European Environment Agency

Municipal waste management in Greece

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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.

Contents

Highlights

Most important factors/initiatives behind the development of MSW recycling in Greece

- Recycling of MSW in Greece has increased by more than 10 % over the last 10 years. This increase in mainly due to concentrated efforts on material recycling, while organic recycling is still very low at about 1 % . Greece will need to make an exceptional effort in order to fulfil the 50 % target of the Waste Framework Directive by 2020;
- Law 2939/2001 on packaging waste transposed the Packaging Waste Directive and established the Hellenic Recovery Recycling Corporation (HERRCO), responsible for effectively all packaging waste recycling in Greece since 2003;
- The National Waste Management Plan introduced in 2003 describes the basic principles and targets for solid waste management in Greece;
- In Greece more than 80 % of MSW was landfilled in 2010 and consequently the target of 75% reduction of BMW by 2010 of the EU Landfill Directive could not be fulfilled, despite the 4 year derogation period granted to Greece;
- The construction and operation of two MBT plants (joint capacity of 520 000 tonnes annually) between 2004 and 2006 had a major effect on the level of recycling of MSW in the country.

1 Introduction

1.1 Objective

Based on historical MSW data for Greece and EU targets linked to MSW in the Waste Framework Directive, the Landfill Directive and the Packaging Directive, 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 Greece's MSW management performance

Waste management has been recognized as one of the most pressing problems in Greece, suffering of a low level of organisation and relying predominantly on semi-controlled landfills until the end of the previous century. Nevertheless, during the last two decades the solid waste management in Greece has been upgraded. While it is still generally considered as a major problem, progress has been increasingly observed, and solid waste management in Greece is becoming a well-structured, organized and environmentally responsible activity with specific goals, mostly in urban areas (EIB, 2010).

The legal framework that designates the direction of waste management in Greece follows closely the development of European waste management and the corresponding Directives (EIB, 2010). Over the last decade all relevant EU Directives have been transposed to Greek laws, with the most recent case being the transposition of the Waste Framework Directive (2008/98/EC) in the Law 4042/2012 of 2012 (YPEKA, 2012).

The major driver behind waste management in Greece in the last decade has been the Joint Ministerial Decision 50910/2727/2003 'on measures and terms for solid waste management - national and regional planning management' with the National Waste Management Plan annexed to it. Basic principles and targets for solid waste management together with the specifications for national and regional planning are set there. The plan will be revised every five years or earlier if necessary (HSWMA, 2012). So far no revision has been made.

The Ministry of Environment is responsible for policy making, national planning, technical matters, as well as licensing and regulating the financing of large waste treatment and disposal facilities. According to the National Solid Waste Management Plan (NSWMP), the operation of transfer stations, the processing and disposal of waste lies within the jurisdiction of Waste Management Authorities (WMA), while the Ministry of Interior is responsible for the establishment of the registry of WMA. For waste streams apart from MSW, the management responsibility lies with producers, according to the 'polluter pays principle' introduced in 2003 by the NSWMP. The inter-ministerial committee for integrated waste management was established in March 2008 according to the M.D. 325/14.03.08 on *'Establishment of a Waste Management Inter-ministerial Committee'* and has been given strategic planning responsibilities (EIB, 2010).

The management of packaging waste came under the Hellenic Recovery Recycling Corporation (HERRCO) as a result of Law 2939/2001 which obliges the economic actors (producers, importers) to organize or participate in collective (or individual) systems of alternative waste management (i.e. return, collection, transportation and recovery systems) in order to achieve specific quantitative targets. It was founded in December 2001 by industrial and commercial enterprises, which either supply packaged products to the Greek market, or manufacture different packaging items, as well as the confederation of Greek municipalities (HERRCO, 2012).

The National Organization for Alternative Management of Packaging and other Products (NOAMPP) is responsible for the monitoring of the management of specific waste streams under Law 2939/2001. Due to organisational and legal implications the NOAMPP systematically failed to fulfil its role and only in 2010 with Law 3854/2010 (amendment of 2839/2001) the organisation was rendered operational. In the meantime, Law 3854/2010 established the 'polluter pays principle' as state law (WWF, 2011). Finally, the NOAMPP was modified by Law 4042/2012 into the Hellenic Recycling Agency (Greece, 2012).

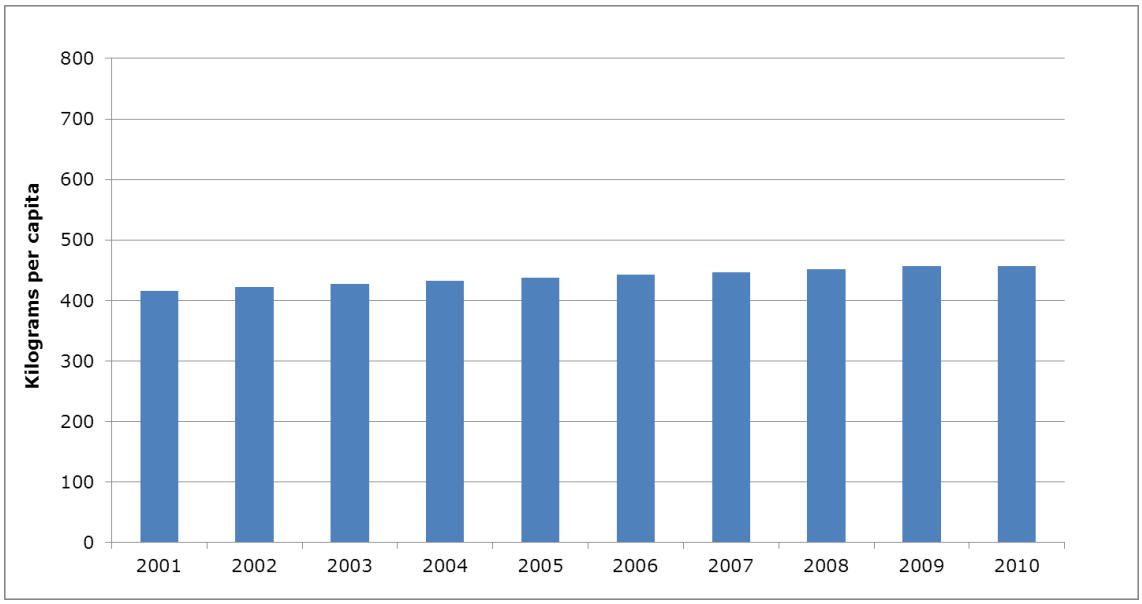
As of 2011, still 109 illegal dumping sites all over Greece remain in operation despite the ruling of the European Court of Justice of 2005 (case c-502/03) which dictated that by the end of 2008 all illegal dumping sites should have been closed and rehabilitated (WWF, 2011).

The generation of MSW in Greece has been constantly increasing since 2001, by approximately 75 000 tonnes more each year, or nearly 1.5 % per annum until 2009. The later increase to 2010 was somewhat more moderate increasing only by 21 000 tonnes. Despite the economic recession and the subsequent financial crisis in Greece, the level of MSW generation has continued to increase.

2.1 MSW Indicators

Figure 2.0 shows the development of MSW generation per capita in Greece from 2001 to 2010. There is a slow but gradual increase throughout the years from 416 kg per capita in 2001 to 457 kg per capita in 2010. Data for the year 2010 is a Eurostat estimate maintaining the same value as in 2009, which denotes a stabilisation trend in the generation of MSW per capita in Greece.

Figure 2.0 MSW generation per capita in Greece



Source: Eurostat, 2012

Greece is among the countries in the EU which still maintain high rates of landfilling. The amount of MSW landfilled in 2010 was 4.2 million tonnes, equivalent to 81 % of the total generated MSW. Although the amount of MSW going to landfill has remained relatively stable over the last 10 years, amounting to around 4 to 4.3 million tonnes, the share of landfilling has decreased by 10 % between 2001 and 2010, from 91 % to 81 %. This trend can be attributed to recycling which has acquired an increased importance in Greek waste management in recent years, especially after the year 2007 when recycling (material and organic) peaked at 20 % of the total generated MSW. The following indicators illustrate the development of the Greek MSW management between the years 2001-2010.

2.1.1 The recycling of MSW from 2001 to 2010

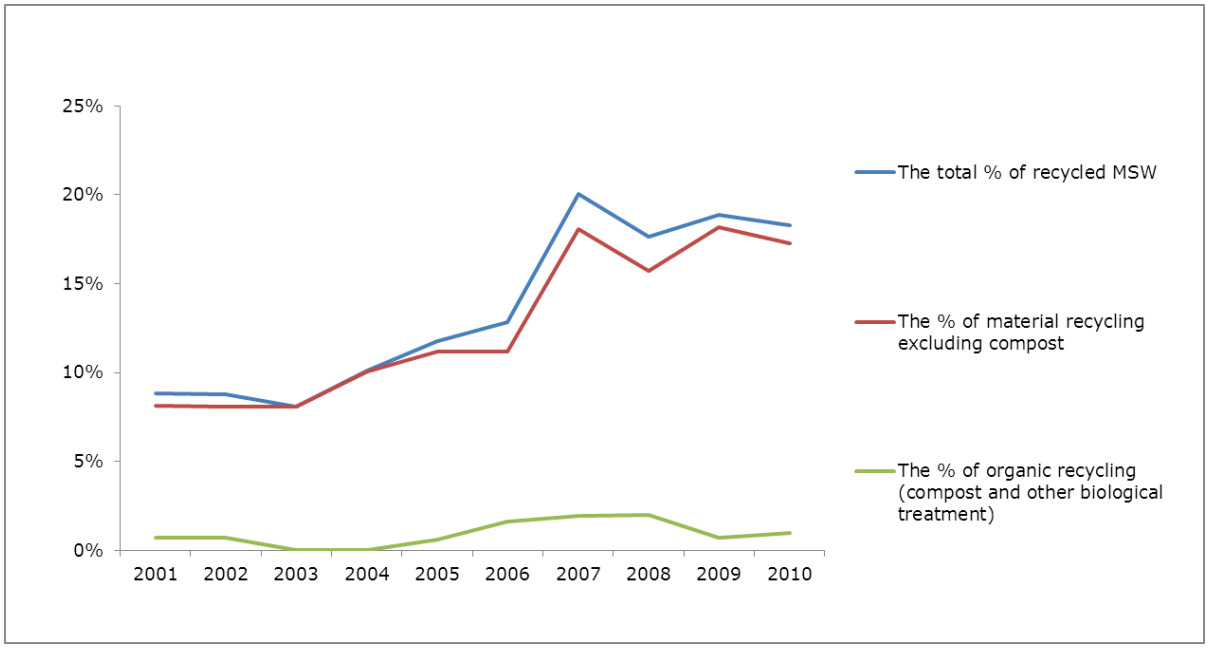
Figure 2.1 shows the development of recycling of MSW in Greece related to total recycling, material recycling and organic recycling (compost and other biological treatment).

In general, recycling increased in Greece in the decade between 2001 and 2010. This increase, however, has not been smooth, since a moderate increase was followed by a sharp one between 2006 and 2007 while afterwards, recycling rates seem to have stabilised.

Composting seems to play a minor role in MSW treatment with no more than 2 % of MSW composted. In fact, no composting was reported in 2003 and 2004.

Both composting (to a lesser extent) and recycling were boosted after the establishment and operation of two large MBT plants in two regions of Greece in 2005-2006 (see figure 2.9). It seems that the MBT output has contributed significantly in providing material recyclables, but not so much compost material.

Figure 2.1 Recycling of MSW in Greece



Source: Eurostat, 2012. Note: The percentages are calculated as % of generated MSW

2.1.2 The yearly increase rate of recycling of MSW

In order to assess the prospects for Greece to meet the 50 % recycling target as set out in the Waste Framework Directive1, 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. Instead of looking at the actual recycling level of MSW, this indicator shows how fast the recycling level of MSW has increased per year during the last five and ten years. Such an indicator could give due credit to countries which began with a low starting level, but where new initiatives now have been successfully implemented. The indicator could show indicatively whether the yearly increase rate of recycling is sufficient to reach the 50 % MSW recycling target of the EU legislation by 2020. Figure 2.2 shows the recycling in Greece as a percentage of the generated MSW, for the years 2001-2010. In order to get an indication of the possible future development in recycling in the country, a simple linear regression is applied to three datasets:

- 2001 to 2005;
- 2006 to 2010;
- 2001 to 2010.

The linear regression line, calculated for each of these datasets is extended to 2020, the target year in the WFD. The results show that all scenarios lead to a recycling level between 25 % and 33 % of MSW generated. The forecasts do not diverge greatly among them, since the recycling developments have been relatively similar for all datasets.

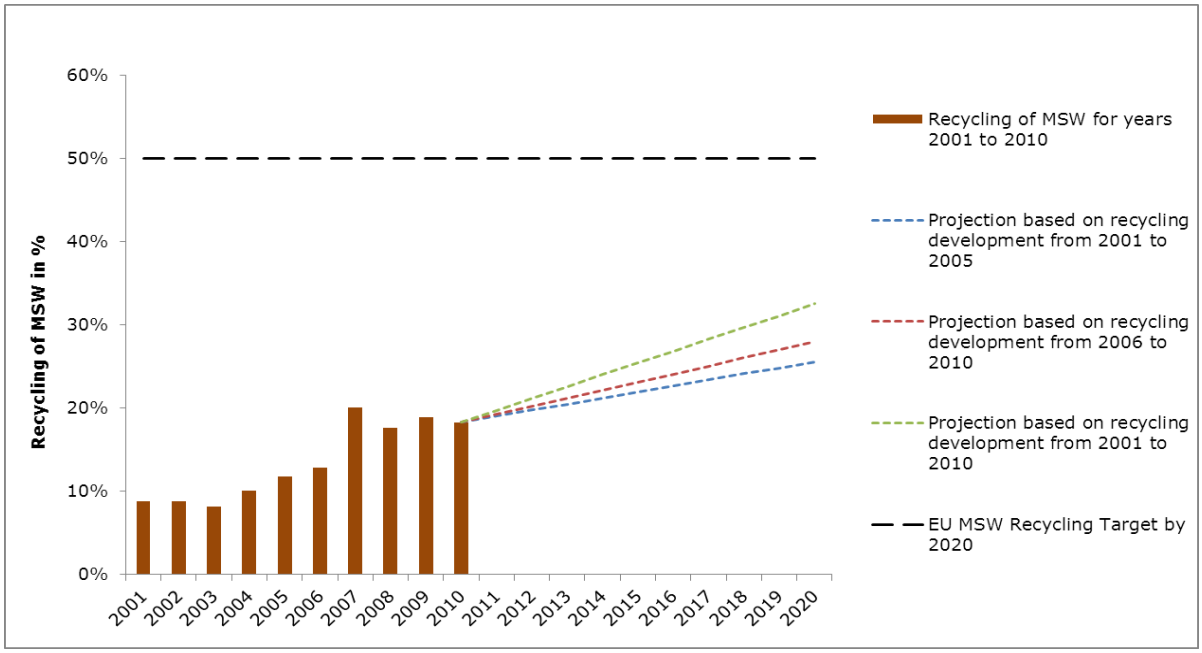
The forecast based on the latest dataset (2006-2010) does not give the highest recycling rate in 2020, which means that Greece has not intensified its efforts in the latest years, in spite of the adoption of the WFD in 2008.

The conclusion of this analysis is that Greece will need to make an exceptional effort if it is to fulfil the 50% recycling target of the WFD in 2020. Greece needs to intensify its efforts in increasing recycling a lot more.

The construction of the planned infrastructure of MBT plants during the next few years might contribute to an increase in recycling, similar to the one observed in 2006-2007, depending on the ability of the MBT plants to generate recyclable waste.

[1] The EU's updated Waste Framework Directive in 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).

Figure 2.2 Future recycling of MSW in Greece



Source: Eurostat, 2012

It has to be kept in mind 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.

2.1.3 Landfilling of biodegradable municipal waste

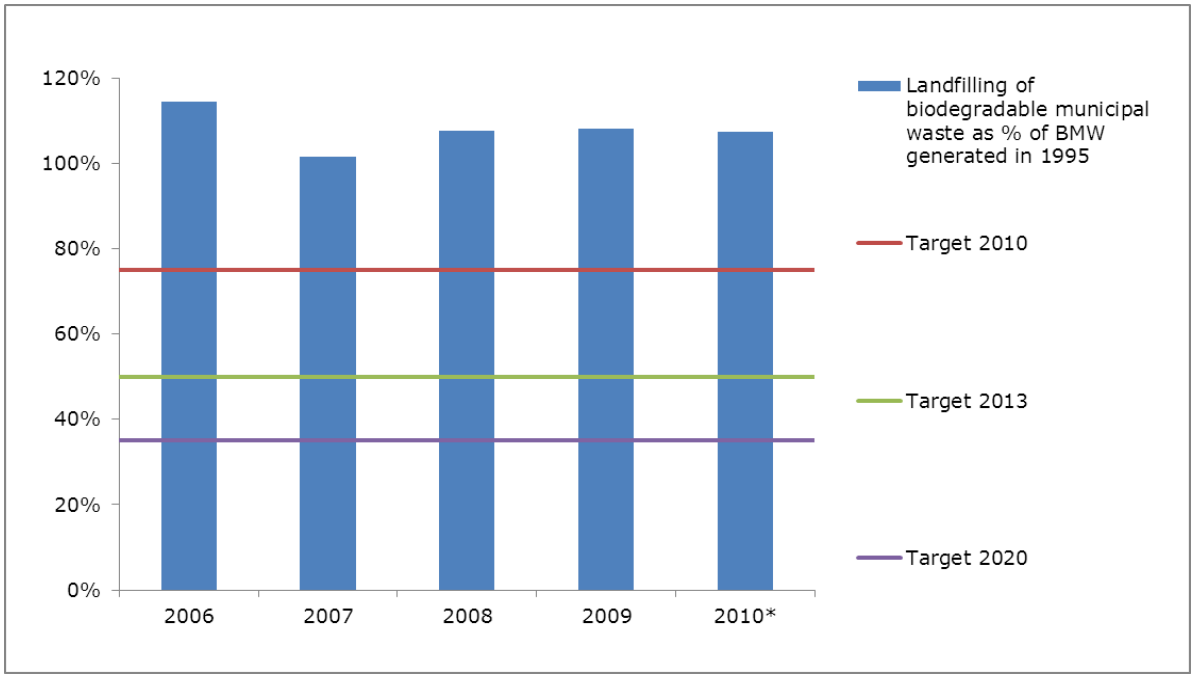
According to the EU Landfill Directive, Member States have to reduce the amount of biodegradable municipal waste (BMW) landfilled to a certain percentage by 2006, 2009 and 2016. However, Greece has been granted a four year derogation period, as one of the countries that landfilled more than 80 % of the generated MSW in 1995. The targets are related to the generated amount of BMW in 1995, in which Greece generated 2 100 000 tonnes BMW. Greece has reported the landfilled amount of BMW to the Commission for the years 2007, 2008 and 2009 (EC, 2012).

Figure 2.3 shows the landfilling levels of biodegradable MSW in Greece between 2006 and 2010 related to BMW generation in 1995, as well as the distance to the Landfill Directive target. The figure for 2010 is based on estimations by Copenhagen Resource Institute (CRI), by considering the increase in composting levels between 2009 and 2010 and subtracting that amount from the landfilled biodegradable MSW in 2009.

According to the estimated 2010 data, Greece has missed the target for 2010 by some 680 000 tonnes. The decrease in landfill of biodegradable MSW observed in 2007 has not continued, followed by an increase and stabilisation. Greece needs to take radical action in order to achieve the 2013 and 2020 targets to reduce BMW landfilled to 50 and 35% of BMW generated in 1995, respectively.

Greece has decided to tackle the issue of landfilling biodegradable MSW by introducing MBT technology in many parts of the country. So far, two plants are operating, which may have caused the decrease observed in 2007 in figure 2.3. If the planned plants start to be operational in the coming years, significant changes may begin to occur for the treatment of the biodegradable part of MSW.

Figure 2.3 Landfilling of biodegradable MSW in Greece



Source: EC, 2012 and CRI calculation*. The figures for 2010 are CRI estimations. Note: The target dates take into account Greece's 4 year derogation period.

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

There is no tax for landfilling in Greece and the management of MSW is covered by a municipal fee (EIB, 2010).

2.1.5 Environmental benefits of better MSW management

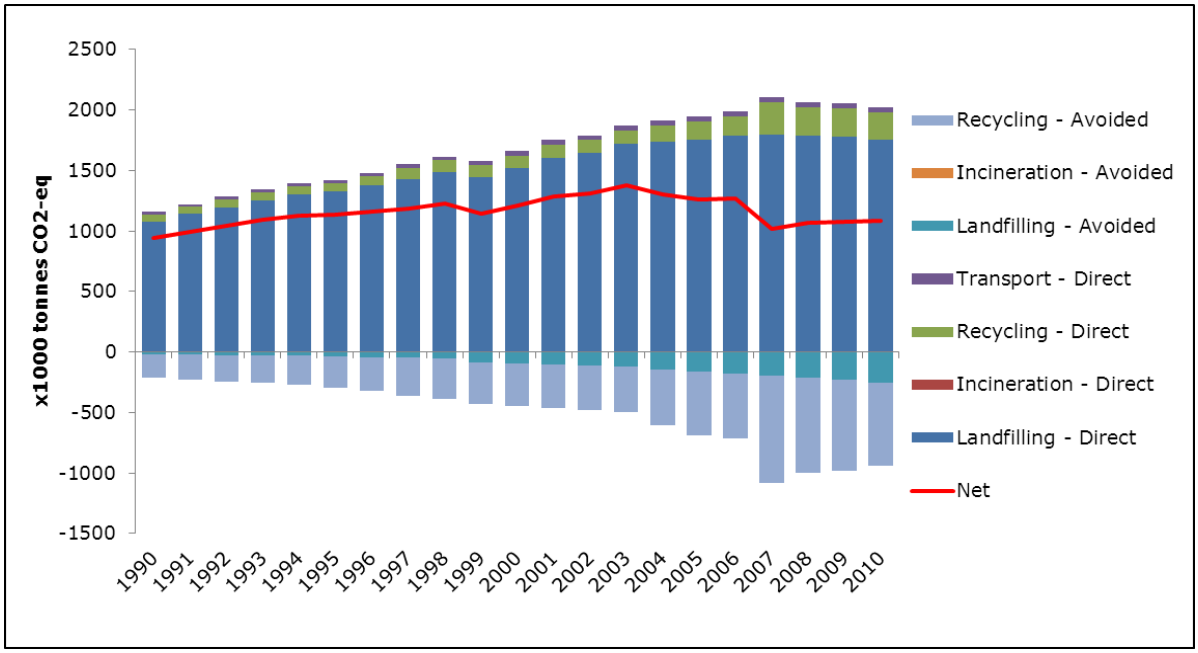
Figure 2.7 shows the development of GHG emissions from MSW management, calculated by using a life-cycle approach. The graph shows the direct emissions, the avoided emissions and the net emissions of the MSW management.

The level of GHG depends on the amount of waste generated and the treatment it undergoes each year. Landfilling heavily contributes to the direct emissions, mainly due to the methane emissions, while recycling has an effect on avoided emissions, stemming from the avoidance of primary production of materials provided by recovery operations of MSW management.

In the case of Greece, the high level of landfilling results in a respectively high level of direct emissions. It is important to note that reducing the landfilling share in MSW treatment does not have an immediate effect on GHG emissions since the waste degrades slowly in a landfill and emits methane for years after it is deposited. The sharp increase in recycling in 2007 has a significant effect on the net GHG emissions, which are subsequently stabilised at a lower level.

Still, Greece has a high potential for GHG mitigation through better MSW management: by increasing recovery operations such as recycling, or introducing energy recovery, the country could, besides meeting their targets and improving waste management, mitigate a substantial part of GHG emissions, an effort that will aid Greece also with its commitments in the various international GHG reduction agreements.

Figure 2.7 GHG emissions from MSW management in Greece



Source: ETC/SCP, 2011

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, bio-treatment 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 bio-treatment. Avoided emissions of bio-treatment include fertilizer substitution. All processes generating electricity are assumed to substitute electricity mix of Greece 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 complete methodology is available from Bakas et al. (ETC/SCP, 2011). The compositions of the MSW disposed in landfills, incinerated or recycled respectively are based on Bakas et al., (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 Greece, have producer responsibility schemes on packaging waste. Private operators of these schemes do not

always report on the sources of the recycled packaging waste, and the packaging waste is therefore not always reported to Eurostat as MSW.

Figure 2.5 shows the recycled packaging waste and MSW amounts. The quantities of recycled packaging waste are clearly lower than the figures for MSW. Both recycling amounts follow the same pattern of development over time which indicates a strong dependency of MSW to packaging waste recycling. In 2007, MSW recycling increased which is possibly the result of a large MBT plant becoming operational. MBT normally receives collected waste other than packaging.

Figure 2.5 indicates that at least part of the packaging waste is included in the reported amounts of recycled MSW.

Another factor for uncertainty could be MSW sent to Mechanical Biological Treatment (MBT), where the whole amount received at the MBT plant in some countries is allocated to recycling. In other countries it is in fact only the actual amount recycled after the MBT, which is included and not the amount subsequently sent to landfilling or incineration.

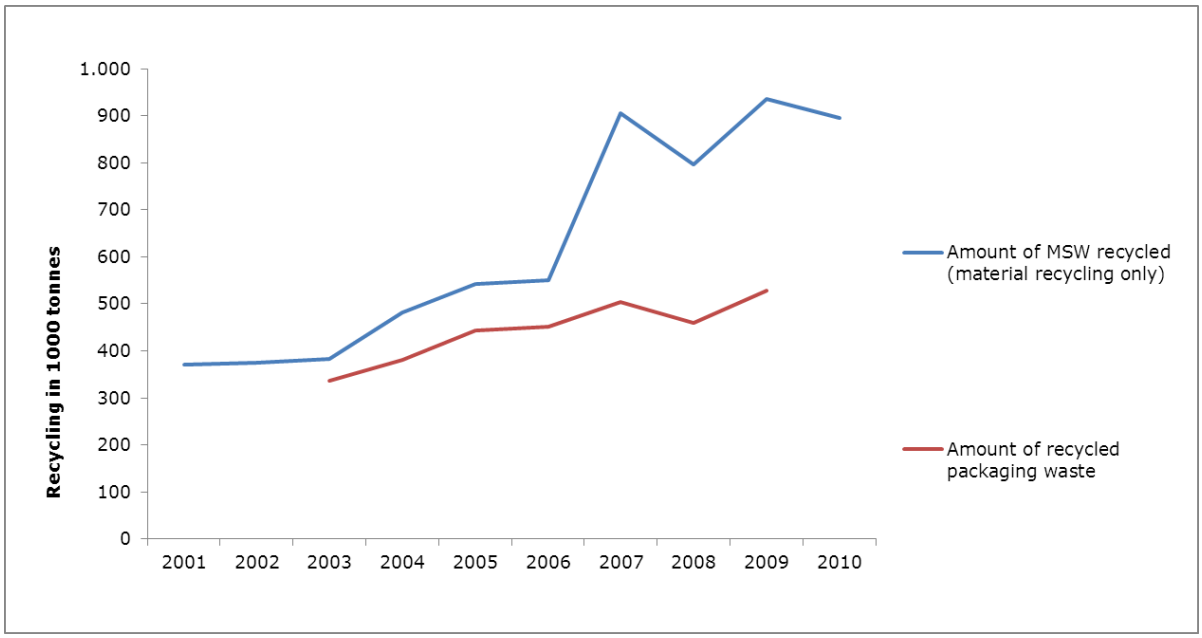
Greece has actually MBT technology installed. Until 2010, there were two MBT plants operating in Greece with a joint capacity of 520 000 tonnes, but no information exists on the actual treated amounts. A large plant became operational in 2006 (450 00 tonnes) and a smaller one in 2004 (70 000 tonnes).

The increase of recycling from 2004 to 2005 is 60 000 tonnes (similar to the increase of packaging waste recycling). The increase of recycling from 2005 to 2007 is 360 000. Therefore, not all of the MBT quantities seem to be reported as recycling, if the plants are working close to their capacity.

On the other hand, the two MBT plants have the capacity of treating around 250 000 tonnes of biodegradable MSW (200 000 for the large plant and around 50 000 for the smaller one). Composting increased by 27 000 tonnes between 2004 and 2005 (small plant begins operations) and by 70 000 tonnes between 2005 and 2007. Both of these increases are far below the capacity of the plants.

Overall, it seems that Greece is not reporting MSW recycling based on the input of the MBT plants, but probably based on the output. However, the analysis performed here is simply indicative and a careful examination of the internal figures of the Greek statistics is necessary for safe conclusions.

Figure 2.5 A comparison of packaging waste recycled and material MSW recycled



Source: Eurostat, 2012

2.3 Important initiatives taken to improve MSW management

In the last decade, several initiatives and policy measures have been employed by the Greek government in order to divert MSW from landfilling and disengage the dependency on landfills. One of the direct outcomes of Law 2939/2001 '*on packaging and recycling of packaging and other products - Establishment of the National Organization for Recycling of Packaging and other Products*' was the establishment of the Hellenic Recovery Recycling Corporation (HERRCO) in the end of 2001, which became fully operational by 2003. Although initially covering less than 40 % of the population, mainly in urban areas, by 2011 around 75 % of the total population of Greece is covered by the collection mechanisms of HERRCO. This operation has significantly boosted the performance of recycling and material recovery, removing a fraction of MSW from landfill (HERRCO, 2012).

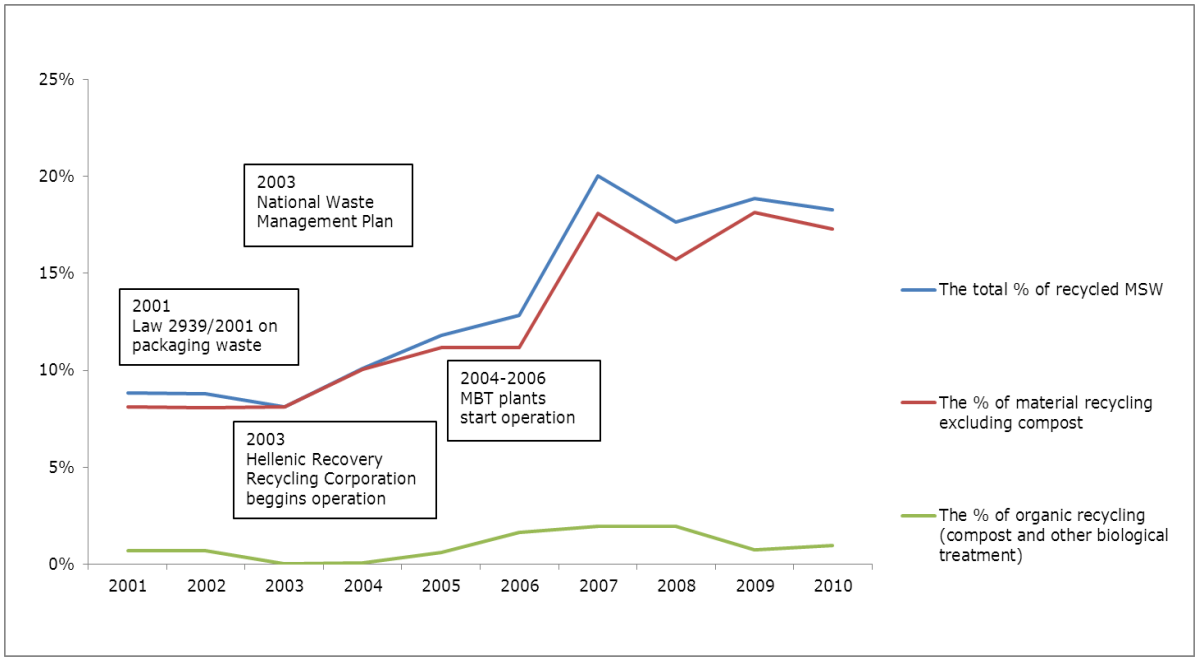
The biggest effort of coordinating waste management in Greece so far has been the Joint Ministerial Decision 50910/2727/2003 on '*measures and conditions on solid waste management - National and Regional Management Plan*' in 2003, setting specific rules and targets which must be met in the waste management planning at the national and regional level (EIB, 2010).

In 2004, a series of Decrees set the rules for the management of different waste streams, including WEEE, batteries, etc. (YPEKA, 2012).

The waste management capacity of Greece was strongly reinforced between the years 2004-2006 with the beginning of operation of two new state-of-the-art MBT plants, one in the greater Athens area and one in the island of Crete. The unit in Athens, which is one of the biggest MBT plants in Europe, treats mixed municipal waste, produces Refuse Derived Fuel (RDF), good quality compost and its annual capacity reaches 450 000 tonnes. The waste treatment plant in Chania, in Crete, has an annual capacity of 70 000 tonnes. Moreover, two additional MBT plants, one in Heraklio (island of Crete) and the other in Kefalonia (one of the Ionian islands) started their operation in 2010 (EIB, 2010), while 6 more MBT plants will become operational by 2014. Furthermore, two incineration plants are at the planning stage on the island of Rhodes and Thiva (EIB, 2010).

The most recent initiative concerns a 'Pay As You Throw' scheme which is a pilot European programme running through 2012 in Elefsina municipality. The results of this scheme and its upgrade into covering a larger area of the country are still unknown but this could indicate that Greece might adopt such schemes to combat existing problems such as not charging households according to waste amounts (Bipro, 2012).

Figure 2.6 Recycling of MSW in Greece and important policy initiatives



2.4 Future possible trends

The future EU targets, already transposed by Greece refer to the Landfill and the Waste Framework Directives, when examining MSW. According to the current trends, Greece is likely to miss the targets of both Directives if it does not intensify efforts towards recycling and diversion of waste from landfill considerably.

Regarding the Landfill Directive, the level of landfilling of biodegradable MSW was estimated to amount in 2010 to around 108 % of the generated amount in 1995. Therefore, besides missing the target for 2010, Greece is likely to experience great difficulties in meeting the targets for 2013 and 2020.

Greece will need to make an exceptional effort in order to fulfil the 50 % recycling target of the Waste Framework Directive by 2020.

On the other hand, Greece seems to have a strong future strategy regarding treatment of MSW. According to (EIB, 2010), a great number of plants are in the planning or construction stage, mainly based on MBT technology, which has the potential to contribute to all Greece's targets by simultaneously diverting the biodegradable fraction from landfills and increasing the material recovery. The introduction of new plants could have the same effect on recycling as the two existing MBT plants which boosted the figures for recycling.

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