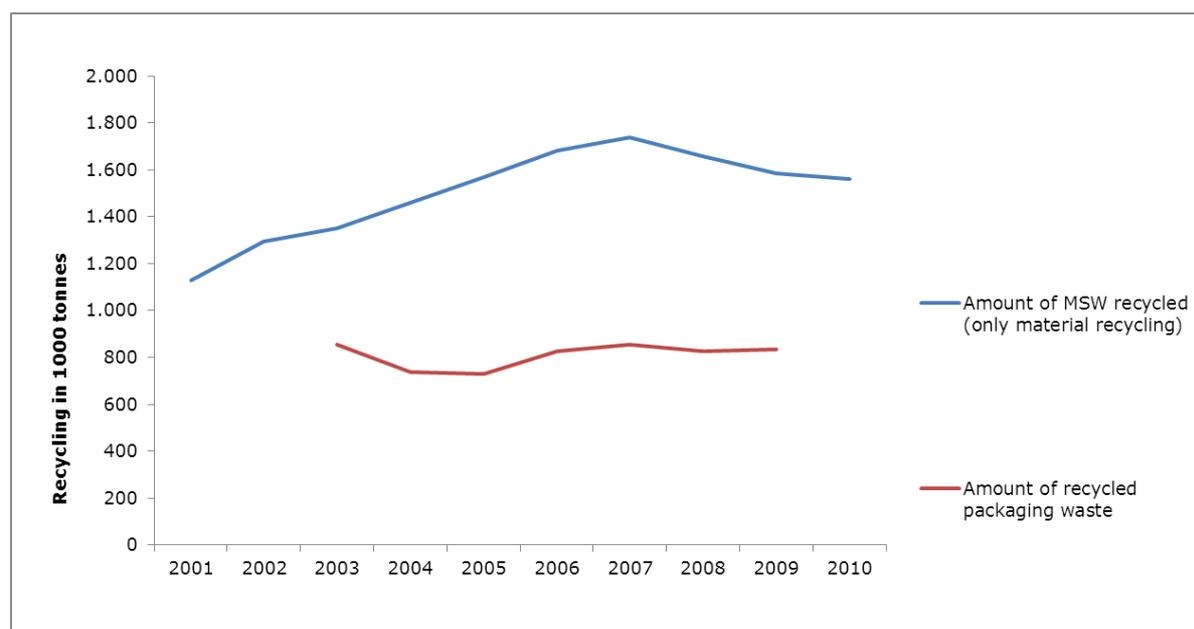
2.2 Uncertainties in the reporting

Some uncertainties or differences included in the reporting of MSW can result in different recycling levels. One example of such differences which might influence the recycling rate of MSW could be the extent of packaging waste from households and similar packaging from other sources which is included in the reported recycling of MSW. Most Member Countries, including Sweden, have producer responsibility schemes on packaging waste and the packaging waste is therefore not always regarded or reported to Eurostat as MSW.

In the case of Sweden, as it can be concluded by comparing Table 2.1 and Figure 2.8, there is little uncertainty about the inclusion of packaging waste in MSW amounts reported to Eurostat. Nevertheless, it is possible to identify different trends in recycling of packaging waste and MSW. The recycling of packaging waste seems to remain more or less stable at around 800 000 tonnes throughout the years and does not correlate with the development of recycling of MSW. The decrease between 2007 and 2008 is the only common trend. Therefore it can be concluded that other waste streams affect more the recycling rates of MSW than the packaging waste.

Another factor for uncertainty is the way MSW sent to Mechanical Biological Treatment (MBT) is reported. However, this factor is not relevant for Sweden as MBT is not used.

Figure 2.8 Comparison of packaging waste recycled and MSW recycled (material recycling)



Source: Eurostat, 2012

2.3 Important initiatives taken to improve MSW management

Municipalities have traditionally undertaken the management of waste in Sweden. Since 1991, Swedish municipalities have come under the obligation of laying down a detailed waste management plan, including information concerning waste and the municipality's measures to reduce the quantity and hazardousness of waste. The plans shall contain targets based on national environmental objectives. The municipalities' plans are coordinated by the county administrative board which then analyses the waste treatment capacity and ensures the sufficient treatment capacity within the region (ETC/SCP, 2009).

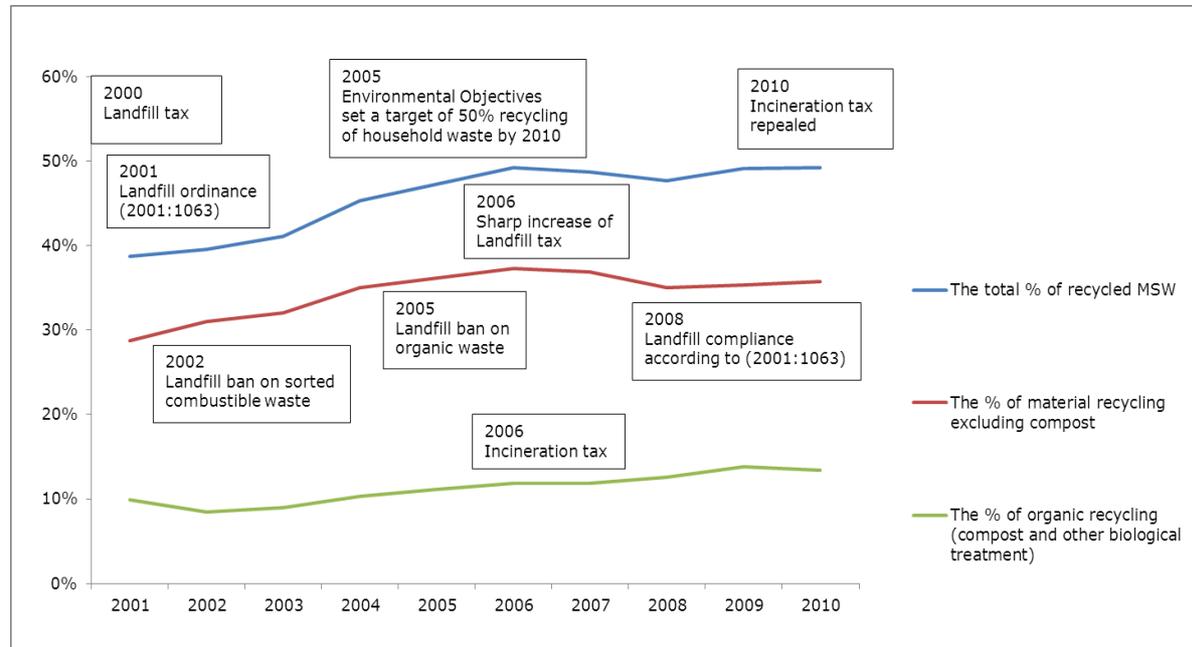
Through the years 1994-1998, several ordinances on producer responsibility for a range of materials (packaging waste, paper, oil, etc.) came into force, imposing upon producers the physical and economic responsibility for collecting and disposing of certain end-of-life products. These measures were introduced before the EU introduced its producer responsibility requirements and improved the management of waste and paved the way to a sustainable reuse, recycling or safe disposal of materials (SEPA, 2005).

Swedish legislation faced a major challenge in 1998 with the enactment of the Environmental Code and especially Chapter 15 on waste management, formulating explicit rules for all relevant authorities. In 1999, the law on waste tax (1999:673) introduced the landfill tax scheduled to take effect by 1 January 2000 at a rate of 250 SEK/tonne of waste (approx. EUR 27.5).

In 2002, the landfill ban on sorted combustible waste came into effect and three years later it was expanded to all organic waste, with only minor exceptions. Together with several increases in the landfill tax (2002, 2003 and 2006), those measures combined resulted in greater diversion of waste from landfills. Additionally in 2006, an incineration tax was introduced which increased the diversion of waste towards the direction of recycling. This trend did not last for long though however. By 2010, the incineration tax was repealed by the Swedish government (Avfall Sverige, 2011).

2005 was a significant year for the future vision of the Swedish waste management, as it was presented in the 'Strategy for Sustainable Waste Management – Sweden's Waste Plan' by the Swedish EPA (SEPA, 2005) for the next 5 years. At the same time, the Swedish government published its Environmental Objectives including specific targets for the reduction of MSW (Sweden, 2004). A challenging target was the 50 % recycling of household waste by 2010, which was nearly attained.

Figure 2.9 Recycling of MSW in Sweden and important policy initiatives



Source: Eurostat, 2012

2.4 Future possible trends

In 2010, MSW recycling had already reached the level of 49.2 %. However, the recycling level has only increased by a mere 1 % in the recent 5 year period (2006-2010), and therefore some additional effort will be required to surpass this level and reach the 50 % recycling target for 2020 as required in the EU Waste Framework Directive.

In the new Swedish waste management plan 'Från avfallshantering till resurshushållning – Sveriges avfallsplan 2012–2017' measures are included for promoting further material recycling. Targets include many initiatives and practices but these are mostly qualitative and advisory in nature. In order to increase recycling in MSW, *'the recycling of household waste shall increase by making it easier for households to sort out and submit materials for recycling or preparation for reuse'* and *'[...] at least 90 percent of households shall be satisfied with the collection'* of recyclables. Furthermore, the plan sets specific goals for food waste, promoting the management of food waste into a priority area to be considered in the future. Specifically *'by 2018, 50 percent of food waste from households, institutional kitchens, shops and restaurants shall be sorted out and treated biologically and at least 40 percent shall be treated, so that energy will be taken advantage of'* (SEPA, 2012).

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