

Municipal management of bio-waste in Greece: overcoming weaknesses

M. Vitoraki

Environmental Studies Program, DERE – The American College of Greece, Ag. Paraskevi, Greece, mariavitoraki@gmail.com

Keywords: waste management, bio-waste, source separation, separate collection

Abstract

In the recent years, the EU has set a very ambitious policy on bio-waste management, aiming mostly at prevention of such waste, along with the introduction of municipal management programs of source separated bio-waste. These programs greatly depend on the ability of local authorities to effectively organize integrated bio-waste management for the prevention and separate collection of bio-waste, increase the participation and capture rates, modify the waste charging system and address the issues of siting, licensing, and operation of municipal composting facilities or other treatment facilities.

So far, there are limited municipal programs dealing with bio-waste through prevention and municipal composting in Greece. Also, there is poor performance and little progress in separate collection of bio-waste, which is the main prerequisite for the production of high quality compost.

What are the main obstacles to a successful management of bio-waste at municipal level in Greece? Why most municipalities are still reluctant to introduce separate collection of bio-waste and municipal composting programs? What factors must be addressed in order to effectively promote such programs?

This paper aims to address the above questions and provide explanations for the weaknesses of the Greek municipalities in bio-waste management, along with proposals for improvement based on good examples from European municipalities that have made a significant progress in this area.

INTRODUCTION

According to the EU Waste Framework Directive 2008/98/EC, bio-waste is defined as: “biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants and other waste with similar biodegradability and compostability properties”.

On a global scale, bio-waste and other biodegradable waste are considered a major anthropogenic source of methane emissions from landfill sites. At EU level, bio-waste is about 32% by weight of the total municipal waste. Greece, on the other hand, has a *highest share* of bio-waste in the total municipal waste, accounting for about 40% by weight. The annual bio-waste generation in the EU countries is about 118 – 138 million tonnes, of which

only 25% is successfully recycled to high quality compost [1]. In Greece the annual bio-waste generation is 2.47 million tonnes, of which only 2% is composted [2].

Despite the provisions of the EU Waste Framework Directive 2008/98/EC for the promotion of prevention, separate collection and composting of bio-waste, there is moderate progress in this area, as can be seen from figure 1:

Figure 1: Bio-waste recycling as a percentage of total municipal waste generated in 2001 and 2010 [1]

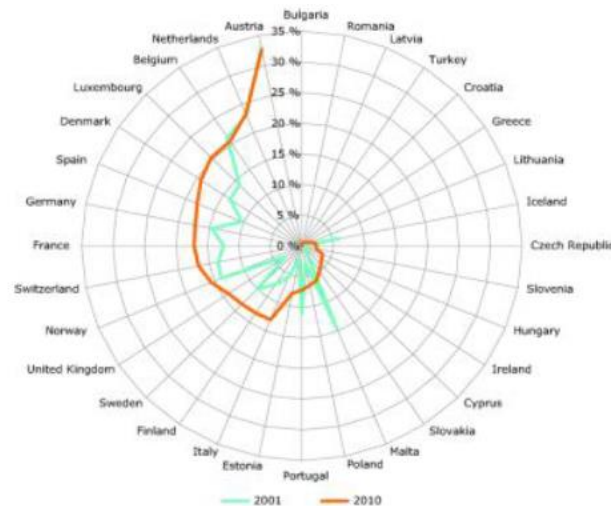


Chart 1: Bio-waste recycling in 32 European countries as a percentage of total municipal waste generated in 2001 and 2010

This is due to the absence of *EU-wide mandatory targets* for bio-waste prevention, separate collection and recycling, as well as the absence of quality standards for the produced compost.

Responding to the above challenges, the European Commission adopted a legislative proposal in 2014, to review waste related targets in the EU Waste Framework Directive 2008/98/EC.

A very significant development in this area took place recently: *the European Parliament adopted the waste legislative proposals on March 17th 2017. With regard to bio-waste, the adopted text includes the following [1]:*

- 70% target for recycling of municipal waste with a 5% of that waste to be prepared for reuse by 2030
- *Obligatory* separate collection for the main waste streams, including bio-waste
- Separate collection at source of bio-waste and introduction of European waste codes for municipal bio-waste that has been separately collected at source
- Introduction of EU's food waste reduction target of 30% by 2025 and of 50% by 2030 compared to the 2014 baseline.

Legislative framework in Greece

The Joint Ministerial Decision 50910/2727/2003 on 'measures and conditions on solid waste management - National and Regional Management Plan' in 2003, aimed to coordinate waste

management, setting specific rules and targets which should be met in waste management planning at the national and regional levels.

The Greek Law 4042/2012 on waste (article 41) sets specific targets for bio-waste management:

- Separate collection of bio-waste at least 5% by weight of the total quantities produced until 2015
- Separate collection of bio-waste, at least 10% of the total quantities produced until 2020

Further, it imposes an additional landfill fee of 35 euros/tonne of untreated bio-waste, which increases annually to a maximum fee of 60 euros per tonne of landfilled bio-waste (article 43).

The National Solid Waste Management Plan, issued by the Ministry of the Environment in June 2015 [3], describes the main strategies and policies for the management of bio-waste and provides directions for the regional and local waste management plans. The main objectives to be achieved by the year 2020 are as follows:

- Clear reduction in per capita waste generation compared to 2015 level
- Preparation of re-use and recycling of source separated materials, including bio-waste must cover 50% of the total waste generation

More specifically, with regard to bio-waste, the National Plan sets the following priorities:

- Prevention of bio-waste using informational campaigns, in combination with economic tools
- Creation of decentralized facilities for composting or anaerobic treatment of source separated bio-waste
- Maximization of source separation of bio-waste, to enhance high-quality recycling
- Separate collection of 40% of bio-waste by 2020 (page 44)

From the above, it becomes clear that in order to achieve a transition from the current unsustainable model of bio-waste management to a *resource efficient model*, there must be a revolutionary approach to reforming bio-waste management at municipal level.

METHODOLOGY

In order to draw certain conclusions for the necessary reforms which must be implemented at municipal level in Greece, to enhance a more sustainable management of bio-waste, several case studies from European and Greek cities are presented and compared.

The European cities selected for presentation have similar characteristics to the Greek case studies, in terms of demographic characteristics and waste composition.

The Example of Parma [4]

Program description

Parma, a city of 190,000 inhabitants in Northern Italy, has implemented a zero waste program, following the waste management hierarchy, to tackle waste.

In 2014, annual waste generation was as high as 636 kg of waste per capita, a rate among the highest in Europe, considering that the EU average was about 476 kg/ca.

The recycling rate was 57%, while residual waste for final disposal accounted for 274 kg per capita on a yearly basis.

In November 2012, Parma applied a curbside separate collection of dry recyclable materials covering about 48% of its total MSW. *There was not separate collection of bio-waste.*

The local government started its zero waste program by improving the separate collection of waste (including bio-waste), through door-to-door collection.

Initially the door-to-door collection of bio-waste covered the city center, but gradually it expanded to the whole city.

In 2014, after two years, all residents were covered by door-to-door collection of four waste streams: bio-waste, paper and cardboard, light packaging and glass, and residual waste. The collection frequency has been variable, depending on the population density and other parameters: in the city center the collection frequency is higher than in suburbs (three times a week for bio-waste and residual waste).

In late 2015, a major change in the overall waste management system was the introduction of a pay-as-you-throw (PAYT) scheme: the waste fee of every household depends on the amount of residual waste generated.

The fee for every household has two components: a flat rate based on the number of household members and the square meters of the household, and a variable charge that depends on residual waste generation.

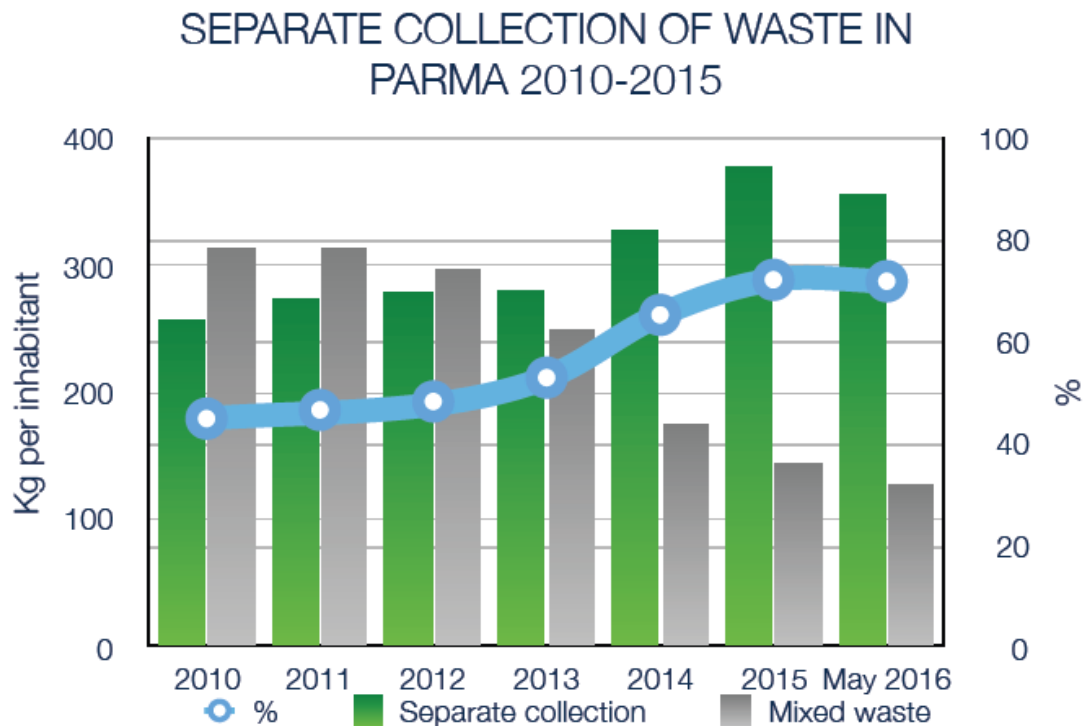
The flat rate covers a minimum number of collections of residual waste per household and fixed costs of waste collection service. Additional removals are charged (€0.7 per bag, €1.4 per bucket and €4.2 per wheeled bin). In terms of economic incentives, households get a 12% reduction in their fee if they do home composting.

As a result, *the collection of residual waste has significantly dropped so that at every collection, only 25% of inhabitants take out their residual waste bin to be emptied.*

Results

The results of Parma are remarkable. In 4 years waste generation has been reduced by 15% and separate collection has increased significantly from 48% in 2011 to 72% in 2015, along with a great reduction in residual waste.

Table 1: Separate collection of waste in Parma , 2010 – 2015 [4]



Source: Zero Waste Europe

The Example of Ljubljana [5,6]

Program Description

Ljubljana, the city capital of Slovenia, along with nine surrounding municipalities, hold a population of 380, 287 inhabitants. In 2016 Ljubljana was declared the European Green Capital, thanks to its overall sustainability performance.

In a time period of twelve years (2002 – 2014) , Ljubljana has achieved a remarkable 59% reduction of residual waste for disposal.

According to 2014 data, Ljubljana achieved a *60% separate collection rate (190 kg/cap out of 320kg/cap)*. More specifically for bio-waste, the rate of separate collection was 22.8%, while the households covered by door- to- door separate collection were 82% [5].

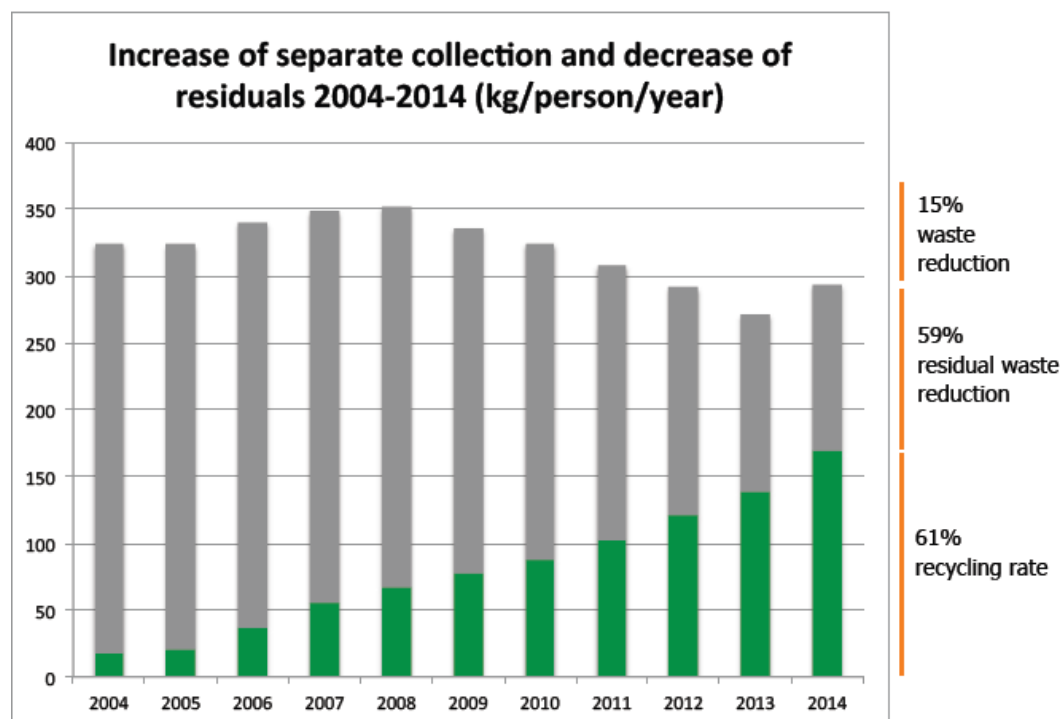
The evolution of the waste management system followed a stepwise process:

- In 2002 there was a curbside collection of paper, cardboard, other packaging waste and residual waste
- In 2006 the door - to - door collection of source separated bio-waste was introduced
- In 2012, the first pilot PAYT scheme was implemented in Brezovica with remarkable results: residual waste decreased by 29% in only three months.
- In 2013 the company reduced the collection frequency for residual waste and sustained the same frequency for bio-waste and dry recyclables.
- In 2014 the municipality adopted the zero waste strategy

A key factor for success was the introduction of door-to-door collection, of bio-waste (kitchen and garden waste), which has greatly contributed to the rapid increase

in recycling rates. As separate collection increased, the amount of residual waste constantly declined. Another important success factor was the well designed and implemented informational campaign.

Table 2: Separate collection of waste in Ljubljana, 2004 - 2014 [6]



Source: Zero Waste Europe

Municipal Programs for source separation and separate collection of bio-waste in Greece.

Various municipal programs on separate bio-waste collection are currently running in Greece. Most recently, a pilot program has been introduced in *the municipality of Kozani*.

According to information provided by DIADYMA S.A., the company that deals with waste management in the region of Western Macedonia, the program covers on average 300 households, 250 from the municipality of Kozani and 50 from the municipality of Voios. The separate collection is accomplished through roadside bins and is treated in mechanical composters. The program started in November 2016 and is expected to be completed by November 2017. It is financed by the Region of Western Macedonia.

By May 2017, 9.5 tonnes of bio-waste have been collected in the municipality of Kozani. *The impurities traced – mostly plastic bags - are as high as 7% by weight.* An interim progress report is expected by the end of May, 2017.

The examples of the municipalities of Athens and Kifissia [7, 8]

A pilot program on bio-waste management has been implemented in the municipalities of Athens and Kifissia, in the time period 2011 – 2014. This was a co-funded European project Life-Environment entitled “Integrated management of bio-waste in Greece – The case study of Athens”, known with the acronym “ATHENS-BIOWASTE” which aimed at establishing a separate bio-waste collection scheme in the Municipalities of Athens and Kifissia and producing high quality compost.

The municipality of Athens, the largest in Greece, holds a population of 664.046 inhabitants, covering an area of 38.96 km². Its population density is approximately 168.30 inh/ha.

The Municipality of Kifissia is located NE of Athens and has a population of 70,600 inhabitants. It covers an area of 35,1 km² and has a population density 20,25 inh/ha.[8]

Throughout this program 557.5 tonnes of bio-waste were separately collected through curbside collection (in Athens) and door – to - door collection in Kifissia. The collected material was processed in the Mechanical Biological Treatment (MBT) facility of Attica region, located in Ano Liosia, through a separate composting channel, producing approximately 130 tonnes of high quality compost [7, 8] .

It has been estimated that the investment cost for establishing a separate collection system accounts for 10€ per inhabitant, excluding the cost for new vehicles [8].

Operational cost is directly linked with the type of the collection scheme applied in the area, the participation rate and the collection frequency. Increasing the participation rate from 25% to 64%, the operational cost per tonne of bio-waste was reduced approximately by 50%, while by doubling the collection frequency, the operational cost increased by 40 to 60% [8].

As a result of this program, *detailed guidelines were prepared in order to assist Municipalities in establishing separate collection schemes for bio-waste.*

Program Description

The municipality of Kifissia

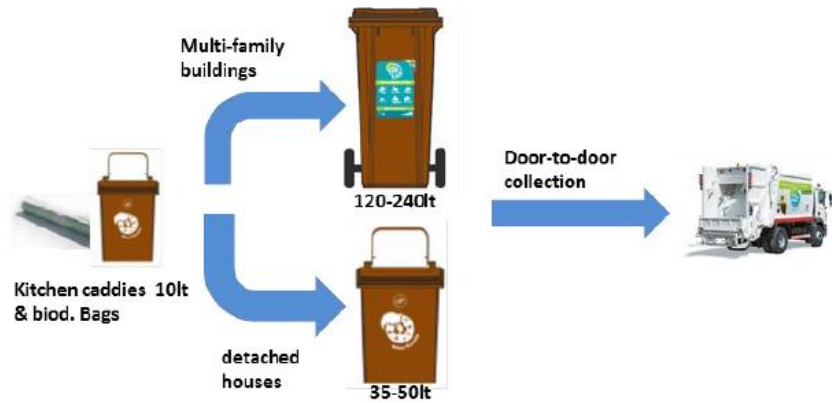
The separate collection of bio-waste started in December 2012 and continued until August 2014 (21 months in total). The areas which participated in the scheme were Nea Kifissia, Kato Kifissia, Ekali and Kastri and later Strofyli and Kefalari.

The total population covered by the program was 5726 inhabitants [8].

The program was implemented in three stages:

- Informational campaign
- Door-to-door collection of source separated bio-waste
- Assessment of the quality of the collected bio-waste and the quality of the produced compost

Separate collection of bio-waste in Kifissia [7]



The collection frequency was 2-3 times per week in all areas. One existing vehicle was used and 3 employees (1 driver and 2 collection employees) were occupied on a daily basis in order to cover all areas. The collected bio-waste was transferred every day or every second day to the MBT plant for composting.

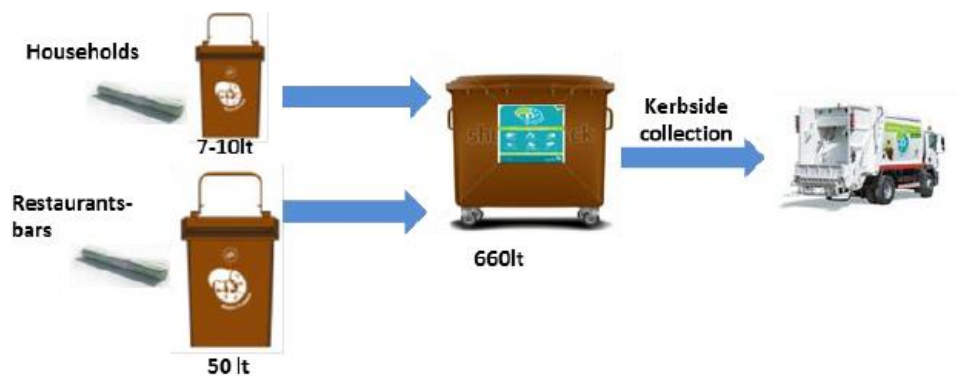
The municipality of Athens

The bio-waste separate collection started in April 2013 and continued until August 2014 (17 months in total). The areas covered by the scheme were Gazi and Kypriadou. It is important to notice that in the area of Gazi, located in the city center, 80 restaurants and bars were covered. These are considered important contributors to bio-waste generation.

The total population covered by the program was 4154 [8]

The collection frequency was 2-3 times per week and the collected material was driven to the MBT plant for composting.

Separate collection of bio-waste in the municipality of Athens [7]



The results, for both areas, are summarized in table 3.

Table 3. Results of separate collection of bio-waste in the municipalities of Athens and Kifissia

	Bio-waste collected (tonnes)	population covered	Program duration (months)	Total Biowaste generation of the participating population in the time period of program implementation (tonnes)	% Capture rate (and in Kg/ca/year)
Municipality of Kifissia	193.240	5726	21	2004.5	9.64 (19.3)
Municipality of Athens	186.030	4154	17	1177.2	15.8 (31.6)

The total amount of bio-waste generation by the participating population was estimated taking into account the per capita bio-waste generation in Greece (200 kg/year or 16.67 kg/month), the total population that participated in the program and the duration of the program. As a result, the total amount of bio-waste generated equals to the total population covered by the program multiplied by the per capita bio-waste generation throughout the program duration.

As can be seen from the above table, the highest capture rate was observed in the municipality of Athens.

The quality of the collected bio-waste was assessed through laboratory analysis of batch samples from both areas. According to the results of laboratory analysis [7], the maximum percentage of impurities traced was 11% by weight in the municipality of Athens and 15% by weight in the municipality of Kifissia. The average level of impurities was 8.5% by weight in the municipality of Athens and 10.2% by weight in the municipality of Kifissia [8].

The produced compost fulfilled EU quality standards and proved to be a *good quality marketable product*. The quality of compost of non-separated bio-waste treated in the MBT is much poorer, failing to conform to the EU standards [8]

DISCUSSION AND CONCLUSIONS

The main conclusions drawn from the above case studies are as follows:

- Source separation and separate collection of bio-waste is a prerequisite in order to achieve good quality, low percentage of impurities and therefore a high quality compost after processing
- A well organised informational campaign and program promotion can boost the participation rate and the capture rate. The informational campaign *should be continued throughout the program implementation* through regular public meetings, frequent update of electronically available data concerning the program and informational material distributed door-to-door.

- The capture of bio-waste per participating inhabitant is very low in both Athens and Kifissia, compared to European data. In Athens, the capture rate was 15.8% or 31.6 Kg per capita/year, and in Kifissia 9.64% or 19.3 Kg per capita/year. For comparison purposes we have to consider that in Italy, the reported per capita capture is much higher accounting for 78 – 122 Kg/year [9]. Also considering the quality of the collected bio-waste, the performance in Athens and Kifissia is rather poor. According to the results of laboratory testing, impurities in Athens were found on average 8.5% by weight and in Kifissia even higher, 10.2% by weight. For comparison purposes we take into account that in Italy, impurities have been traced at a level of less than 1-2% by weight [9]
- In the examined case study of Kifissia, door-to-door collection has not increased the capture rate, as in other European case studies. This could be achieved if the program involved the introduction of a *pay-as-you throw charging scheme* [10]. Also, the higher capture rate in Athens could result from the contribution of restaurants and bars in the area (these are large contributors to waste generation).
- Using the experience gained from pilot programs, it is much easier for the municipalities to expand gradually the separate collection program. In the above case studies of Athens and Kifissia, the program has not expanded yet, due to financial limitations and lack of the required technical equipment. However, the case studies of Ljubljana and Parma demonstrate that a *shift towards a pay-as-you throw charging scheme* could be the solution to this problem. *The cost of bio-waste collection could be fully covered by imposing a residual waste dependent fee, while at the same time the collection frequency of residual waste is reduced.*
- Bio-waste must be collected at least twice or three times a week – especially in city center, whereas at the same time, the collection frequency of residual waste must drop significantly to about once or maximum twice a week. *This will be an additional incentive for residents to participate in the bio-waste separate collection program.*

Overall, the Greek municipalities have to move very fast in order to implement the necessary reforms and comply with the legislative requirements, especially with regard to bio-waste. This is a challenging task, but the only sustainable solution.

References

Interreg Europe – Policy Learning Platform – Environment and Resource Efficiency (2017): *Sustainable management of bio-waste: Regional cooperation for improved bio-waste management, Policy brief*

European Environment Agency – European Topic Centre on Waste and Materials in a Green Economy (2016): *Municipal Waste Management – Country fact sheet - Greece*

Greek Ministry of Environment, Energy and Climate Change (September 2015): *National Waste Management plan*

Zero Waste Europe (2016): *The story of Parma*

European Commission – DG ENV (2015): *Assessment of separate collection schemes in the 28 capitals of the EU – Final Report*

Zero Waste Europe (2015): *The story of Ljubljana*

Moustakas, K., Malamis, D., Bourka, A., Venetis, C., Skiadi, O., Giannaki, S., Xipolitas, V., Loizidou, M., (2013): *Development & application of separate collection and management scheme for biowaste in Greece; the cases of Athens and Kifissia, ISWA conference proceedings.*

LIFE 10 ENV/GR/000605 (2015): *Final report on Athens – Biowaste project.*

Favoino, E., (2003): *Source segregation of biowaste in Italy, ECN/ORBIT e.V. Source Separation Workshop 2003*

Morlok, J., Schoenberger, H., Styles, D., Galvez – Martos, J., Zeschmar –Lahl, B., (2017): *The Impact of Pay-As-You-Throw Schemes on Municipal Solid Waste Management: The Exemplar Case of the County of Aschaffenburg Germany, Resources* 2017, 6(1), 8; doi:[10.3390/resources6010008](https://doi.org/10.3390/resources6010008)