Implemention of bio-waste separation at source in Athens and Kifissia.

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Abstract

The ATHENS BIOWASTE project aims at the pilot separate collection of biowaste in selected areas of the Municipalities of Athens and Kifissia as case study areas. The project is funded by LIFE+, the European financial instrument for the Environment and will be implemented from Autumn 2012 in two areas of Municipality of Athens (Kypriadou and Gazi) and two specific points (Officers Club of Ministry of Defense and Agricultural University of Athens) and four areas of Municipality of Kifissia (Kato Kifissia, Nea Kifissia, Ekali & Kastri) aiming to be the pilot for many Greek authorities to update their waste collection and implement a contemporary bio-waste management system. More than 6,500 inhabitants from both Municipalities will participate in the project. Bio-waste will be collected separately in the dedicated for the project bins and will be treated in the Mechanical Biological Treatment Plant of EDSNA in order to produce high quality compost.

Keywords: separation at source, biowaste, compost, Athens, Kifissia.

1. INTRODUCTION

Sustainable waste management is an important objective for all European and Mediterranean countries, the key to which is the separation of biowaste at source. The revised framework directive on waste (2008/98/EC) contains specific provisions for the management of biowaste, including the promotion of bio-waste separation at source. Moreover, according to recent studies at European level, the separation of biowaste at source is considered a prerequisite for ensuring efficient allocation and utilization of the produced compost market. Apart from the diversion of the organic fraction of municipal solid waste from the landfills, (compliance with EU Directive 1999/31/EC on landfill), separation of biowaste at source improves the calorific value of the remaining municipal solid waste and creates a cleaner stream of biowaste, allowing the production of high quality compost. In recent years, there has been a significant increase in separation at source programs of biowaste in many regions of the European Union and it is regarded as a successful option for waste management.

1.1. Kerbside collection and waste treatment in Greece

In many municipalities of Greece, municipal solid waste is collected in two kerbside collection streams: packaging waste collected by local authorities in cooperation with the Greek Recovery & Recycling Corporation (HERRCO) which ends up in Material Recovery Facilities (MRF) and the remaining residual waste, also collected by local authorities, ends
up in landfills or Mechanical Biological Treatment (MBT) Plants. In Athens, there is one MBT plant in Ano Liossia, treating approximately 20% of the total waste generated in the area, producing RDF (waste derived secondary fuel) and low-quality compost.

1.2. Necessity for an integrated biowaste management

The biowaste is on average 32% w/w in the EU, while in the case of Greece the same percentage composition is about 40% w/w. Currently, apart from some home composting initiatives, municipal biowaste is directed to the landfills. The Regional Solid Waste Management Plan of Attica and the action plan of the Association of Municipalities and Communities of Attica (ESDKNA) provide the construction of three new composting facilities in the greater Athens area (Fyl, Grammatiko and Keratea), which will treat pre-sorted organic waste. Therefore, the separation of biowaste at source is essential.

From the environmental perspective, the importance of integrated management of biowaste, with the integration of separation systems, lies in diverting them from landfills and in their exploitation. During the deposition of this waste streams in landfills, conditions of anaerobic biodegradation occur, with consequent emission of significant quantities of biogas and production of leachate heavy in organic and inorganic load. This process takes place for several years after disposal. The major problem regarding the burial of bio-waste is the emission of biogas with high methane content, one of the chemically active gases contributing to climate change. It is worth noting, that the estimated quantities of anthropogenic methane emitted globally from the disposal of bio-waste in landfills, amounts to 11% for the year 2010. Therefore, diverting them from landfills can contribute significantly to reducing the impact on climate change. Besides air pollution by landfilling, solid’s waste content in organic matter and nutrients is no longer available for recycling and reuse. In addition, the life span of landfills is shortened and the need for new landfills is created.

1.3. Legislation regarding biowaste management

Newly issued Law 4042/2012 “Framework for the production and the treatment of waste - Transposition into national law of Directive 2008/98/EC”, defines that until 2015, the percentage of biowaste separate collection must ascend at least up to 5% of biowaste total amount by weight and until 2020 up to 10% of biowaste total amount by weight. Furthermore, starting 2014, everyone who sends untreated waste to landfills, will have to pay an additional gate fee of 35 €/tn, which will increase annually by 5 € with a maximum fee of 60 €.

2. THE ATHENS BIOWASTE PROJECT

For Greece the implementation of these strategies on a national level will count as an innovation. A first step to test their implementation is the current project “Integrated management of bio-waste in Greece: The case studies of Athens & Kifissia” with short title “ATHENS BIOWASTE”. ATHENS-BIOWASTE (LIFE10/ENV/GR/000605) is a co-financed project by the European financial instrument for the Environment (LIFE+). The project is implemented in Athens, Greece and has a total duration of thirty six months (start: 1.9.2011, end: 31.8.2014).

Beneficiaries

- National Technical University of Athens (NTUA), Unit of Environmental Science and Technology, School of Chemical Engineering: Project coordinator.
- Association of Municipalities in the Attica Region (EDSNA): EDSNA is the Solid Waste Management Authority for all the municipalities in the Attica Region.
EPTA SA – Environmental Engineers – Consultants: EPTA, as a company specialized in waste management is the technical consultant of the project.

Municipality of Athens (MoA): The City of Athens is the capital city and most populous municipality in Greece with 789,000 inhabitants and an area of 3,895 ha.

Municipality of Kifissia (MoK): The Municipality of Kifissia is located north of Athens with a population of 64,000 inhabitants and an area of 3,510 ha.

2.1. Aim

The ATHENS BIOWASTE project aims at the pilot separate collection of biowaste in selected areas of the Municipalities of Athens and Kifissia and their processing in the Mechanical Biological Treatment Plant of EDSNA in order to produce high quality compost. Furthermore, by developing appropriate software tools, it will identify the benefits of sustainable biowaste managing methods on emissions of greenhouse gases (contribution to climate change), while an assessment will be carried out on the quality of compost produced. A practical guide for bio-waste management targeting local authorities will be created. The market for compost and awareness of the public, the responsible authorities and other stakeholders regarding the management of biowaste will be promoted. In addition, proposals will be drafted to amend the existing specifications and legislation for waste management.

2.2. The actions

For the successful implementation of the project ten interconnected actions are foreseen, as shown in Table 1. This paper deals with the characteristics of these Actions and their activities.

Table 1. Actions of ATHENS-BIOWASTE project

<table>
<thead>
<tr>
<th>Action No.</th>
<th>Title</th>
<th>Duration</th>
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<tbody>
<tr>
<td>1</td>
<td>Project Management and Reporting to the EC</td>
<td>36 months</td>
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<tr>
<td>2</td>
<td>Planning of a separate collection pilot system in the region of Athens</td>
<td>12 months</td>
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<tr>
<td>3</td>
<td>Implementation of the separate collection program in the selected areas</td>
<td>13 months</td>
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<td>4</td>
<td>Composting of the collected material and analysis of the final product</td>
<td>17 months</td>
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<td>5</td>
<td>Bio-waste management software tool</td>
<td>11 months</td>
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<td>6</td>
<td>National bio-waste plan and recommendations</td>
<td>7 months</td>
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<td>7</td>
<td>Dissemination</td>
<td>36 months</td>
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<td>8</td>
<td>Monitoring &amp; Evaluation</td>
<td>36 months</td>
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<tr>
<td>9</td>
<td>After Life Communication Plan</td>
<td>2 months</td>
</tr>
<tr>
<td>10</td>
<td>Networking with other projects</td>
<td>36 months</td>
</tr>
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2.3. **ACTION 2: Planning of a separate collection pilot system in the region of Athens**

*Review and evaluation of the bio-waste source separation methods and programs in the EU and especially in the Mediterranean EU countries.*

Review and evaluation of the existing bio-waste management practices in the EU has been compiled providing information about (a) the different source separation methods that can be applied for biowaste (door-to-door collection, kerbside collection etc.), (b) the equipment required for the source separation of waste (i.e. bins and vehicles), (c) the main parameters that need to be considered for the effective design of a source separation scheme and (d) the public awareness information in regard to source separation. Additionally, biowaste source separation practices in selected EU countries and EU regions have been examined.

Furthermore, a site visit took place on the 12th and 13th of December 2011 in Milan (Italy), a city of 1.3 million inhabitants that has common characteristics with Athens Municipality and Kifissia Municipality. Milan has already achieved high collection at source rates for recyclable materials and organic waste (around 65%).

*Identification and description of case study areas in the municipalities of Athens and Kifissia.*

The aim of this activity was to identify and evaluate the pilot areas, where the separate collection of biowaste will take place. The Activity is divided in three phases:

**Phase A: Main Characteristics of the Municipalities and Preparation of Digital Maps**

At the first phase, a profile of the two participating Municipalities has been created, so as to facilitate discussions and further analysis.

More specifically, the Municipality of Athens is the largest city in Greece with a population of 655,780 inhabitants, covers an area of 3.896 ha and has an average population density 168 inh/ha. The main characteristics of Athens are its high population density, its high variety on living standards (very high and very low cost areas) and the abundance of multi-family building arrangements.

The Municipality of Kifissia is located NE of Athens, has a population of 71,100 inhabitants, covers an area of 3.510 ha, while its population density is 20 inh/ha. The Municipality has been formed under the Law 3852/2010 (Kallikratis) by the former Municipalities of Kifissia, Ekali and N. Erythraia. Main characteristic of Kifissia is the high living standard and the detached houses.

In order to filter these areas and conclude to a smaller area of 3.000 inhabitants, required for the pilot system, digital maps have been prepared with the use of GIS (Geographical Information Systems).

**Phase B: Development and Application of Criteria for the Selection of the Pilot Areas**

The second phase included the development of certain criteria for their application in the framework of the GIS model. Each Municipality decided on the criteria to be applied taking into account the following:

- Each Municipality had to select an area with a population of 3.000 inhabitants
- The areas to be selected in Athens and Kifissia had to be significantly different in order to allow evaluation on how these characteristics influence the implementation of the biowaste source separation scheme.

*Municipality of Athens*

After the application of the aforementioned criteria with the use of the GIS model, two neighborhoods were selected:
**Kypriadou** - a high density residential area representative of the municipality with average population density and an average living standard.

**Gazi** – a low density area with many restaurants and other catering facilities with high production of biowaste.

Regarding the case study areas that have already been presented above, two more specific points have been added in the pilot scheme: 1. Ministry of Defense - the Club (restaurant) of Officers located at Vasilisis Sofias in the center of Athens and 2. Agricultural University of Athens located in Votanikos area, near the centre of Athens (food waste from its restaurant and part of its green waste).

**Municipality of Kifissia**

For Kifissia, it was agreed that at least one area will be selected from the former municipalities, i.e. Kifissia, Ekali and Erythraia. In addition, among these areas, one area at least should have a very low building co-efficient (≈0.4) so as to test a door-to-door collection system and one with a mixed housing system and a relevant high living standard.

After the application of the aforementioned criteria with the use of the GIS model, four neighborhoods were selected:

- Kato Kifissia & Nea Kifissia are medium density areas with flats and detached houses,
- Kato Ekali is a low density residential area with big houses with yard and
- Kastri combines characteristics from Kato Kifissia, Nea Kifissia and Kato Ekali and is considered to be a relative low density residential area. It must be noted that only part of the neighborhoods was selected, in order to avoid a very large number of population.

**Phase C: Description and Analysis of the Pilot Areas**

The third phase included the detailed analysis of the pilot areas in terms of:

- Determination of the pilot area border by applying the GIS model to the selected neighborhoods and assessing the detailed population number
- Recording street addresses and numbers
- Identification of other facilities (schools, supermarkets, etc.) covered by the areas
- Aerial photos of the areas
- Site visits
- Registration of existing infrastructures and bins

**Selection and planning of separate collection method for the case study areas**

The aim of this activity was to select and plan the separate collection system in the pilot areas. More specifically, the current activity included the following four phases:

**Phase A: Consultation on the separate collection method to be applied in each pilot area**

Following several meetings that took place among the project beneficiaries, in order to decide on the separate collection methods to be applied in each area, it was decided that the MoA will implement a collection with road containers/bins, while the Municipality of Kifissia will promote door to door collection, wherever possible, in combination with collection with road containers/bins. The aforementioned methods for the Municipality of Athens and the Municipality of Kifissia are illustrated below (Figure 1).

The collection and transport of biowaste to the recycling plant of EDSNA in Ano Liosia will take place with the existing collection vehicles of the Municipalities. More specifically, one vehicle will be dedicated for the collection of biowaste and an online fleet management system will be placed and operated in the vehicles, so as to allow monitoring of biowaste collection.
**Figure 1.** Illustration of the proposed separate collection method for each Municipality.

### Phase B: Household Database and Estimation of the required bins (quantity)

This phase included the estimation of the required bins in the selected areas through the estimation of the number of households that will participate in the collection scheme. According to this analysis, the number of households per area was estimated as following:

- **Selected Areas in Athens:** 2,084 households which correspond to a population of 3,500-4,500 inhabitants. The pilot collection areas in Athens include also around 70 businesses (restaurants, bars, etc.) that produce food waste material.
- **Selected Areas in Kifissia:** 1,743 households which correspond to a population of 3,000-4,000 inhabitants

### Phase C: Detailed Specifications of Required Equipment and Consumables

This phase included the market research on the available types of bins, biodegradable bags and fleet management system according to the needs and special features of each Municipality. Especially, for the Gazi area the project team contacted a detailed research in the area about the type and size of bins that would be convenient for the restaurants and bars to be placed within their food preparing areas. Relevant informative material was distributed. In addition, the product prices were estimated based on different offers from suppliers, in order to prepare the tender budget.

It must be noted that specifications for bins as well as for the biodegradable bags are not available in Greece, as this is the first time that separate collection of biowaste takes place. For this reason, this task required great effort from all project beneficiaries to combine European experience in this field, the product availability in the Greek market with the special requirements of each pilot area.

### Phase D: Tendering Procedures

This phase includes the preparation of the tender documents for the equipment/consumables required - bins, biodegradable bags and the Online Fleet Management. All of the aforementioned equipment/consumables will have the LIFE logo stamped or printed (Figure 2).

**Figure 2.** The ATHENS-BIOWASTE project logo.
Planning of the awareness campaign

The aim of this activity was the preparation of the biowaste scheme awareness campaign, targeting directly in the citizens and professionals of the selected areas. It includes three basic phases:

1. Awareness Phase before the start-date of the pilot scheme: In Autumn 2012 a letter has been sent via post or door-to-door service, by each Mayor/Vice Mayor to all the participating households, accompanied with an Informational Leaflet for Biowaste Collection at Source.

2. Awareness Phase at the start-date of the pilot scheme: In Autumn 2012, the citizens were approached door-to-door and provided with the kitchen caddies, the biodegradable bags and one-page instructions on how to start collection at source. In addition, a dedicated telephone help line and a separate email address for information and enquiries by the citizens have been created by each Municipality.

3. Awareness Phase during the implementation of the pilot scheme: In order to remind the citizens about biowaste collection and promoting higher collection rates each Municipality organizes its own events. All events take place inside the pilot areas.

Furthermore, a press conference of MoA together with MoK, one or several information days in each pilot area and animation workshops in schools of the area dedicated to composting are planned.

2.4. ACTION 3: Implementation of the separate collection program in the selected areas
- Implementation of the awareness campaign by the involvement of citizens in the pilot areas
- Implementation of separation at source by the distribution of biowaste collection bins in the pilot areas. Recovery of 720 tn of biowaste
- Laboratory analysis of collected samples (e.g. waste composition, moisture content) in order to evaluate the success of the separation.

2.5. ACTION 4: Composting of the collected material and analysis of the final product

The aim of this action is to process the collected biowaste using the composting unit of the Mechanical and Biological Treatment Plant (EMAK) of EDSNA, in order to produce high quality compost. Furthermore, in order to evaluate the final product, a series of laboratory tests to characterise quality of the produced compost (containing impurities, pH, heavy metals, pathogens) will be carried out and appropriate software will be developed to correlate the quality of compost to the collection and processing of biowaste.

2.6. ACTION 5: Bio-waste management software tool

The aim of action 5 is the development, verification and validation of appropriate software to calculate the carbon footprint of the collection at source and treatment of biowaste (quantification of environmental impacts based on life cycle analysis).

2.7. ACTION 6: National bio-waste plan and recommendations

The goal of the 6th action is to summarize the results of all previous actions in order to create a guide for local authorities on sustainable management of biowaste through
separation at source. Moreover, the sixth action plan includes the compilation of proposals to revise / modify the existing technical standards and regulations of the current Greek legislation dating from 1997 (JMD 114218/1997 Set up of standards framework and general solid waste management programs).

2.8. ACTION 7: Dissemination

The ATHENS-BIOWASTE working team has given emphasis on this Action which includes Project Website Notice Boards, Publication of Prospectus, Information Campaign, Participation in conferences, Layman’s Report Organization of Final Conference, since the high dissemination impact is a necessary precondition for the success of the ATHENS-BIOWASTE activities.

With regard to dissemination activities the main achievements include:

(1) the project webpage available at www.biowaste.gr, which provides information in greek and english about biowaste management in general and the project in particular. Especially, citizens and professionals of the pilot areas, will find it easy to obtain information about the exact borders of the selected areas, the separate collection system that will be implemented and the ways with which they can communicate with the respective municipality if they need more detailed information.

(2) information desk in each of the participating Municipalities,

(3) the 1st Newsletter (GR),

(4) two Notice Boards (GR), one for each Municipality,

(5) one press conference on 9th November 2011,

(6) a large number of press releases in numerous national newspapers, local newspapers, news websites, etc (available at: http://www.biowaste.gr/site/news/anafores-tupos/?lang=en#more-52)

(7) TV coverage at national level and radio coverage,

(8) presentations of the ATHENS-BIOWASTE project in two events, participation of the working team in the ATHENS 2012 International Conference on Sustainable Solid Waste Management and the Steering Committee Meeting.

(9) two LIFE 20-year anniversary events addressing thousands of inhabitants and generally citizens within the Attica Region:

1. Kifissia Flower Show, 26th April – 13th May 2012. MoK developed a kiosk in order to promote and inform about the ATHENS-BIOWASTE project and LIFE in general.

2. The Acropolis Half Marathon 2012 – Athens Run 2012, Athens, Sunday 20th May 2012 was organized by the working team of MoA.

(10) a Facebook account in order to support the ATHENS-BIOWASTE activities (http://www.facebook.com/athensbiowaste).

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