PAST, PRESENT AND FUTURE OF MUNICIPAL SOLID WASTE MANAGEMENT IN SPAIN

Marc MILIAN and Tsunemi WATANABE
Kochi University of Technology

ABSTRACT: In Spain in the old times municipal solid waste (MSW), which includes predominantly nonhazardous domestic waste, was practically non existent and predominantly biodegradable. Therefore, it was not a problem for society nor did it require special attention.

However, since the development of the economy and the subsequent increase of the standard of living, the amount of MSW has grown continuously, by 40% between 1996 and 2003 (Spanish Ministry of Environment). Also, the composition of the waste has changed from being predominantly organic to containing an important amount of non-biodegradable materials, mainly packaging (26%. Source: Spanish Ministry of Environment). As a result, MSW has become an important environmental issue in Spain and a source of social concern.

This complex situation makes MSW management a challenge for at least the near future. The purposes of this paper are to describe the present situation of Spanish MSW management and its evolution during the last 15 years, and then, to suggest some possible measures to improve the situation.

Regarding the present situation, it is clear that management has not been effective. Most of the goals set in the 2000-2006 National MSW Plan have not been reached. The main failures have been the inability to discourage the creation of waste (the first step, according to the law itself) and also the misuse of the organic portion of MSW due to an inefficient composting. In addition, the data provided by the government and other organizations are not all based on the same criteria. Information is incomplete and usually its publication is delayed by several years. These facts complicate having a clear view of the situation and, therefore, its management.

Several measures are suggested against these issues, but especial focus is set on how citizen's behaviour can be changed in a more ecological direction. In answering this question, environmental education is considered one important tool.

KEYWORDS: MSW, Spain, waste

1. INTRODUCTION

Preserving a good natural environment is essential for a good health and quality of life (Ministry of Environment of Spain, 2006). However, at present, the environment is damaged all around the world by several main factors, such as global warming gases emissions, excessive resources extraction or persistent organic pollutants release. Waste is one of them. Particularly, MSW creates special concern among the general public due to its close relationship with the daily life of the lay person.

In Spain, the increase of MSW generation began

during the second half of the 20th century, with the economic development after the post civil war depression. The increase becomes obvious during the last quarter, with the modernization of Spain after its democratization and its membership of the EU. The deterioration of the waste problem is reflected in the proliferation of MSW related protest sent to the Ombudsman of Spain during the last part of the 20th century. (Ombudsman bureau of Spain, 2000).

1.1. Objectives

The purposes of this paper are to describe the present situation of Spanish MSW management and its evolution during the last 15 years, using official data from the Spanish government and other sources; and then to suggest some possible measures to improve the situation.

1.2. Paper layout

This document is organized as follows: First, background information about the nature of MSW and the basic Spanish legislation on MSW management is introduced. Then, we present the main data that characterizes MSW situation in Spain from 1990 to 2005, and subsequently make comments on this information. After that, we propose some actions to improve the situation.

2. BACKGROUND INFORMATION

2.1. What is MSW?

MSW is the waste produced by households (domestic waste) and commerce collected inside a municipal area. Nowadays it typically includes these kinds of waste:

- Biodegradable: food and kitchen waste, green waste…
- Recyclable material: paper, glass, cans, certain plastics, etc.
- Inert: construction and demolition waste, dirt, rocks, debris...
- Composite: clothing and similar, Tetra Paks, toys….
- Hazardous and toxic: paints, light bulbs, fluorescent tubes, spray cans, fertilizer and pesticide containers, batteries…

It should be noted that from a legal point of view waste is defined and classified within the European Union by the European Directive 91/156/CEE (European Waste Catalogue).

The amount and nature of MSW produced in a community depends on the characteristics of the area. On an economically developed urban modern region the amount of MSW will be much higher than in a developing rural area. In the same way, waste produced in a developed region will have a high percentage of plastic and packages, contrasting with the predominantly biodegradable waste in poorer regions (OECD, 2007) (Fig. 1).

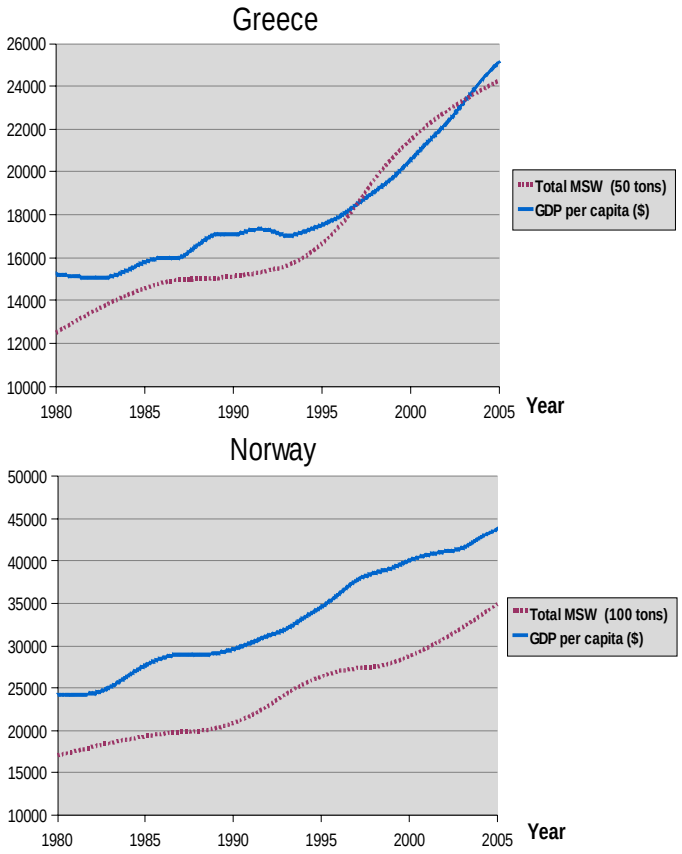

Fig 1. MSW and GDP per capita in Greece and Norway

These countries are in the opposite sides of Europe (geographically, economically, and culturally), but both show a correlation between GDP and MSW. We can find a similar correlation in other European countries.

2.1.1. Why is MSW a problem?

In the past, the amount of waste was relatively low, and mainly of organic nature. Because of this, and also because the common lack of understanding of the public health problems that an improper management of MSW can cause, as pointed out during 19th century (USEPA, 2007) waste was not, or was not seen, as a problem. Therefore, little effort was done to manage MSW. Indeed, the main problems of MSW, pollution of aquifers and land, visual impact and bad smell, as well as the related popular protest against the construction of new landfills or incinerators, are related to the continuously increasing amount of waste and the growing percentage of non-biodegradable materials (Greenpeace Spain, 2006).

2.2. Main legislation

In Spain, it was not until 1985, when the first National MSW Law was passed, that the problem of MSW was confronted at national scale. This new law forced most municipalities to manage their waste and protect the environment. To do so, attempts have been made of following a unified criterion and improving coordination although the law ambiguity reduced its actual affectivity (Morton Barlaz et al., 2002). In the following years, other waste related regulations were approved, most of them being incorporations into national law of the corresponding European Directives.

One fundamental law was the 1997 packaging law, which established a model of Extended Producer Responsibility: forcing manufacturers to be responsible for recovering and managing the products they place on the market. This brought the creation of a “Green Dot” system. Under this management scheme, manufacturers pay a fee destined to compensate municipalities for the extra cost of recovery and recycling over direct landfilling of the packaging they produce. Previously, only glass bottles were widely reused or recycled by means of “deposit and return” systems, managed directly by each producer, following a 1981 Royal Decree (Law: legislative power; Royal Decree: executive power, less preference than a Law).

In 1998 the second National MSW Law was approved. The responsibility and obligations of each party was clearly established, in contrast with the vague 1985 Law. Selective collection of recyclable materials was enforced at municipal level and national recovery and recycling targets were defined. Now, municipalities had to establish an Integrated System of Management (ISM) in order to achieve these goals. One option was to work with Ecoembes, a non-profit organization created by the main manufacturers to manage the ISM nationwide. The other option was to apply for Green Dot funds directly and create their own strategy, although this alternative is not so popular (Morton Barlaz et al., 2002).

The 2000-2006 MSW Plan, supported by the 1998 Law, introduced new specific goals and provided funds to develop infrastructures, launch information campaigns and promote R&D. This plan was a milestone in MSW management development in Spain.

3. SITUATION 1990-2005

3.1. Data

To observe the state of MSW we are going to look at the evolution of the amount of MSW generated, its composition and the treatment it received. There is no comprehensive national information before 1990, and even after this point data is not always available or it can vary depending on the source (Environment ministry, National Statistics Institute or Eurostats). Additionally, the data publication is typically

delayed by several years. (Greenpeace Spain, 2006). In spite of this drawback it is still possible to obtain an overall image of the situation.

3.1.1. Generation

According to data from the Spanish Ministry of Environment, the amount of MSW produced at the beginning of the 1990s was about 325 kg/hab/year, lower than the European average. However from 1990 to 2004 MSW production grew incessantly reaching 525 kg/hab/year, a 62% increment. Additionally, the growth rate was superior to that of the EU average (Ministry of Environment of Spain, 2006), making it probably converge by 2006 (Fig. 2).

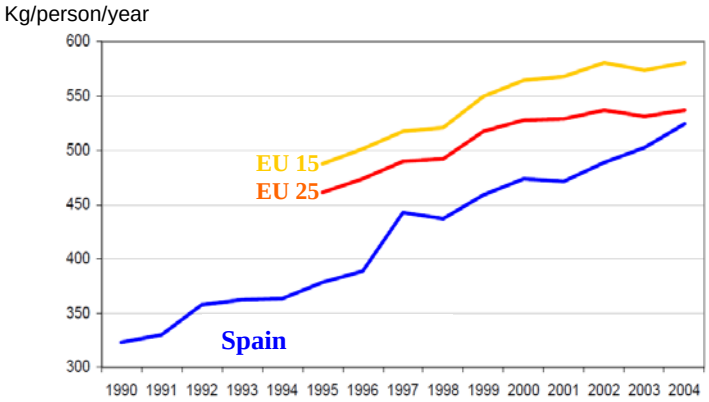

Fig. 2 MSW evolution in Spain, EU 15 and EU 25 from 1990 to 2004 (Environment Ministry of Spain)

3.1.2. Composition

There is also limited data regarding the composition of municipal solid waste. Only 2 limited studies have been performed, in 1996 and 1999. The later indicates that almost half (49%) of MSW is organic matter, 18% is paper, 12% is plastics (1% increase from 1996) and 8% glass. Therefore 77% of MSW are potentially recyclable or recoverable.

3.1.3. Treatment

However, the reality, according to the Spanish Environment Ministry, is that 49% of MSW (2004) is directly landfilled and 7% incinerated (doubled from 1995 to 2003). 31% is sent to composting plants and 9% is selectively collected (the final amount actually recycled is unknown, but could be close to 30% of this 9%) (Greenpeace Spain, 2006). 3.2% ends in illegal dumping sites, a clear improvement from 11% in 1997. From the organic MSW sent to composting plants only 10% is actually composted due to its low quality (Greenpeace Spain, 2006) rendering effectively a minimum of 87.2% (49% directly landfilled, 7% incinerated, 28% rejected compost, and 3.2% illegal dump) of the total MSW being eliminated, not recycled or valorized. Incineration, even with energy recovery, is not considered valorization according to a decision of the European Commission in 2003.

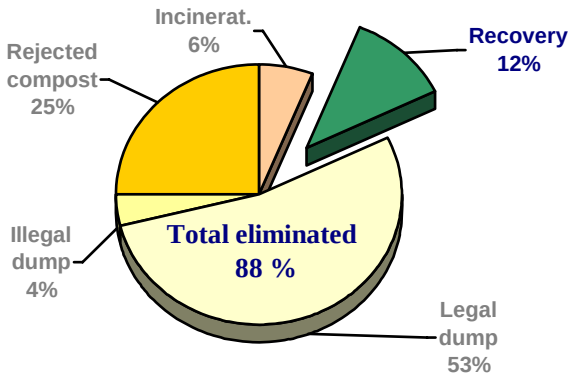

Fig. 3 Treatment of the MSW in Spain. Only 12% is reused or recycled. The other 88% of MSW is eliminated by incineration or landfilling (Environment Ministry)

3.2. Data commentary

The constant growth of MSW is a problem by itself, but more important is the fact that the efforts to address the problem have not been effective. The 1998 MSW Nation Plan, which was supposed to be the fundamental tool to solve the waste issue, set an objective of reducing overall MSW by 6% (from 1996) before 2004. However, it increased by 40% in that period. Similarly, the growth estimated by the OECD for 2010, based on 1996 data, was already reached in 2001. Recycling rates followed a similar trend. This failure indicates that in spite of the 1998 law introducing prevention as the first measure to take in order to manage MSW issue, the interventions actually focused on the “end of the pipe”, and not on prevention and reduction of waste

generation. This maybe due to the business created around the waste problem (Greenpeace Spain, 2006). At the same time, relatively simple and effective solutions, as an improvement in the composting efficiency has not been achieved. Note that due to the organic matter being 50% of the total, even a small improvement would render in a noticeable overall reduction of landfilled waste.

As seen above the data is not reliable. The figures vary from source to source and they are frequently obtained from estimates or limited-coverage surveys. This results in a reduced amount of information to plan a suitable MSW management strategy, and therefore is also one of the main issues to be resolved.

Lastly, we have to pay attention to the increase of incineration as MSW treatment (Fig. 4). Incineration can produce up to 200 dangerous substances which pollute the air, water and soil and have harmful effects on human health (Greenpeace Spain, 2006, EU Directive 2000/76/EC). Theoretically, modern incinerators have low emissions of contaminants, but the fact is that in many cases even if these pollutants (that vary depending on the waste burned) are not going into the atmosphere, they remain in the ashes, that are typically sent to a landfill. "*Precautions must be taken to prevent their dispersal into the environment and tests must be carried out to establish their polluting potential*" (EU Directive 2000/76/EC). The energy recovery, mandatory nowadays, accounts for less than 30% of the energy that would be saved by recycling or reuse of the products burned (Greenpeace Spain, 2006). In fact, incineration, even with energy recovery, is considered elimination by the EU. Therefore the increased incineration in Spain not only is opposed to the waste hierarchy (Fig.5), but also does not offer environmental guarantees.

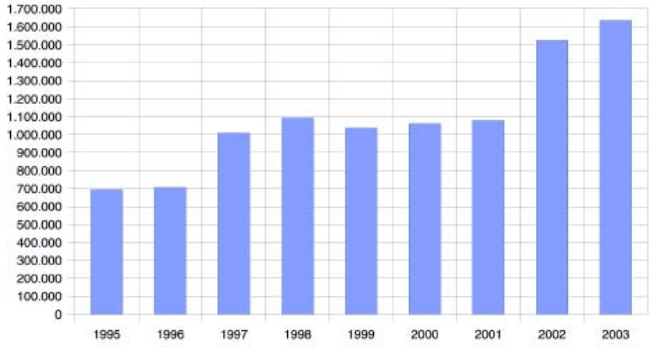

Fig 4. Incineration in Spain (tons per year). From 1995 to 2003 (Environment Ministry of Spain)

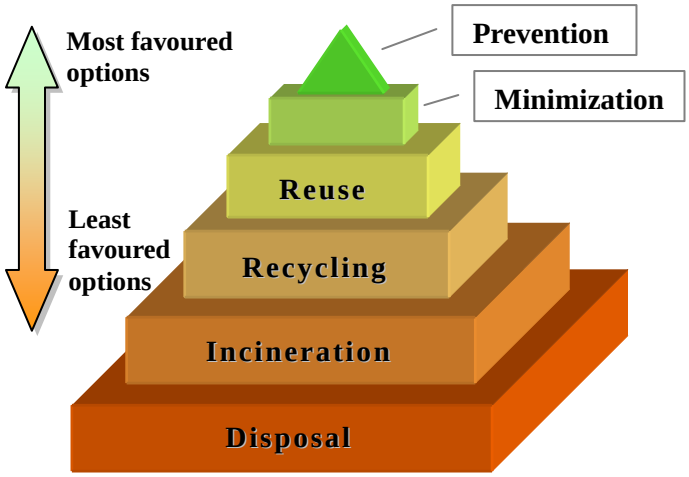

Fig 5. An example of a waste hierarchy pyramid. Incineration and disposal are both considered elimination in EU

4. PROPOSALS

4.1. Regulations

Although nearly 50% of the total amount of MSW is organic, more than 90% of it is ultimately landfilled. Thus, one of the first steps should be to set up selective recovery of organic waste for composting. This would improve the efficiency of the composting plants as well as the quality of the compost, reducing the amount of MSW sent to landfills and also opening more possibilities of use for the compost produced.

Regarding packaging, "container deposit" systems, especially for bottles and other reusable items, should be introduced. This method is usually more effective than the "colored containers" system (United States Senate, 2002) regarding the amount recovered. It allows direct reuse of the collected

items, as they are perfectly sorted and not damaged. The system should be convenient for consumers, allowing return of items at any point of sale, not only the original seller. Additionally, fiscal measures should be taken to discourage excessive packaging and packaging which is difficult to reuse or recycle.

To assure the regular collection of comprehensive and reliable data, an independent department of the Environment Ministry should work exclusively on the compilation of data, issuing annual reports without unnecessary delays.

Finally, any kind of measure or law would be useless without a response in the case it is not abided. Therefore, the department of the environment ministry in charge of controlling the application of the law should have more resources and more power to directly act in case of violation of regulations or in case that a municipality or province fails to achieve the goals.

4.2. Encourage ecological behavior

Although all this regulations or other up-to-bottom approaches are needed, they are not enough. In the end, anonymous individuals of the society have the final responsibility to make the system works, for example, by sorting waste for recycling or reducing waste generation. Even if regulations encourage or try to enforce these kinds of activities, eco-responsibility and its associated behaviours are crucial to solve or diminish many of the waste related problems.

This eco-behaviour is influenced by factors as the perception of the environmental conditions, knowledge about how the environment works, external conditions (social approval, reduced taxes, or even outside temperature (Olsen, 1981) and home characteristics (Verhallen & Van Raaij, 1981)), the opportunities to act and the existence of feedback (results) on these eco-actions (Kruse, 1995). Following this idea, the main tools to promote the degree of eco-action would be environmental education (at school for children, and in mass media for the general public) and information (of the situation and of the results of the citizen's actions). Environmental knowledge and values, which can be given through environmental education, explain 40% of the variance of ecological behaviour intention which, in turn, predicts 75 per cent of the variance of general ecological behaviour (F. G. Kaiser et al., 1999). Transparency in the information is also important, as it will increase the sense of control over the problem and thus raise the participation level (Fleming and Baum, 1993). However, even nowadays it is not uncommon to have the idea among the general public that sorting waste at home is useless ("Because even if I do, the other people will not"), that nothing can be done to solve the problem ("So, why bother?") or even that the kerbside collection trucks eventually unload the sorted materials in the general MSW landfill instead of in a recycling plant (Example: Moore, M., 2001).

Therefore, an important effort to provide education and information to the society is needed to change these and other perceptions and to promote the eco-behaviours among the individuals and communities. Especial emphasis should be given to encourage community level actions, as the participation level will probably be higher, due to the additional values, as mutual support and approval or the perception of an increased possibility of success (control), that the group dynamic brings implicitly.

5. CONCLUDING REMARKS

As we have seen, the situation concerning MSW is less than optimal. During the last 15 years it has not

been improved. Actually it has become even worse in spite of the several Laws and Plans aimed specifically at solving the issue. This could mean that there is a fundamental flaw in the way these Plans and Laws are designed or executed, as suggested above.

In this paper an attempt is made to point out some of the most important problems and a few general ideas on how to improve the condition. Most of these issues have been already recognized in the (draft of the) 2007-2011 National MSW Plan, and in fact some of the measures proposed in the plan are similar to the ones we proposed. However there is already doubt about the likelihood of success of this new Plan. According to a Greenpeace report (Greenpeace Spain, 2007), the Plan fails to provide concrete measures, it is too *weak* to achieve its goals of waste reduction and, at the same time, promotes a raise in MSW incineration as a solution. As explained previously, any type of incineration is considered elimination according to the European commission.

The future of MSW in Spain at this point is uncertain. Even if the new MSW plan is effective, it will take many years to achieve a stable and acceptable waste condition. In the meantime, a lot of works are needed by not only the government side but also the society side.

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