



WASTE CYCLE



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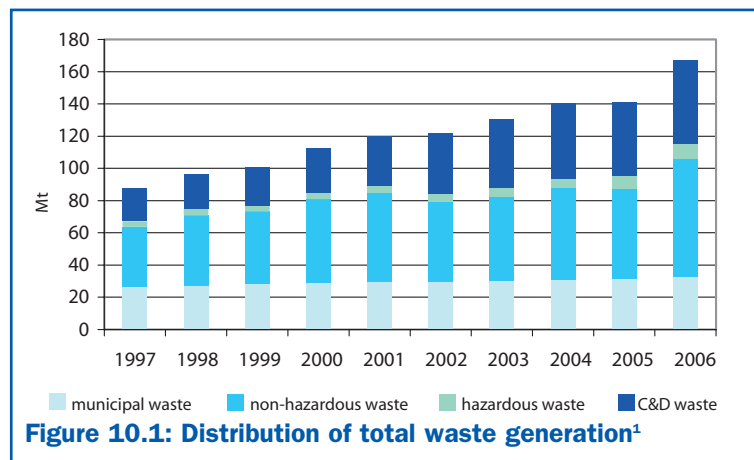
*Between 1997 and 2006 total waste generation increased from approximately 87.5 million tons in 1997 to 167 million tons in 2006.*

*In 2007, for the first time in several years, municipal waste generation had a lower growth with respect to GDP and household consumption (+0.1% against +1.5% and +1.3%).*

## Generation

In 2006 total waste generation reached approximately 167 million tons, suffering an increase of about 91% with respect to 1997 (Figure 10.1).

After many years of high growth, stabilization in waste generation was noted between 2006 and 2007 actually reaching 32.5 million tons (only 40,000 tons more than the previous year, marking an increase of approximately 0.1%).



**Figure 10.1: Distribution of total waste generation<sup>1</sup>**

Waste generation is known to be strictly correlated to socio-economic indicators, like GDP and household consumption. However, between 2004 and 2006, the increase in municipal waste generation was practically double with respect to the increase of socio-economic indicators (+4.3% against +2.4% for GDP and +2% for household consumption). In 2007, instead, for the first time in several years of study, a lower growth was registered with respect to GDP growth and household consumption (+0.1% against +1.5% and +1.3% respectively).

Such positive progress may be explained taking into account that hazardous and non-hazardous waste deriving from commercial,

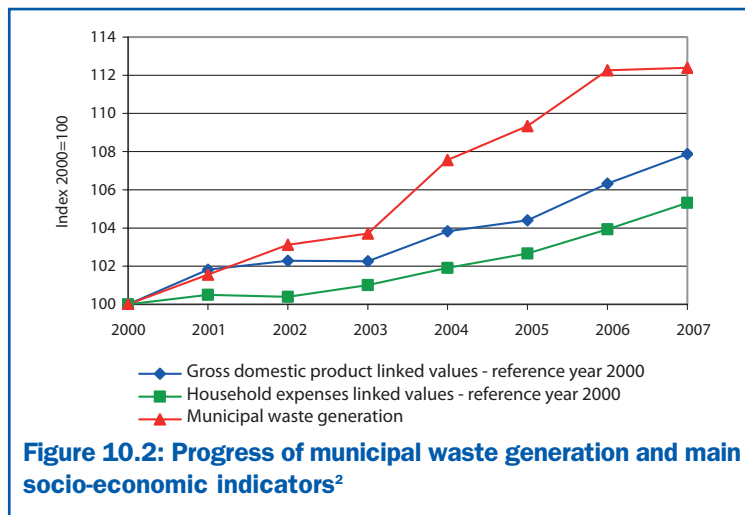
<sup>1</sup> Source: ISPRA



craft and production firms located inside the city was collected as municipal waste, in a more or less prominent way depending on the various territorial contexts.

The latest regulations, introduced by Legislative Decree no. 152/2006, amended in January 2008 by Legislative Decree no. 4/2008, have limited the possibility of collecting municipal waste with hazardous and non-hazardous waste. This aspect may have affected, not in a minor way, the stabilization of the result related to absolute generation of municipal waste. A further slowdown factor of municipal waste generation is the introduction of specific prevention measures in some territorial contexts.

Over the last few years, several public administrations (especially the most efficient ones in terms of organization of waste integrated management systems) have in fact promoted incentives for the prevention and minimization of waste generation. Initial positive effects of this new management policy have therefore been noted.



*In 2007, the growth of municipal waste generation was lower than the GDP and household consumption increase (+0.1% against +1.5% and +1.3% respectively) while a definitely higher growth was registered in the previous three-year period.*

In order to separate production from resident population levels, *per capita* generation needs to be assessed. In 2007 this showed a contraction with respect to 2006. As a matter of fact, in 2007

*The analysis of per capita waste generation is aimed at separating generation from population levels. In 2007 per capita waste*

<sup>2</sup> Source: ISPRA



generation reached  
546kg/inhab.

In 2007 the highest generation values were recorded in the Central area, (with approx. 630 kg/inhab.) and the lowest values in the South (508 kg/inhab.). The North produces about 539 kg/inhab.

national *per capita* generation of municipal waste reached 546 kg/inhabitant per year against a value of 550 kg/inhabitant per year, registered in 2006.

In this regard, it is worth noting that the reduction of *per capita* generation was substantially affected by the official number of the resident population, which increased by 488,033 people (+0.8%) between 31 December 2006 and 31 December 2007. Therefore, the population increased more with respect to the waste generation value.

In 2007, like previous annual surveys, the highest values of municipal waste generation in the three geographical macro-areas were noticed in the Central area, with approximately 630 kg /inhabitant per year. The lowest ones were registered in the South, with approximately 508 kg/inhab. per year. In particular, *per capita* municipal waste generation with respect to the previous year dropped by 1.1% in the Centre (-8 kg/inhab. per year) and by about 0.2% in the South (-1 kg/inhab. per year).

As for the North, it produces approximately 539 kg/inhab. per year, -0.9% with respect to 2006 (-5 kg/inhab. per year).

The analysis of regional *per capita* generation values in 2007, like in previous years, highlights that higher production values were found in Tuscany (with over 694 kg/ inhab. per year), Emilia Romagna (673 kg/ inhab. per year), Umbria (639 kg/inhab. per year), Liguria, (610 kg/ inhab. per year), Lazio (604 kg/ inhab. per year) and Aosta Valley (601 kg/inhab. per year).

It is worth noting that the *per capita* generation value is calculated according to the number of resident citizens in each single geographical area. Therefore, it does not take into account the so-called fluctuating population (linked for example to the flow of tourism), which could even substantially influence the level of absolute generation of municipal waste and therefore make the *per capita* production value rise. Moreover, this value may also be affected by the phenomenon of assimilation whereby the total amount of municipal waste also includes waste resulting from the production cycle and therefore not directly connected to the resident population consumptions.

In the long-term, generation of hazardous and non-hazardous waste also continues to grow increasing from 83 million tons in 2000 to





approximately 135 million in 2006. In 2006, the total quantity of hazardous and non-hazardous waste generated in Italy was equivalent to 134.7 million tons.

Of these, 125.5 million tons was non-hazardous waste (including Construction & Demolition) and 9.2 million tons was hazardous waste. Waste from C&D amounted to over 52 million tons.

Analysing results points out that in the two-year period 2005-2006 non-hazardous waste increased by 23.6% and hazardous waste increased by 16%. However, due to amendments in regulations (lifting of obligation to provide the Italian MUD environmental declaration for all producers of this type of waste) non-hazardous waste values in 2006 were estimated on the basis of specific production coefficients of the various industrial sectors. This resulted from a specific research conducted by ISPRA. Values referring to the various years of reference are therefore not fully comparable. Information on hazardous waste generation, instead, entirely derives from the MUD data bank.

In 2006, hazardous and non-hazardous waste generation *per capita* was equivalent to 1,397 kg/inhab. per year (excluding waste from construction and demolition). Of these, 1,241 kg were non-hazardous waste and 156 kg were hazardous.

The greatest share of total generation of hazardous and non-hazardous waste comes from the construction industry with around 40% of total generation. Followed by the manufacturing industry with over 37% of total generation.

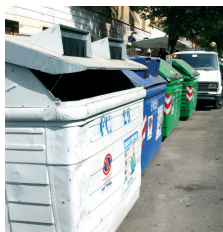
A separate analysis of the flow of non-hazardous and hazardous waste shows that the larger quantity of the former comes from the manufacturing industry (43.6 million tons, equivalent to 59.4% of total, excluding non-hazardous waste from construction and demolition).

The waste treatment industry follows with 16 million tons, 21.8% of total non-hazardous waste. The service industry, instead, produces 7.6 million tons, equivalent to 10% of total non-hazardous waste.

Similarly to non-hazardous waste, the greatest share of hazardous waste comes from the manufacturing industry (6.5 million tons, equivalent to 70.1% of total), followed by production from the

*In the long-run, special waste production continues to grow, increasing from 83 million tons in 2000 to approximately 135 million in 2006. Of these, 125.5 million tons was non-hazardous waste (including C&D) and 9.2 tons was hazardous waste.*

*40% of total hazardous and non-hazardous waste generation comes from the building industry followed by the manufacturing industry with over 37% of total generation.*



*Separate collection provides a positive response to the pressure exercised by waste on the environment. In 2007 it reached a nationwide percentage of 27.5% of total municipal waste generation. Although this value highlights a further growth with respect to the value registered in 2006 (25.8%), it still turns out to be lower than the 40% target to be achieved by 31 December, 2007.*

service industry, with approximately 1.4 million tons, equivalent to 15.1% of total.

In the manufacturing industry, the greatest share belongs to the chemical sector, with 3.1 million tons (approximately 48.3% of total), followed by the metal, alloys and metal product industries, with about 1 million tons (24.7%).

### **Management (Response)**

The new Framework Directive 2008/98/EC on waste of the European Parliament and of the Council, dated 19 November 2008 declares, under Art. 4, that waste management must be carried out in accordance with the following priorities:

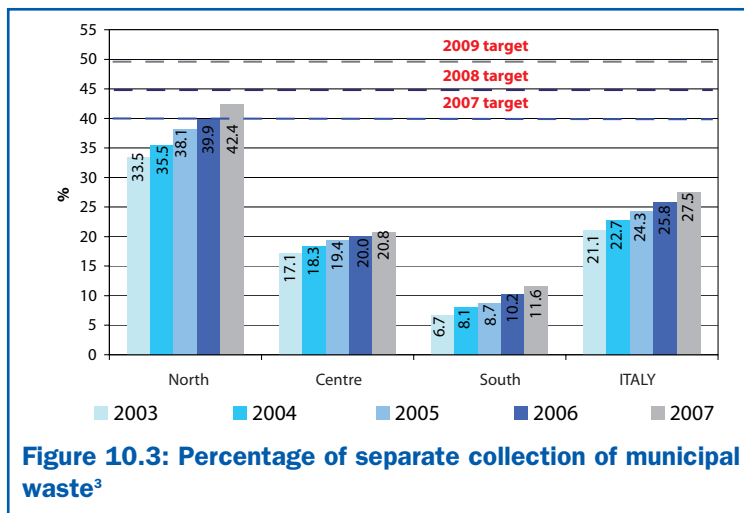
- quantity and quality prevention of waste;
- preparation for re-use of products which have become waste;
- recycling;
- other types of recovery (e.g. energy recovery);
- disposal.

Separate collection provides a positive response to the pressure exercised by waste on the environment. In 2007, it reached a nationwide percentage equivalent to 27.5% of total municipal waste generation. Although this value highlights a further growth with respect to the value registered in 2006 (25.8%), it still turns out to be lower than both the 35% *target* provided by Art. 205 of Legislative Decree 152/2006 of 31 December 2006, and the 40% *target* of 31 December 2007 introduced by Law no. 296 of 27 December, 2006.

As pointed out many times in previous editions, the situation is undoubtedly different from one macro-area to the other. As a matter of fact, while the North widely exceeds the 2007 target with a 42.4% separate collection rate, practically achieved already in 2006 (39.9%), the Centre and South (with percentages of 20.8% and 11.6% respectively) are still definitely far from this target (Figure 10.3). In absolute terms, between 2006 and 2007 separate collection at national level increased by over 580,000 tons, a lower value with respect to the 700 thousand-ton-growth recorded between 2005 and 2006. In 2007 (like the previous year), the greatest contribution to the overall waste generation



growth was shown by Northern regions (approximately +380,000 tons, equivalent to +6.5%), where the collection systems had already been established since few years.



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Among the various waste fractions, cellulose and organic ones represent, as a whole, more than 62.5% of total waste collected separately. If added to textile and wood waste, they make up the so-called biodegradable waste, for which Legislative Decree 36/2003 introduced specific landfill disposal reduction targets.

In 2007, the quantity of biodegradable waste collected with the separate collection was equivalent to over 6.3 million tons, with a percentage growth of approximately 7.5% compared to 2006. In terms of *per capita* values, the quantity of this type of waste produced is approximately 106 kg/inhab. per year, marking a growth of over 6.5 kg/ inhab. per year with respect to 2006, and of 31.5 kg/inhab. per year compared to 2003. As far as glass is concerned, in 2007 the total value of separate collection reached nearly 1.3 million tons, of which just below 93%

<sup>3</sup> Source: ISPRA



*Between 2006 and 2007, the highest percentage growth in separate collection was recorded for wood (+10.6%).*

*In 2007, Trentino Alto Adige and Veneto registered separate collection percentages of 53.4% and 51.4% respectively, reaching the target fixed for 31 December 2009 two years in advance.*

was used for packaging.

Between 2006 and 2007, the highest percentage growth in separate collection was recorded for wood, with an increase of +10.6%, corresponding to an absolute value increase of just below 62,000 tons.

The separate collection of plastic marked an increase of about 9.4% (approximately +43,000 tons), which (according to data received) was almost entirely made up of packaging waste.

In 2007, Trentino Alto Adige and Veneto regions reported separate collection percentages of over 50% (specifically 53.4% and 51.4% respectively), reaching the target fixed for 31 December, 2009 two years in advance.

This means that over half of municipal waste generated in these two regions was collected separately. This operation has a primary importance in the subsequent recovery of the various types of waste.

Remarkable progress was registered also in Piedmont (44.8%) and in Lombardy (44.5%).

In the Centre, Tuscany exceeds the threshold of 30%, with a separate collection rate of approximately 31.3%. Umbria and Marche respectively reported separate collection percentages of 25% and 21%.

Lazio's separate collection level is of approximately 12.1%. However, only Rome and Latina provinces exceed 10%, with lower separate collection rates in the other three provinces of the region (Viterbo 9.3%, Rieti 4.5%, Frosinone 4.1%).

In the Southern macro-area, Sardinia recorded a separate collection rate of 27.8%.

Following the activation of specific separate collection systems in several provinces, even at household level, between 2005 and 2007 this region marked an increase of about 18% in the collection percentage rate (in 2005 the separate collection percentage was in fact less than 10%).

In 2007, Abruzzo's separate collection rate almost reached 19% and Campania 13.5%.

However, in Campania very different situations are found according to the province. Avellino and Salerno, in fact, have separate collection percentages of over 25% (25.3% and 25.2% respectively),





Benevento reaches 15.9% while Naples and Caserta (which have problems related to persisting emergency conditions for collection and management of municipal waste) have percentages of 10.3% and 7.1% respectively.

Instead, several regions of the South (Molise, Basilicata, Apulia, Calabria and Sicily) show values lower than 10%. In 2007, Molise had a separate collection percentage of 4.8% and Sicily of 6.1%.

An analysis of municipal waste management data of 2007 shows a reduction of 2.4% in the use of landfills compared to 2006. In quantitative terms, this corresponds to a reduction of over 614,000 tons, which can mainly be attributed to the North of Italy.

A total of 16.9 million tons of waste are directed to landfills. More limited variations are found in the Centre (-1.9%), with a reduction of approximately 95,000 tons of waste. The South, however, still shows a disposal increase of over 180,000 tons of waste. This corresponds to an increase of 2.5% in waste disposed through landfills.

In 2006 the number of operating landfills was reduced by 34 units. Of these, 23 are in the South (-15 in Sicily and -5 in Calabria).

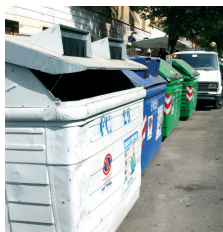
On the other hand, the landfill situation appears to be substantially stable in the Centre (-6 plants) and in the North of Italy (-5 plants).

Lombardy holds the respectable leadership for being the region with the lowest percentage of municipal waste in landfills (10% of total), recording a consistent contraction with respect to 2006 (-11%).

Excellent results, in terms of disposal reduction, have also been achieved in Friuli Venezia Giulia (which disposes 28% of waste in landfills), Veneto (29%) and Trentino Alto Adige (28%) where the rate of separate collection has reached noteworthy levels. In the South, improvements have been observed in Calabria and Sardinia, which dispose in landfills less than 60% of total waste generated in the regions (respectively 55% and 58%). Molise, Sicily and Apulia are the regions with the highest percentage of waste disposed in landfills with respect to the total amount

*In 2007, the use of landfills for municipal waste was reduced by 2.4% compared to 2006. This result is mainly visible in the North of Italy.*

*Lombardy holds the respectable leadership for being the region with the lowest percentage of municipal waste in landfills (10% of total), recording a consistent contraction with respect to 2006 (-11%).*



generated (respectively 95%, 93% and 91%).

Not too far from these values is Lazio, with approximately 2.8 million tons disposed and a percentage of 83% over total generated. In 2006, the city of Rome alone disposed 1.4 million tons in landfills, against the 2 million of the entire province. Waste is, in any case, always submitted to preliminary treatment.

As far as other management methods are concerned, incineration involves 3.9 million tons of waste.

This represents 10.3% of the waste managed in 2007, a similar result to 2006. However a reduction of these operating plants can be noticed (from 50 to 47), due to the shutdown of three incinerators located in Verona, Siena and Taranto provinces.

The ratio between the incinerated quantity and the related generation of municipal waste (12.2% in 2007) is still stable with respect to 2006 (12.1%).

The 44 operating plants equipped for energy recovery have recovered approximately 3 million MWh of electric energy and 1.1 million MWh of thermal energy.

In general, an efficient integrated management system complying with Community policies must make ample use of biological treatment.

This enables the recovery of materials from waste and is also fundamental for reaching targets on the biodegradable waste landfilling within the optimal management areas, as provided by Art. 5 of Legislative Decree no. 36/2003.

In this context, composting from selected biodegradable waste after separate collection is also essential.

This recorded a 4.8% increase with respect to the previous year. Quantities directed to anaerobic digestion plants also increased by 34.2%, going from 172,000 tons in 2006 to 231,000 tons in 2007. This is also due to the opening of new plants.

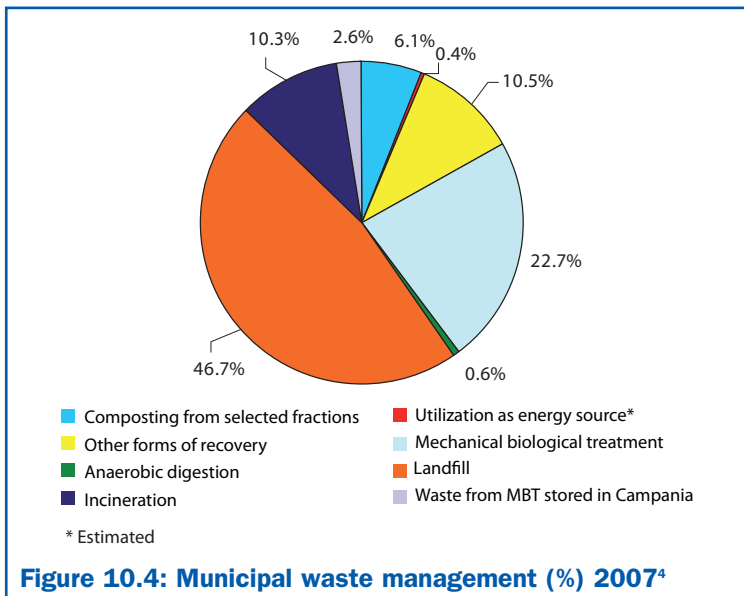
As regards mechanical biological treatment of mixed waste, quantities treated in 2007 reached 8.8 million tons, with an increase of 7.6% with respect to the previous year.

In 2007, the overall capacity (equivalent to over 14 million tons), showed an increase on a national basis of approximately 2.4 % with respect to 2006.

This development was particularly noticed in the Central regions



and in the South, where increases of 5% and 7.5% were recorded. In the Northern regions, instead, the total capacity reduced by 3.6% (Figure 10.4).



*An analysis of data related to 2007 highlights a reduction in landfill disposal (-2.4%) and an increase in mechanical biological treatment (+7.6%) and composting from selected waste (+48%).*

Over 117 million tons of hazardous and non-hazardous waste was globally managed in 2006, against a generation of over 134.7 million tons, 91.6% of which consisting of non-hazardous waste and the remaining 8.4% of hazardous waste.

When analysing the values (Figure 10.5), it is worth noting that the predominant management method for hazardous and non-hazardous waste is represented by material recovery operations, with approximately 57.7 million tons (49.3%). On the other hand, the use of landfills remains the most common disposal operation, with approximately 19 million tons (16.3% of total managed waste). The quantity of waste destined to storage amounts to a total of 13.4 million

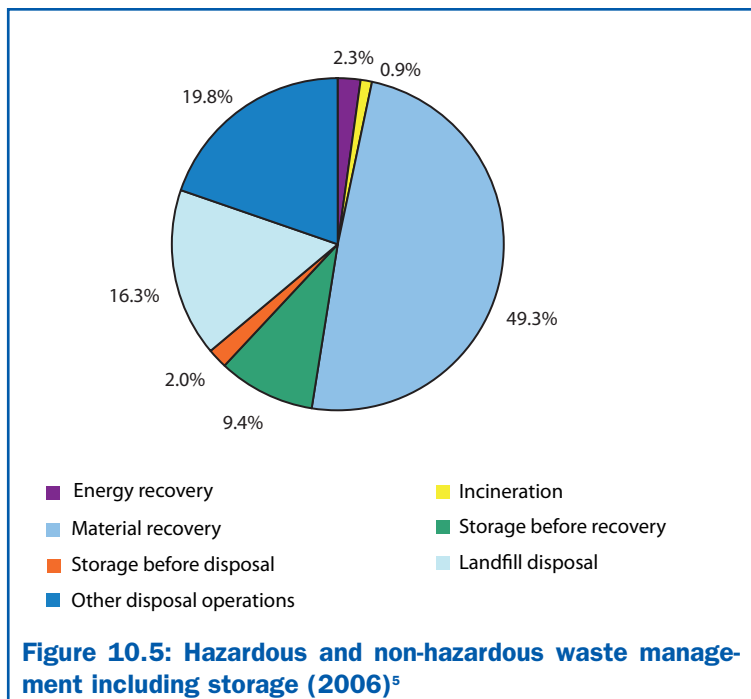
*The analysis of values, excluding the quantity destined to stockpiling, points out that recovery of material (49.3%) is the most common management method. Landfills still are the most widely used disposal method, representing 16.3% of total waste managed.*

<sup>4</sup> Source: ISPRA



tons (which are respectively 2% and 9.4% of total waste managed). This type of waste treatment is carried out by plants performing other recovery and/or disposal operations. Therefore, in these cases, there is an overestimate in the total quantity of waste managed. In general, it should be pointed out that in 2006 the amount of waste directed towards recovery operations increased by 3.3% with respect to 2005, corresponding to approximately 2.3 million tons. Such a growth can be attributed to the increase of waste destined to “recycling/recovery” operations of other inorganic materials (+4.5%), for an absolute value of 1.5 million tons. Among other disposal operations, it is worth noting that between 2005 and 2006 chemical-physical and biological treatments recorded a considerable increase (+25%), corresponding to over 4 million tons of waste treated by chemical industries.

*The total quantity of hazardous and non-hazardous waste managed in 2006 amounts to approximately 117 million tons. Of these, more than 60 are destined to recovery, over 43 to disposal activities and almost 13.4 to storage (R 13 and D15).*



**Figure 10.5: Hazardous and non-hazardous waste management including storage (2006)<sup>5</sup>**

<sup>5</sup> Source: ISPRA