

# Municipal waste management in Portugal



Prepared by Ioannis Bakas  
ETC/SCP

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EEA project manager Almut Reichel

**Author affiliation**

Ioannis Bakas, Copenhagen Resource Institute, <http://www.cri.dk/>

**Context**

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**Disclaimer**

This ETC/ECP 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.

# Contents

<b>Highlights</b> .....	<b>4</b>
<b>1 Introduction</b> .....	<b>5</b>
1.1 Objective .....	5
<b>2 Portugal’s MSW management performance</b> .....	<b>5</b>
2.1 MSW Indicators.....	6
2.1.1 The recycling of MSW from 2001 to 2010 .....	7
2.1.2 The yearly increase rate of recycling of MSW .....	8
2.1.3 Landfilling of biodegradable municipal waste .....	9
2.1.4 Regional differences of MSW recycling from 2001 to 2010.....	10
2.1.5 The relation between landfill tax level and recycling level of MSW .....	12
2.1.6 Environmental benefits of better MSW management .....	13
2.2 Uncertainties in the reporting .....	14
2.3 Important initiatives taken to improve MSW management .....	15
2.4 Future possible trends.....	16
<b>References</b> .....	<b>17</b>

# Highlights

## **Most important factors behind the development of MSW recycling in Portugal:**

- Portugal has been slowly increasing its recycling rate since 2001 to 19% of MSW generated in 2010, mainly because of an increase in material recycling.
- The national strategy for the reduction of BMW landfilled, launched in 2004, aims at increasing separate collection and establishing modern facilities for its treatment;
- The launch of the second national waste management plan (PERSU II) in 2006 aims at tackling the inefficiencies of the previous national plan and aligning the country with EU standards and targets;
- Taking ten new MBT plants in operation in 2010 can be expected to have a significant effect on the development of the entire MSW management system in the future;
- Portugal needs to intensify its efforts for meeting the final two targets of the Landfill Directive. Portugal is rescheduling and readjusting the management of BMW in line with the landfill diversion targets for 2013 and 2020. It is expected that this effort, together with the full operation of all the facilities projected for BMW recovery, will reverse the present situation and contribute to the compliance with its landfill diversion target (Portuguese EPA, 2012).
- Portugal will need to make an exceptional effort in order to fulfil the 50 % recycling target of the Waste Framework Directive by 2020;

# 1 Introduction

## 1.1 Objective

Based on historical MSW data for Portugal and EU targets linked to MSW in the Waste Framework Directive, the Landfill Directive and the Packaging Directive, the analysis undertaken for each country 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 Portugal's MSW management performance

Portugal is facing multiple problems with MSW management and is attempting to tackle them by passing legislation in order to improve the performance of waste management systems. The country has made substantial progress in the waste domain from the situation that existed at the end of the last century when depositing in open dumps was the dominant (if not exclusive) treatment method.

Portugal has an average level of waste generation compared to other EU countries (514 kg/cap in 2010). Waste management is currently dominated by landfilling, but Portugal has invested in many other treatment options including incineration, composting and MBT technology.

The drivers behind the developments in MSW include the national legislation, which predominantly transposes the EU Directives, and the National Waste Management Plans (PERSU). There have been two PERSUs in Portugal: PERSU I was ratified in 1997 and covered the period until 2006, when PERSU II came into play which targeted the period 2007-2016.

PERSU I set both quantitative and qualitative targets for Portugal's MSW management system following in parallel the developments at the EU level. The main objective of the PERSU I was to eliminate open dumps and divert the waste, according to specific quantified targets, to recycling, incineration and composting. This has been a difficult task, as in 2001, more than 340 dumps were yet to be closed (Magrinho et al., 2006). Despite the plan's success in eradicating the open dumps, most of the targets set were not achieved (Ribeiro et al., 2011). Therefore, by taking into account the need to modernise the MSW system, PERSU II was ratified in 2006.

PERSU II aims to eliminate inefficiencies observed in the implementation of the previous plan:

- Adapt EU legislation to Portuguese reality;
- Rationalize the costs;
- Encourage participation of all stakeholders, based on input from all of them;
- Support incineration with energy recovery and MBT as solutions to MSW treatment;
- Introduce separate collection of organic wastes and other measures to divert them from landfills, and
- Maximize by-products utilization.

The quantitative targets included in PERSU II are adopted from EU legislation.

The legal framework governing waste management has been consolidated over the last few years, with systems for managing certain specific flows, and placing the onus on producers to pursue targets for prevention, separate collection, recycling and other forms of recovery (SOER, 2010). Besides the general frameworks such as PERSU, there are various other decrees regulating specific waste streams or treatment options (ETC/SCP, 2006).

The Ministry of the Environment is responsible for all waste legislation. The organization of the waste management system involves three other types of organizations (Magrinho et al., 2006):

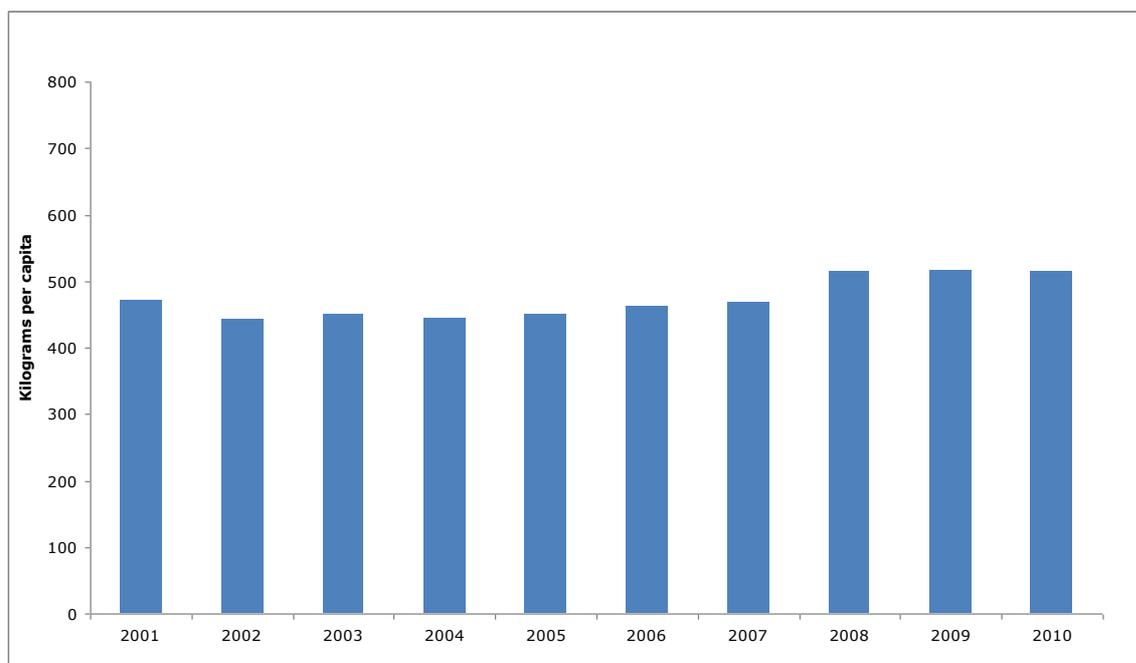
- Municipalities which are responsible for collection of (normally only mixed) waste;
- SGRSU which are entities dealing with waste treatment;
- SPV which is the Portuguese Green Dot System responsible for recycling packaging wastes.

## 2.1 MSW Indicators

Portugal generated around 5.5 million tonnes of MSW in 2010, and the treatment is still heavily based on landfilling. In the decade from 2001 to 2010, landfilling remained the dominant option with more than 60 % in all years, but with a decreasing trend. This is mainly due to recycling which has steadily increased to 12 % in 2010. Incineration covers around 20 % while the rest is composted. The following indicators illustrate the development of the Portuguese MSW management between the years 2001-2010.

Figure 2.0 shows the development of MSW generation per capita in Portugal from 2001 to 2010. There is a slow increase throughout the years 2002 to 2010 from 443 kg per capita in 2002 to 514 kg per capita in 2010. There is a break in series in 2002, when the data collection method was changed: The statistical survey was replaced with administrative data sources. For 2001, the figure shows the

**Figure 2.0 MSW generation per capita in Portugal**



Source: Eurostat, 2012

amount of municipal waste collected. In 2001, 99 % of the population was covered by a municipal waste collection scheme; thus, the amount is slightly underestimated.

### 2.1.1 The recycling of MSW from 2001 to 2010

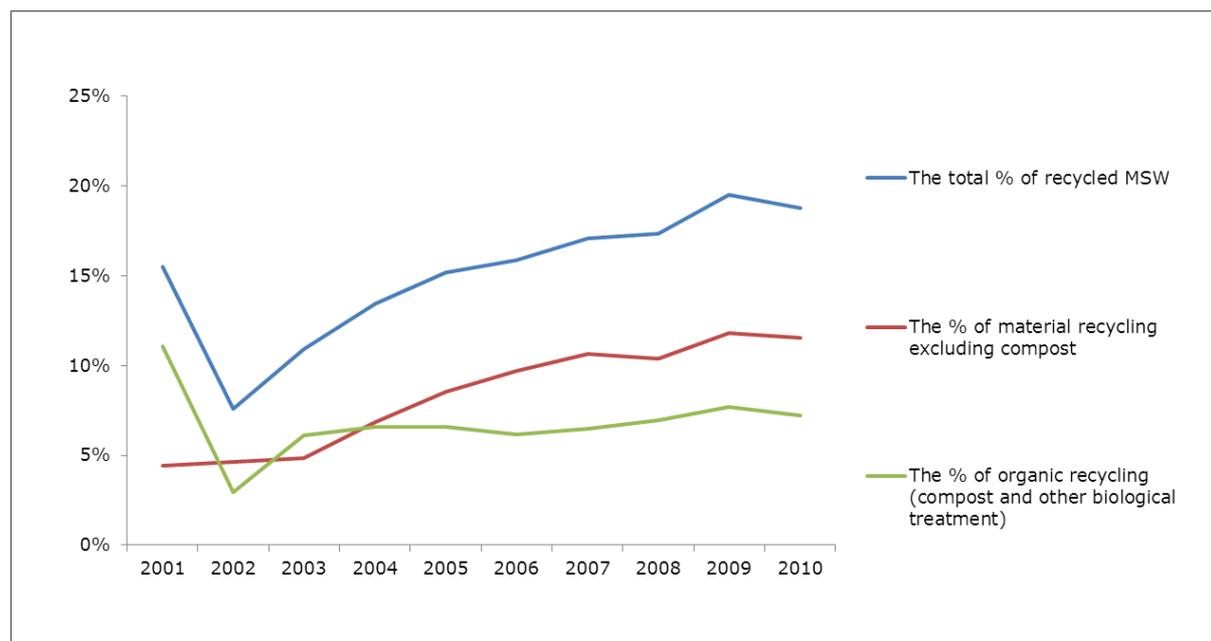
Figure 2.1 shows the development of recycling MSW in Portugal in the past decade (when data exists). In the same graph, the total recycling of MSW is broken down to material recycling and organic composting. After a sharp decrease in 2002, recycling in Portugal significantly increased before progress stagnated in 2009. The driver behind this increase is mainly material recycling which has grown at a faster rate than organic recycling. Overall, recycling in Portugal is relatively low compared to other EU countries, but nevertheless shows an increasing trend.

According to the data, the sharp decrease in total recycling in 2002 was caused by composting. However, this sudden decrease is more likely to be caused by changes in data registration than an actual decrease in composting. It may be because in Portugal there are numbers for both the amount entering into the organic recovery facilities and the amount finally composted. Most of the entering waste is rejected for landfilling as it is mixed waste that is often unsuitable for the composting process (Magrinho et al., 2006).

On the other hand, the stabilisation observed in 2009-2010 may be an effect of the economic downturn, which can also be noted in the generation of MSW which stopped increasing in 2008-2010.

The specific targets and the encouragement of recycling, included in PERSU II, seem not to have had an immediate effect on the recycling levels after PERSU II was ratified (2006).

**Figure 2.1 Recycling of MSW in Portugal<sup>12</sup>**



Source: Eurostat, 2012

<sup>1</sup> Recycling is presented as % of MSW generated

<sup>2</sup> For the period 2002 to 2004, the landfill, incineration and recycling figures are related to the amount of municipal waste collected. As part of the population is not covered by a municipal waste collection scheme (in 2000 about 6 % of the city inhabitants and 26 % of the inhabitants of rural regions), the total amount of waste generated is underestimated. ,

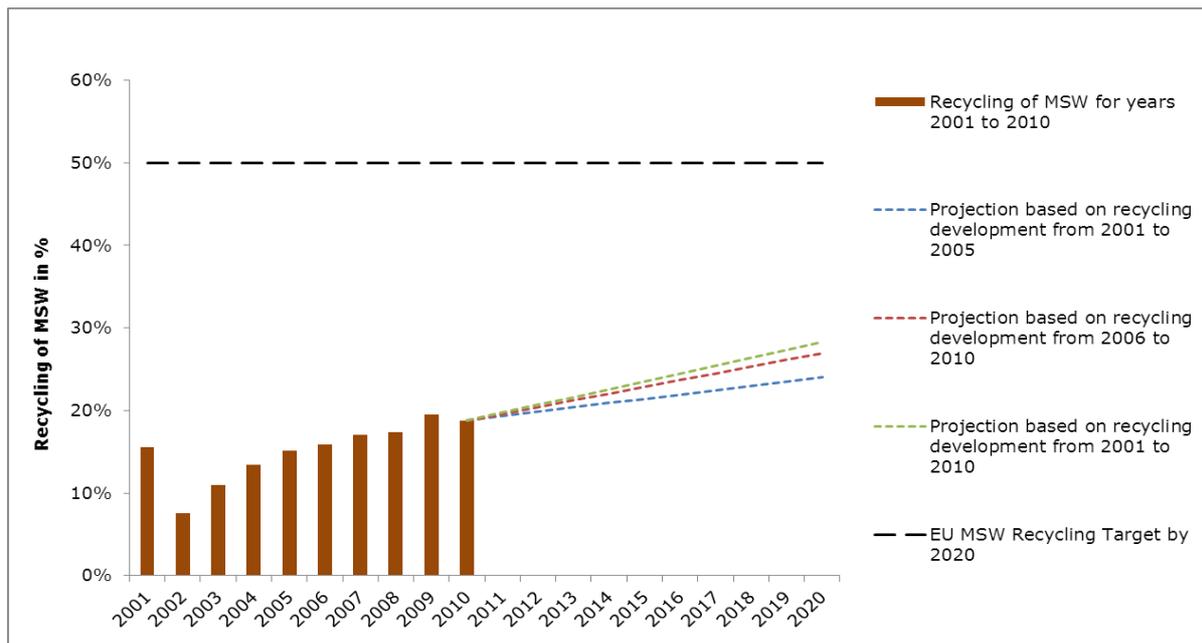
### 2.1.2 The yearly increase rate of recycling of MSW

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 have now been successfully implemented. The indicator could show whether or not the yearly increase rate of recycling is sufficient to reach the 50 % targets set by the EU legislation by 2020<sup>3</sup>. Figure 2.2 shows the recycling in Portugal as a percentage of the generated MSW, for the years 2001-2010. In order to get an indication of the future 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 year of the WFD target). All scenarios lead to a recycling level between 20 % and 30 % of the MSW generated. The forecasts do not diverge greatly among them, since the recycling developments have been relatively similar for all datasets.

**Figure 2.2 Future recycling of MSW in Portugal<sup>4</sup>**



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

The projection based on the latest five years of data does not yield the highest recycling in 2020, which means that Portugal has not been increasing its efforts in the more recent years.

<sup>3</sup> The EU's updated 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).

<sup>4</sup> For the period 2002 to 2004, the landfill, incineration and recycling figures are related to the amount of municipal waste collected. As part of the population is not covered by a municipal waste collection scheme (in 2000 about 6 % of the city inhabitants and 26 % of the inhabitants of rural regions), the total amount of waste generated is underestimated. .

This analysis shows that Portugal will need to make an exceptional effort if it is to fulfil the WFD target in 2020 intensifying its efforts in recycling a lot more.

Portugal is investing in MBT technology and the planned plants will be soon fully operational, which could well have a drastic effect on the recycling figures.

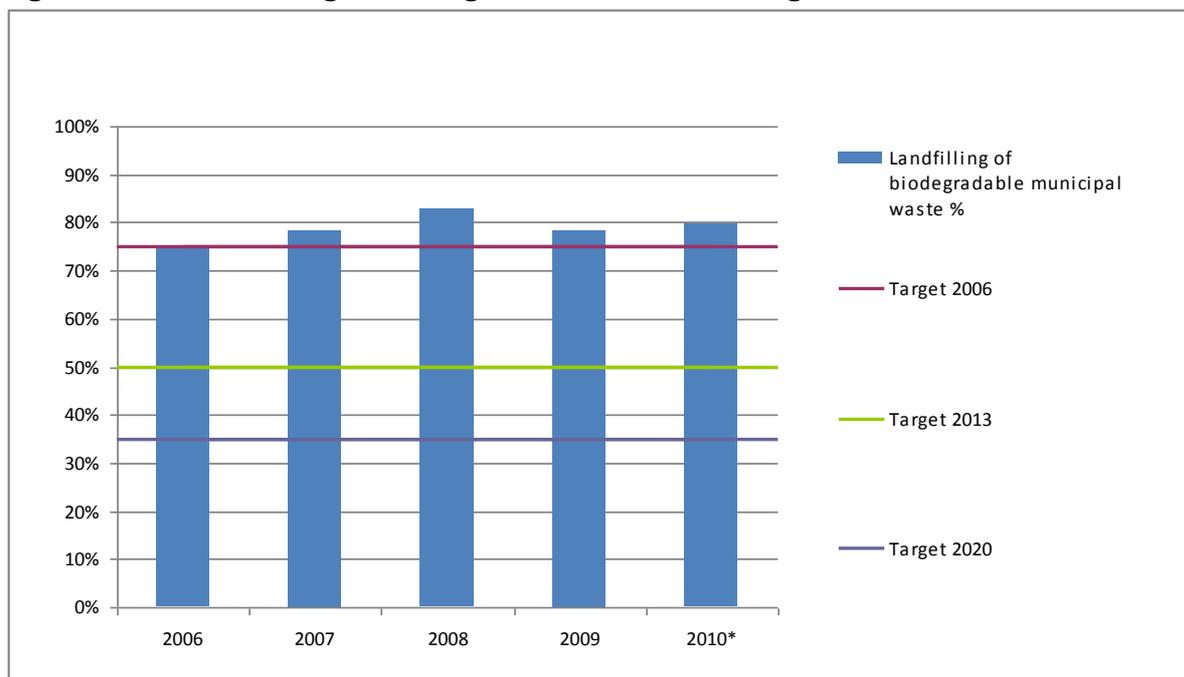
Please note that these three scenarios are very simplistic and do not take into account any planned policy measures. In addition, they are based on one calculation methodology for recycling of municipal waste (MSW recycled/MSW generated, using data reported to Eurostat) whereas countries may choose to 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.

### 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) by a certain percentage by 2006, 2009 and 2016. However, Portugal obtained a 4 year derogation period for the last two targets owing to some delays that occurred in the build up and the operation of new strategic infrastructures (Portuguese EPA, 2012). The targets are related to the generated amount of BMW in 1995, in which Portugal generated around 2 250 000 tonnes BMW. Portugal has reported the landfilled amount of BMW to the European Commission for the years 2007, 2008 and 2009 (EC, 2012).

Figure 2.3 shows the landfilling levels of biodegradable MSW in Portugal between 2006 and 2010 related to the generated amount in 1995, as well as the distance to the Landfill Directive targets. The figure for 2010 is based on an estimate which calculates the increase in composting levels between 2009 and 2010 and subtracts that amount from the landfilled biodegradable MSW in 2009.

**Figure 2.3 Landfilling of biodegradable MSW in Portugal**



Source: EC, 2012 and CRI calculation.\* The figures for 2010 are CRI estimations

According to the graph, Portugal achieved the target for 2006 (75 % of the generated amount of BMW in 1995) with the exact necessary percentage. However, the BMW landfilled has increased since then. The observed trend, although not sufficient for drawing safe conclusions, shows that Portugal is likely to miss the next target for 2013, unless strong changes are introduced in the area of

BMW treatment. The short time series of data does not allow safe conclusions to be drawn regarding the final target in 2020.

Portugal has emphasised the need for reform in the treatment of BMW: The national strategy for the reduction of biodegradable waste for landfilling (2004) sets the principles of separate collection of organic matter, construction of new recovery plants, gradual compost production and quality warranty of the compost in order to achieve minimization of BMW landfilling (Magrinho et al., 2006).

Portugal has invested in organic waste recovery facilities (including MBT technology) and has eradicated all uncontrolled landfilling within its territory. The combination of new treatment facilities becoming operational (mainly MBT) and the incentives provided by the PERSU II can be expected to change the development in landfilled biodegradable MSW.

#### **2.1.4 Regional differences of MSW recycling from 2001 to 2010**

Eurostat's database includes regional data on recycling of MSW for some countries, including Portugal. The analysis of this regional data gives an overview of the regional performances in the country. Regional differences could indicate good practices existing in specific regions can serve as examples for other regions to learn from.

Figure 2.4 shows the differences at regional level in Portugal concerning recycling. The regions with the highest and lowest performance in terms of total recycling, material recycling and composting, are shown as well as the developments in the region with the highest MSW generation.

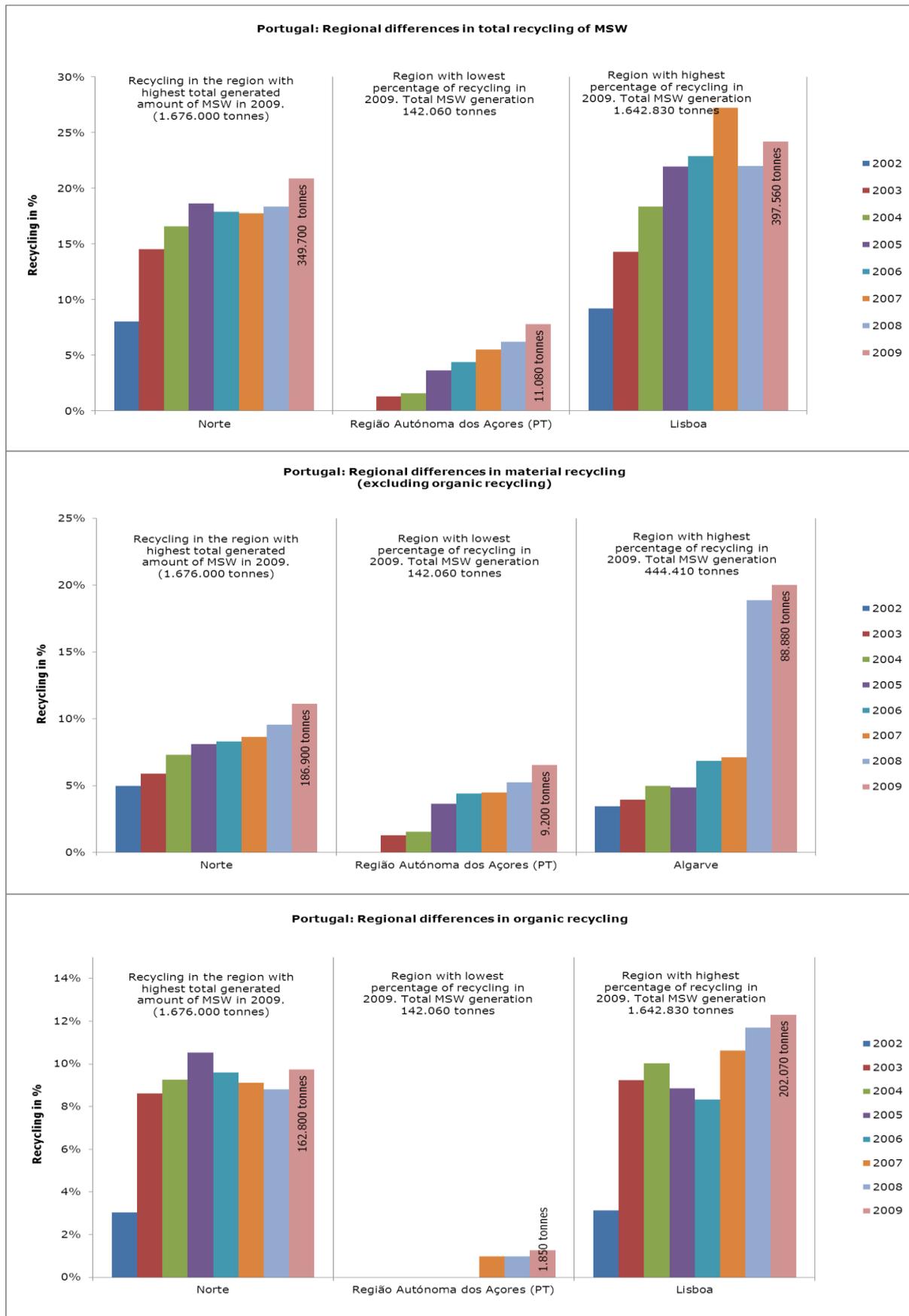
The figure shows significant differences between regions, especially in organic waste recycling. In total recycling, Lisboa and Região Autónoma dos Açores have 16 percentage points of difference (24 % and 8 % respectively) for the latest year of data, while the two regions have 11 points of difference for composting (12 % and 1 % respectively). Lisboa is not the best performing region for material recycling where the difference between Algarve and Região Autónoma dos Açores is 13 percentage points.

The region with highest generation of MSW (Norte) is always in between the best and least performing regions, following the developments at national level.

The differences between regions are significant and show that there are lessons to be learned between the various Portuguese regions.

On the other hand, it should be mentioned that there are limitations in how good practices among regions can be transferred. For example, in urban regions such as Lisboa it is technically and economically more feasible to establish and maintain higher levels of recycling than it is in rural areas.

**Figure 2.4 Regional differences in recycling of MSW**



Source: Eurostat regional data, 2012

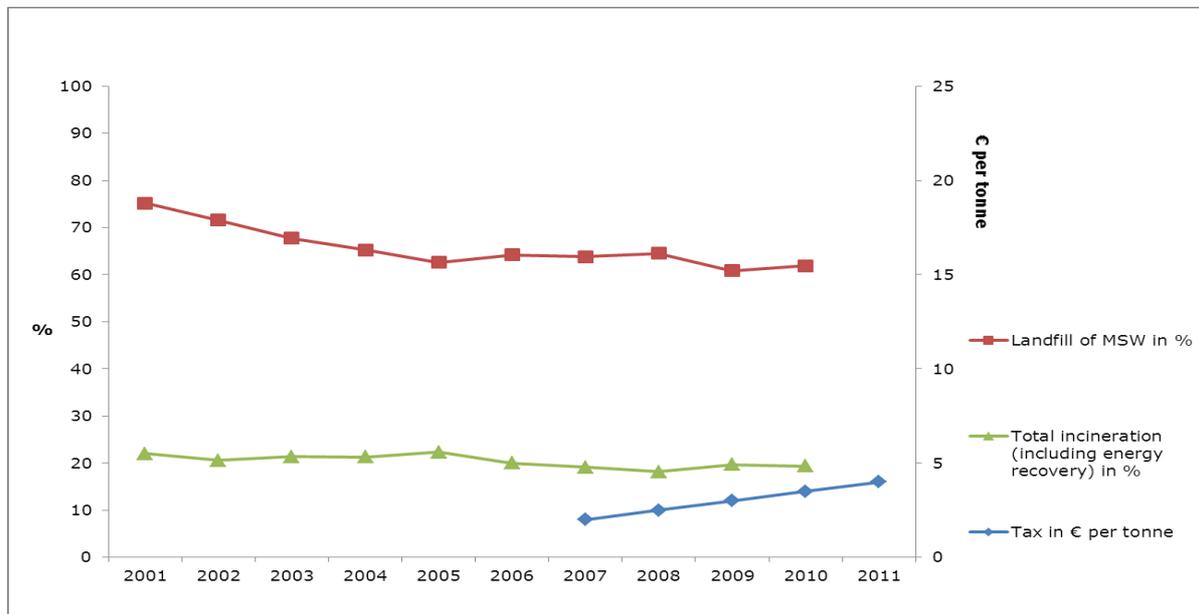
### 2.1.5 The relation between landfill tax level and recycling level of MSW

In this section, the relationship between landfill tax and the level of landfilling of MSW is examined. Portugal introduced a landfill tax in 2007 of EUR 2/tonne that was increased to EUR 4/tonne in 2011. The tax is supposed to provide an economic incentive to waste producers to divert waste from landfill and towards more sustainable solutions such as recycling or incineration with energy recovery.

In figures 2.5 and 2.6, the level of landfill tax is plotted against the levels of landfilling, incineration and recycling (total, material and organic). It seems that the landfill tax only had a weak effect on the management of MSW. Recycling has been increasing since the introduction of the tax but it continues the increasing trend observed before and no extra stimulus is observed due to the tax.

This weak effect of the tax might be a result of the low level of the tax. Compared to other EU countries, the level of landfill tax is very low in Portugal and it might not fulfil its aim of rendering landfilling a more expensive option than other alternatives.

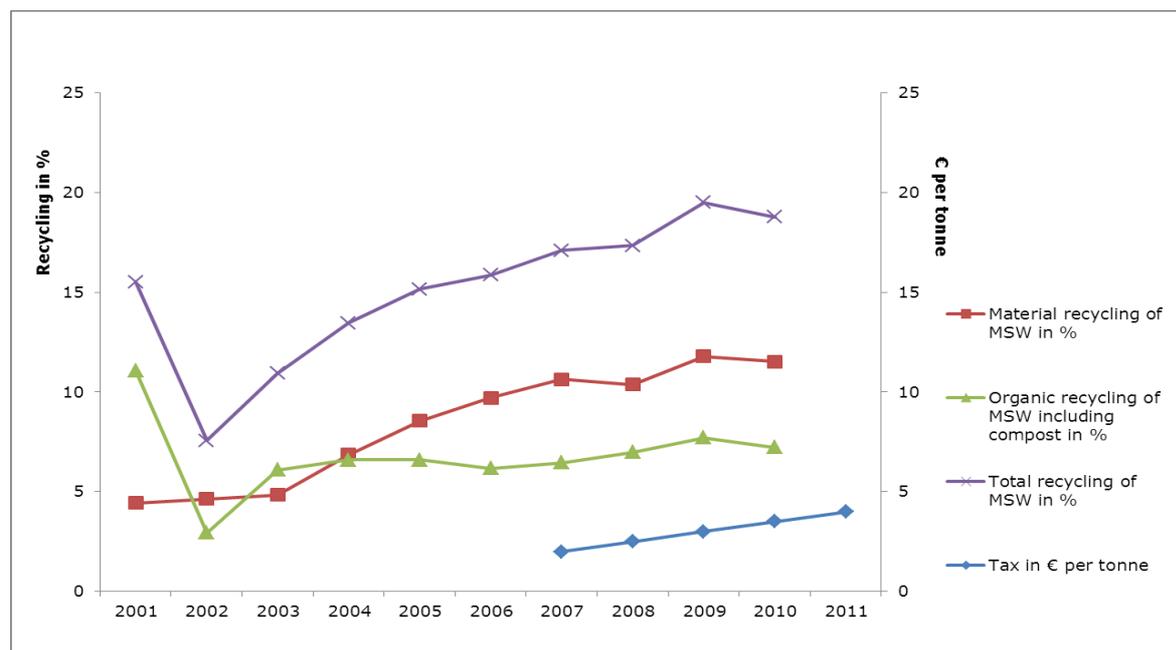
**Figure 2.5 Development of landfilling and incineration of MSW and landfill tax in Portugal<sup>5</sup>**



Source: Eurostat, 2012; ETC/SCP, 2012

<sup>5</sup>For the period 2002 to 2004, the landfill, incineration and recycling figures are related to the amount of municipal waste collected. As part of the population is not covered by a municipal waste collection scheme (in 2000 about 6 % of the city inhabitants and 26 % of the r inhabitants of rural regions), the total amount of waste generated is underestimated. ,

**Figure 2.6 Development of MSW recycling and landfill tax in Portugal**



Source: Eurostat, 2012; ETC/SCP, 2012

### 2.1.6 Environmental benefits of better MSW management

Figure 2.7 indicates the development of GHG emissions from MSW management calculated using a life-cycle approach. The graph shows the direct emissions, the avoided emissions and the net emissions of the MSW management<sup>6</sup>.

The level of GHG emissions depends on the amount of waste generated and the treatment it undergoes each year. Landfilling is a heavy contributor to the direct emissions, mainly due to its methane emissions. At the same time, recycling avoids emissions as a result of the avoidance of the primary production of materials which are provided by recovering MSW.

In the case of Portugal, the high level of landfilling results in a respective 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 from landfills since the biodegradable waste slowly degrades in a landfill and emits methane for years after it is deposited.

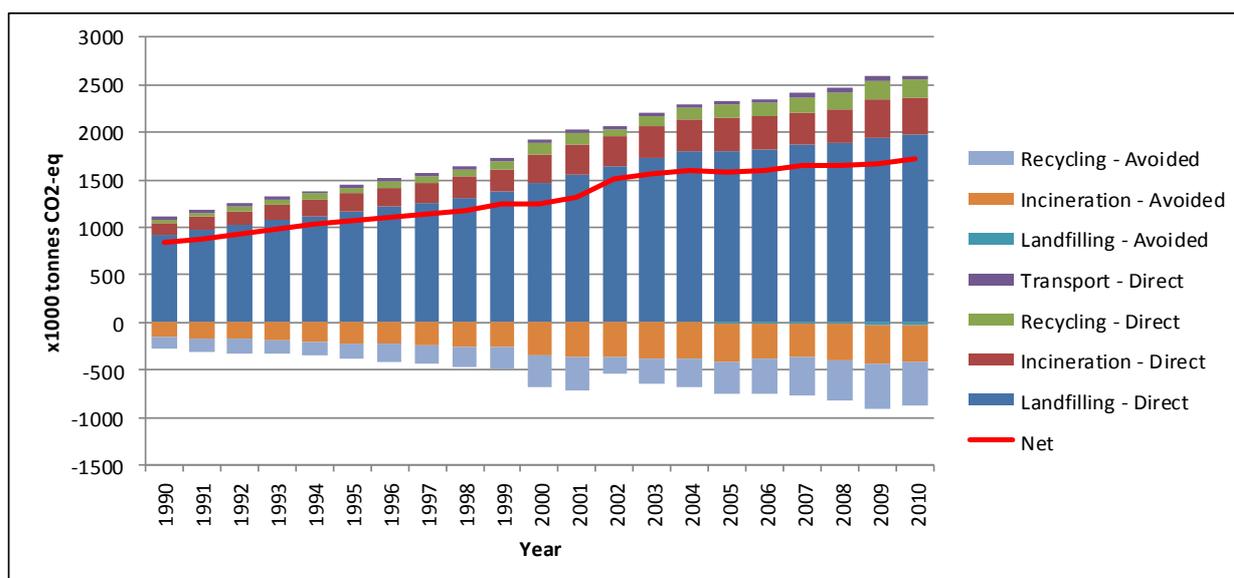
<sup>6</sup> All the GHG emissions (positive values) represent the direct operating emissions for each waste management option. These direct operating emissions have been calculated with the use of the IPCC methodology for landfills and incineration and life cycle modelling for the other technologies (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 the electricity mix of Portugal in 2009. Processes generating heat are assumed to substitute the average heat mix for the EU25 in 2002. The electricity mix and heat mix are assumed to remain constant throughout the whole time series. The composition of the MSW disposed in landfills, incinerated or recycled respectively are based on Bakas et al., ETC/SCP 2011. In an Eionet consultation process, initiated by the EEA in 2012, Portugal updated the composition of the landfilled, incinerated and recycled MSW for 2010. The complete methodology is available from Bakas et al, ETC/SCP (2011).

GHG emissions have steadily increased, mainly because of the increase in MSW generated. Although recycling and incineration have increased as well, the benefits of this were not able to mitigate the extra burden from the additional generated MSW.

The double benefit of diverting waste from landfill – reduced direct emissions from landfill and emissions avoided via recycling and energy recovery - gives Portugal a high potential for improvement by increasing the amounts of waste recovered (energy or material recovery). A further move towards recycling and recovery might help Portugal also achieve its GHG reduction commitments.

**Figure 2.7 GHG emissions from MSW management in Portugal<sup>7</sup>**



## 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 may 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 States, including Portugal, have producer responsibility schemes on packaging waste and the packaging waste is therefore not always reported to Eurostat as MSW.

Figure 2.8 shows the recycled packaging waste and MSW amounts in the same graph. The quantities of recycled packaging waste are clearly higher than the figures for MSW. This could be interpreted as an indication that recycled packaging waste or part of it is not included in the reported MSW recycled as a considerable part of packaging waste recycled usually comes from households. On the other hand, both recycling amounts follow the same pattern of development over time which indicates a correlation between MSW and packaging waste recycling.

Another factor for uncertainty could be that in some countries the whole amount of MSW sent to Mechanical Biological Treatment (MBT) is allocated to recycling, whereas in other countries it is in

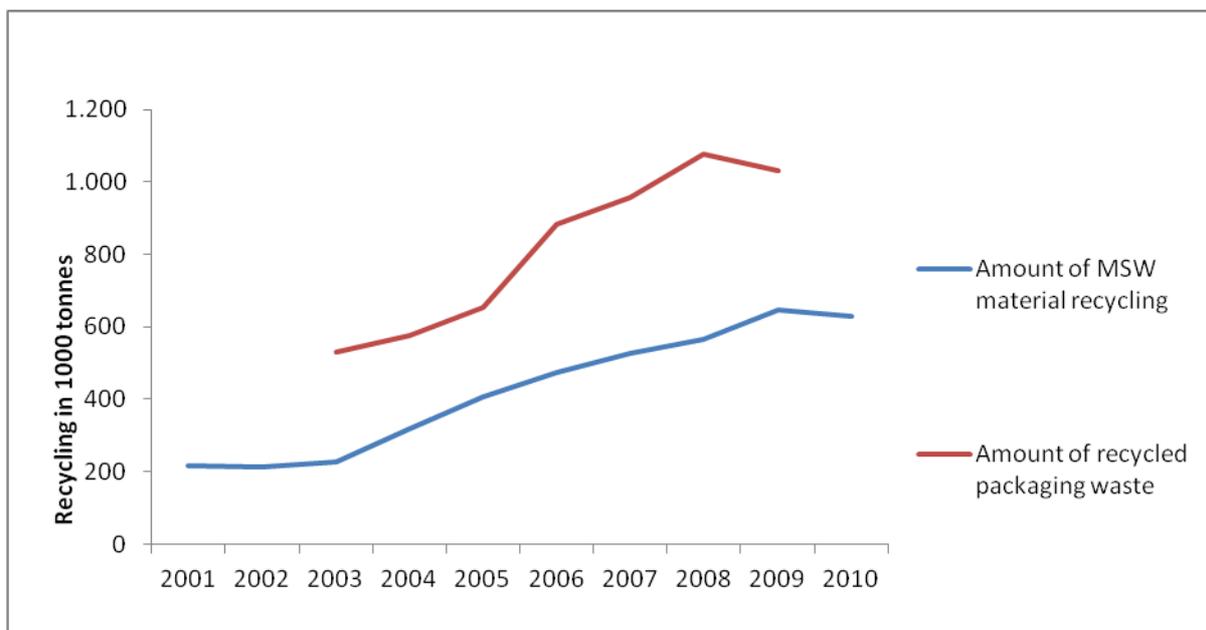
<sup>7</sup> Results presented in this figure should not be used for the compilation of GHG reporting (national inventory report of the IPCC) or compared with IPCC figures, as the methodology employed here relies on life cycle thinking and, by definition, differs from the IPCC methodology.

fact only the actual amount recycled after the MBT, which is reported as recycled MSW, excluding the amount sent to landfilling or incineration after MBT treatment. The reporting method concerning MSW treated in MBT plants can have a considerable impact on the reported data.

In 2010, Portugal had 9 facilities for organic recovery in operation on the mainland, with a couple of them being dedicated to bio-waste composting. The ETC/SCP could not find information about how MSW treated in these facilities is reported. The sharp decrease in the composting amounts between 2001 and 2002, observed in figure 2.1, may be due to a change in reporting method but this is not certain.

In 2010, 10 new facilities for organic recovery were under construction (most of them MBT facilities making use of anaerobic digestion) and another 5 facilities were projected for the organic recovery of MSW. Total treatment capacity of the new MBT plants amounts to approximately 400 000 tons per year (Portuguese EPA, 2012). Taking these new facilities into operation can be expected to considerably change the waste management situation but the way the treated MSW amounts are reported is crucial for properly accounting for this change.

**Figure 2.8 Comparison of packaging waste recycled and MSW recycled from 2001 to 2010**



Source: Eurostat, 2012

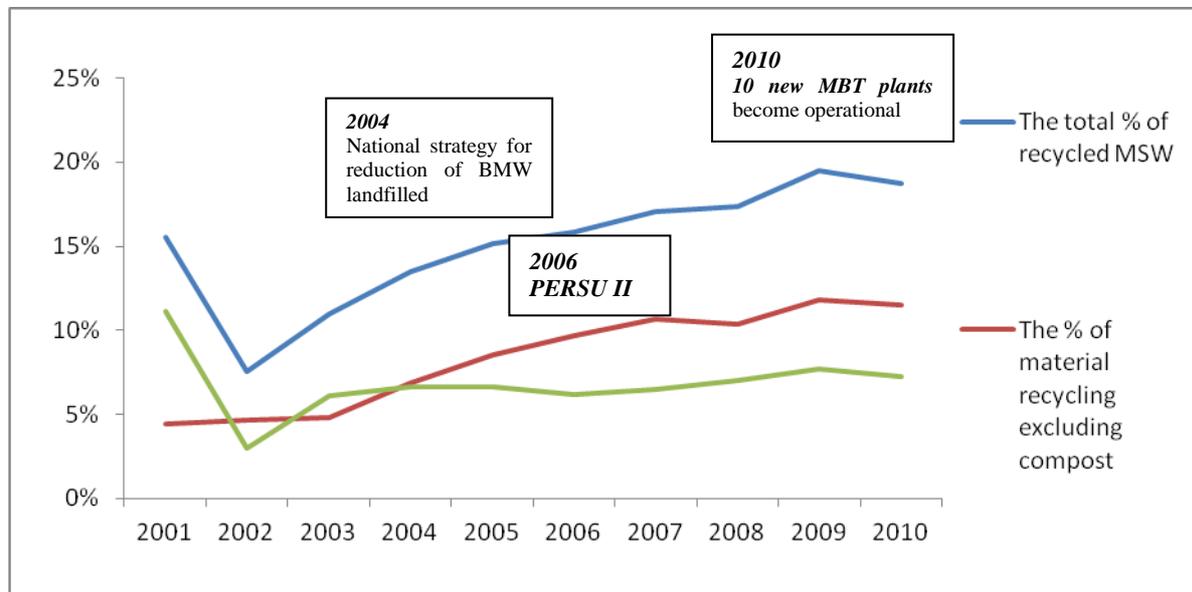
### **2.3 Important initiatives taken to improve MSW management**

A main element of Portugal’s waste policies is the second national waste management plan, PERSU II. PERSU II was ratified in 2006 and covers the period 2007-2016. PERSU II is trying to eliminate the inefficiencies observed in the implementation of the previous plan and incorporates the European legislation’s objectives in national law. Although the principles of PERSU II clearly promote recycling and recovery in general, the effect on the MSW management situation until 2010 was small since its ratification.

The most important initiatives found in Portugal in the recent past years refer to BMW. The legislation addressing BMW was updated in the 2000s with various decrees aligning the Portuguese legislation with EU Directives (Magrinho et al., 2006).

The national strategy for the reduction of BMW landfilled, launched in 2004, aims at increasing separate collection and establishing modern facilities for its treatment. Portugal invested also in MBT technologies, with 10 more new plants close to be put into operation in 2010, which can be expected to have a significant effect on the development of the entire MSW management system in the future.

**Figure 2.9 Recycling of MSW in Portugal and important policy initiatives**



Source of data: Eurostat, 2012

## 2.4 Future possible trends

Recycling has been increasing at a more or less constant pace except for the last two years. However, the stable percentage of landfilling and the slow increase of recycling show that Portugal will need to make an exceptional effort in order to fulfil the 50 % recycling target of the Waste Framework Directive by 2020, as well as the diversion targets of the EU Landfill Directive. However, Portugal expects that the rescheduled and readjusted management of BMW in line with the targets of 2013 and 2020, together with the full operation of all the facilities projected for its recovery, will reverse this situation and contribute to the compliance with its landfill diversion targets (Portuguese EPA, 2012).

Regarding MBT technology, this form of treatment can yield significant improvements for Portuguese MSW management. Portugal seems to give priority to BMW recovery with organic waste recovery facilities that are already functioning, with a further ten MBT plants that became operational in 2010. Their additional treatment capacity of 400 000 tonnes would cover a significant part of the MSW and could rapidly change the structure of MSW treatment. On the other hand, data show that after the waste enters the organic recovery facilities (composting or MBT plant) the majority is rejected and sent to landfill (Magrinho et al., 2006). If the efficiency of the sorting process is increased, more waste can be treated and less landfilled. However, this efficiency is limited by the fact that the organic recovery facilities are treating mixed waste, which has an effect on the quality of the output.

The strategic framework is in place in Portugal with PERSU II covering all aspects and objectives of a sound and improved MSW system. However, there appears to be difficulties with its implementation insofar as its ratification failed to create any observable results on the MSW management until 2010, while the implementation of the previous plan was only partial. The landfill tax seems to be too low to have a significant effect on the landfill rate. Overall, Portugal needs to intensify the implementation of the plan and considerable additional efforts will be needed to fulfil the EU targets.

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