LIFE Project Number

LIFE12 ENV/GR/000427

FINAL Report

Covering the project activities from 01/07/2013 to 30/06/2016

Reporting Date

30/09/2016

LIFE+ PROJECT NAME or Acronym

LIFE RECLAIM

Project Data

Project location	Greece
Project start date:	01/07/2013
Project end date:	30/06/2016 **Extension date: -**
Total Project duration (in months)	36 months
Total budget	€ 1,377,004.00
Total eligible budget	€ 1,299,563.71
EU contribution:	€ 615,521.00
(%) of total costs	47.4%
(%) of eligible costs	47.4%

Beneficiary Data

Name Beneficiary	ENVECO S.A.
Contact person	Mrs Zoi Gaitanarou
Postal address	1 Perikleous Str, Marousi, 15122, Athens, Greece
Visit address	1 Perikleous Str, Marousi, 15122, Athens, Greece
Telephone	+30 2106141357, -369
Fax:	+30 2106148149
E-mail	zgaitanarou@enveco.gr; life@reclaim.gr
Project Website	www.reclaim.gr

List of contents

List of key-words and abbreviations

CB: Coordinating Beneficiary
CP: Common Provisions
DU: Demonstration Unit
EU: European Union
FR: Final Report
IncR: Inception Report
LF: Landfill
LFM: Landfill Mining
LMET: Laboratory of Mining and Environmental Technology
LMiPr: Laboratory of Mineral Processing
MoP: Municipality of Polygyros
MSW: Municipal Solid Waste
MTR: Mid-term Report
NAP: National Action Plan
NTUA: National Technical University of Athens
PC: Project Coordinator
PCB: Printed Circuit Boards
PL: Polygyros Landfill
SEA: Strategic Environmental Assessment
SMME: School of Mining and Metallurgical Engineering
TMO: Technical Monitor
WEEE: Waste of Electrical and Electronic Equipment

1. Executive Summary

The present report is the Final report of the project entitled "Landfill mining pilot application for recovery of invaluable metals, materials, land and energy (acronym: reclaim)" (reference code: LIFE12 ENV/GR/000427), which was implemented within the framework of the LIFE+12 call. The project started in July 2013 and was completed in June 2016 (total duration of 36 months). The total project budget is €1,377,004 of which €688,501 (50% of total eligible budget) is funded by the EU.

The consortium of the project consisted of: (1) two private companies – ENVECO S.A. and HELECTOR, (2) one governmental body – the Municipality of Polygyros (MoP) in the Region of Central Macedonia, Greece and (3) one University body – the School of Mining and Metallurgical Engineering (SMME) of the National Technical School of Athens (NTUA).

The project aimed at building a temporary pilot application on productive scale in order to mine parts of existing landfills, separate useful materials and produce marketable products, introducing innovation elements from the mining industry, suggesting a new concept of waste valorisation. It also assessed the viability of the proposed method, as well as provided a scientific evaluation on the potential alternatives of the management of waste disposal sites.

The basic objective was to introduce Landfill Mining (LFM) as a complementary approach of management of past Landfill (LF) (controlled or uncontrolled) sites and create a useful tool for the recovery of:

- Useful materials, especially ferrous and non-ferrous metals,
- Space, which equals to extra landfill capacity and lifetime in cases of expansion,
- Soil material, which has been disposed off along with the waste and which is a natural resource valuable to local ecosystems as well as to landfill industry itself,
- Recyclable materials, like plastic and paper products, which can be either post-processed in a suitable recycling plant or burned in modern incinerators,
- Land, in the case of old landfills, which will lead to a successful rehabilitation scheme with minimal environmental footprint which can be easily adapted to different waste compositions and site conditions.

At the same time the Project objectives included the familiarisation of the public with the issue of waste post-disposal processing and the potential of the procedure for metal recovery and site rehabilitation, resulting in a cleaner environment and rational management of controlled or uncontrolled landfills (focusing on old ones).

The abovementioned objectives of material and/or energy recovery are widely known today in the waste processing industry and precede disposal, but had not been utilized in connection to (a) a wider program of waste post-disposal processing and (b) material beneficiation for valuable metals, by means of ore processing methods.

The project's aim and objectives were reached through the implementation of carefully planned actions, which included amongst others, the consolidation of the international experience in LFM, the design and operation of a LFM Demonstration Unit (DU) in the sanitary landfill of Polygyros and the monitoring and assessment of its potential environmental and socioeconomic benefits. These actions concerned the development of an exploitation plan, the design of the waste treatment process, the actual mining and processing of Municipal Solid Waste (MSW) and the elaboration of an environment rehabilitation plan. Also, actions concerning the evaluation of the LFM method and its potential at a broader scale included among others the creation of a Landfill inventory to understand the LFM potential in Greece and selected areas of the European Union (EU), carrying out an in depth financial and socioeconomic analysis, developing a National Action Plan and an accompanying Strategic Environmental Assessment study. Additionally, public dissemination actions as well as stakeholder meetings and networking activities were implemented, aiming to establish LFM as a recognised waste management method and to integrate it in the long-term in regional or National waste strategies.

The project has been implemented on time and there was no need for prolongation. Any time divergences were identified as early as possible and all the appropriate measures were taken through the communication among beneficiaries and the Management Team in order to ensure the implementation of every task of the project.

However, during the project implementation some challenges appeared which concerned the following:

(1) The delay of completion of the Landfill Inventory, as most of the data were provided long after it was planned, despite the persistent communications of the Project Team with the relevant authorities;
(2) The mobilisation of MoP's personnel was slower than anticipated due to bureaucratic limitations concerning employing personnel in the public sector in Greece;
(3) The rainy weather slowed down the productivity during the operation of the DU, since wet waste cannot be separated and could also cause issues to the health and safety of the staff.
(4) The general elections in Greece affected the socioeconomic survey of the project.
(5) The local recyclers determined different costs for the recyclables after the capital controls were applied in the country. Moreover, they showed much less interest in collecting the mined recyclables for free.

Aiming at getting over the above unexpected circumstances, the following corrective actions were taken:

(1) The Project Team engaged into many communication actions (e-mails, phone calls, etc.) to acquire the necessary data for the Landfill Inventory.

(2) MoP's permanent staff and personnel from the other Beneficiaries were mobilised to cover the necessary labour, when it was necessary.
(3) The delay due to the rainy weather was limited by purchasing plastic covers to protect both the open pit and the already mined waste. By using the plastic covers, the waste remained dry and could be processed straight after the rain stopped.
(4) Due to the general elections, the project team decided to postpone the socioeconomic survey for a few months, aiming at receiving unbiased answers. Unluckily, the capital controls applied at the time of the implementation of the socioeconomic survey probably affected people's willingness.
(5) The project team made many more contacts to find the recyclers to collect the mined material.

During the implementation of the reclaim project some points were highlighted which should be considered in case of a new LFM application. For example, the financial assessment of the project showed that the purchase of the machinery appears to be more cost-effective than its rental. Moreover, selecting an island for LFM implementation could be an interesting option since most of the islands in Greece face serious waste management issues. This opinion was derived mainly from the fact that people from the local authorities in the Greek islands were very interested in LFM and approached the project team to discuss the potential implementation of the method in their area. Finally, although the dissemination activities were intensive during the implementation of the project, information days in schools could be a useful tool aiming at promoting the value of saving energy, land and materials.

The replicability and the added value of the project were focused on the following topics:

a. The consolidation of knowledge and information: the data derived from the project (i.e. from literature, mining, processing and socioeconomic analysis) could be used as guidance for future similar projects.
b. The Landfill Inventory which supports the geographical data for landfills and dumpsites in Greece and the EU contains very useful information to examine the LFM potential of the reported areas.
c. Data derived from the DU operation could be very helpful for the organisation of the technical part of the LFM application.
d. The RECLAIM-hab tool which is the multi-criteria analysis tool produced during the project could assist in the decision making process for choosing the most suitable rehabilitation plan after LFM.
e. The National Action Plan is the main policy tool aiming at the incorporation of LFM to the national waste management plan.

In the present report, the LIFE reclaim project, its main objectives and targets and how these were achieved are presented in Chapter 2.

The course of the project's implementation was in general successful due to, among others, the effective and productive cooperation between beneficiaries. The administrative system which is described and evaluated in Chapter 3, managed to ensure the effective administrative, scientific and financial coordination and proper implementation of the project. The general Project Coordination was done by the Coordinating Beneficiary (CB) and the rest of the Project Team was divided into four Teams under the supervision of the Team Coordinator: Management Team, Analysis Team, Application Team and Communication Team.

The Technical part of the project was implemented as planned and is presented in Chapter 4. The Preparatory Actions successfully set the baseline for the main project Implementation Actions and the technical goals of the project such as building a LFM Demonstration Unit, testing the method as a tool for the recovery of materials, land and space and setting the base for future LFM projects in Greece and abroad, were easily reached. The Dissemination Actions were a great success and managed to introduce LFM to the Greek audience, raise awareness about the potential of post-disposal waste valorisation and distribute the project results. The Deliverables of the actions will remain available to all interested stakeholders so that the results of the project can promote best practices of LFM.

Chapter 5 presents in detail the financial statement of the project. Particularly, project expenses reached the amount of €1,299,563.71 covering the 94.4% of the initial approved total budget. The EU contribution was calculated to the amount of €615,521.00, respecting the 2% rule for the public bodies. Two detailed tables show the costs incurred per budget category and per action. Chapter 5 describes also the accounting practices that were applied during the project.

The main conclusions and outputs of the project are summarized below:

- There is a great potential for LFM in Greece and in the EU, as a tool in an integrated waste management system;
- LFM can have a beneficial impact on the environmental and social conditions;
- LFM proved to be financially feasible under certain circumstances;
- LFM policy would be beneficial if it was incorporated to the national waste management plan.
- The dissemination actions were very important to this project since a large part of the public administration, the business sector and the scientific community are not aware of the LFM concept.

2. Introduction

The project RECLAIM was implemented under the framework of LIFE+ Environment Policy and Governance components and had duration of 36 months. Addressing the issue of resources recovery, the project's main aim was to turn landfill mining (LFM) into a useful tool for reclaiming useful materials (ferrous and non-ferrous metals), space, soil material, recyclable materials (plastic, paper) and land, all of which can be easily adapted to different waste compositions and site conditions. This target was achieved by building a temporary pilot application on productive scale in order to mine parts of existing landfills, separate useful materials and produce marketable products, introducing innovation elements from the mining industry.

The area selected to apply the abovementioned practice and set the pilot Demonstration Unit (DU) was the Polygyros Landfill (PL), in the area of Chalkidiki (Northern Greece). The municipal solid waste management in Polygyros has faced some problems in the past related to waste collection and waste disposal. Recycling and home-composting systems have been introduced in 2013 and it is estimated that only a 4% of the total waste is being recycled and thus, the PL accepts mixed waste.

The project's target was achieved through a group of carefully planned actions:

- The import of international knowledge and experience in LFM,
- The in-depth description of the baseline environmental and social conditions,
- The creation of a Landfill Inventory and a web-GIS application,
- The design and implementation of the excavation process as well as the Pilot-scale DU for the treatment of the MSW,
- The environmental monitoring and samples testing,
- The analysis of the social and economic impact of the project and the elaboration of a generalized Financial and socioeconomic analysis,
- The elaboration of a National Action Plan promoting LFM,
- The development of a Strategic Environmental Assessment,
- The monitoring of environmental and social impact of the project,
- The organization of dissemination events, material and actions as well as the creation of the project's website,
- The closely monitored project management of the project.

The LIFE reclaim project successfully demonstrated the benefits of the LFM method as an addition to an integrated waste management system and its dissemination actions effectively promoted the project's results and suggested relevant policy changes at a regional and National level. Also, the networking activities with experts and organisations in various countries of Europe are a means to influence change at the continent's broader geographic level.

3. Administrative part

3.1 Description of the management system

The project applied a specific management system (Annex 1: Organisation and Management Chart) in order to ensure the effective administrative, scientific and financial coordination and proper implementation of the project. The project was divided into two phases: The preparatory phase (including the activities from Actions A1-A3) and the implementation / dissemination phase (including the activities from Actions B1-B10, Actions C, D and Actions E5-E6). The management system (Actions E1-E4) was uniform from the beginning until the end of the project.

The general Project Coordination was done by the Coordinating Beneficiary (CB) (ENVECO S.A.) and particularly, by the Project Coordinator (PC) and the Financial Manager. The PC had a central role in relation to the management of the project technical activities, the dissemination of the project's results and the promotion of public awareness. PC was responsible for the timely preparation of the reports, as well as for securing the effective communication and coordination with the participating companies/organizations. He was also in charge for the monitoring and control of the technical performance of the Actions (timetable, deliverables etc.) and he was directly supported by the Financial Manager. The basic duties of the Financial Manager were: a) the supervision of the administrative procedures carried out by the project partners, as well as to give advice related to the EU's and Common Provisions' financial rules, b) the monitoring and support to the completion of the Financial Reports and c) the control of project budget and potential changes.

The Project Team was divided into four Teams, all under the supervision of the Team Coordinator (ENVECO):

(i) Management Team,

(ii) Analysis Team,

(iii) Application Team,

(iv) Communication Team.

Each Team had a Team Leader, responsible for defining the Team's priorities. Each Team Leader reported to the Team Coordinator and bore responsibility for issues and matters of his Team, upon authorization from the Team Coordinator. The Management Team led by ENVECO was responsible for internal reporting and monitoring of the Project progress, based on the indicators of each Action. Other management tasks included the quality control and timely submission of the deliverables, the compliance to the time-schedule, the completion of the financial forms and timesheets, the organization of internal meetings between the Beneficiaries, the submission of the monthly reports to the TMO and the annual reports to the EU.

The Project Team sent to the European Union (EU) (and the Technical Monitor (TMO)) the following reports: 1) the Inception Report (IncR) - 31/03/2014, 2) the Mid-term

Report (MTR) with payment request – 31/03/2015 and 3) the present Final Report (FR) – 30/09/2016. The answers to the questions of the EU letters of 30/06/2015, 31/08/2015 and 16/09/2016 (with reference numbers: ENV E.4/AT/Ares(2015) 2735155, ENV E.4/AT/nl/Ares(2015) 3572668 and ENV-E-4 AT/KP/jcs Ares (2016) 5415920 , respectively) are attached to the present report (Annex 2).

The project was carried out by a well-organized consortium consisting of: two private companies (ENVECO S.A. and HELECTOR S.A.), one University [National Technical University of Athens (NTUA)-School of Mining and Metallurgical Engineering (SMME)] and one public body [Municipality of Polygyros (MoP)].

The Coordinating Beneficiary is ENVECO S.A., a private company that is active in the field of providing specialized environmental consultancy services and is EN ISO 9001:2008 certified by TUV Austria Hellas for the quality assurance procedures applied in its consultancy work. The fields of activity were formed in line with the EU and international market demands and the specialized experience of the company's staff. Specifically, the fields of activity of ENVECO S.A. include issues related to water, air and natural environment management, management of environmental and natural resources, management of environmental projects, environmental policy and economics and management of liquid, solid and hazardous waste. The long involvement of the company's employees in environmental issues and their perfect cooperation contributes to the compilation of high quality environmental assessment. The company's members are also active in the research field.

HELECTOR S.A. specializes in the field of waste management and waste to energy applications. HELECTOR is active and experienced in every part of the whole waste treatment chain, from reception to disposal and site rehabilitation. Its activities focus on the most valuable pieces, like recycling, treatment and disposal with many references in design, construction and operation of such facilities. By implementing its high level technological portfolio, the company aims at improving the environmental effects of wastes, by reducing the waste volume disposed in landfills, reducing the emissions and the greenhouse effect, preventing the pollution of water resources and recovering energy and materials out of wastes.

The School of Mining and Metallurgical Engineering (SMME) is the Department of the National Technical University of Athens (NTUA) which deals with the exploration and description of minerals, the production and exploitation of mineral and energy resources, the development of materials of advanced properties and applications, the utilization of the classic mining and metallurgical science and technology for the resolution of problems and requirements of modern societies as well as environmental management. NTUA participates through two Laboratories of the School of Mining and Metallurgical Engineering, namely the Laboratory of Mining and Environmental Technology (LMET) and the Laboratory of Mineral Processing (LMiPr). LMET has an extensive experience of more than 25 years in mine design, environmental mining, financial and cost benefit analysis, environmental valuation, risk assessment and management of contaminated land and hazardous waste management,

utilization of mining and other waste. LMiPr is fully equipped with mineral processing laboratory equipment and has an extensive experience in mineral processing methods study and development, processing study of treatment methods (e.g. gravity separation wet and dry magnetic separation, etc.) and study of the properties of ores, industrial minerals and rocks. In addition, it has carried out pre- and feasibility studies regarding the design of mineral processing production plants, environmental studies of mineral processing plants, etc.

The Municipality of Polygyros (MoP) is a public body responsible for the administration of an area equal to 951sq.km. According to the 2011 census, the population is 22048 cap. MoP lies under the administration of the Region of Central Macedonia. The administration is responsible for various services to citizens, including potable water, waste management, education & schools, culture/tourism etc. MoP is the supervising authority of the Body for Solid Waste Management (FoDSA). This body is responsible for waste management and disposal in the area. Consequently, MoP is directly interested in waste valorisation and waste management optimisation.

A personnel list is provided in Annex 3. Each of the four beneficiaries was responsible for the implementation of specific Actions. The role, rights and responsibilities of the beneficiaries in specific Actions are presented in the Partnership Agreements which were signed by all beneficiaries at the beginning of the project and have been submitted with the IncR (*Annex 6*).

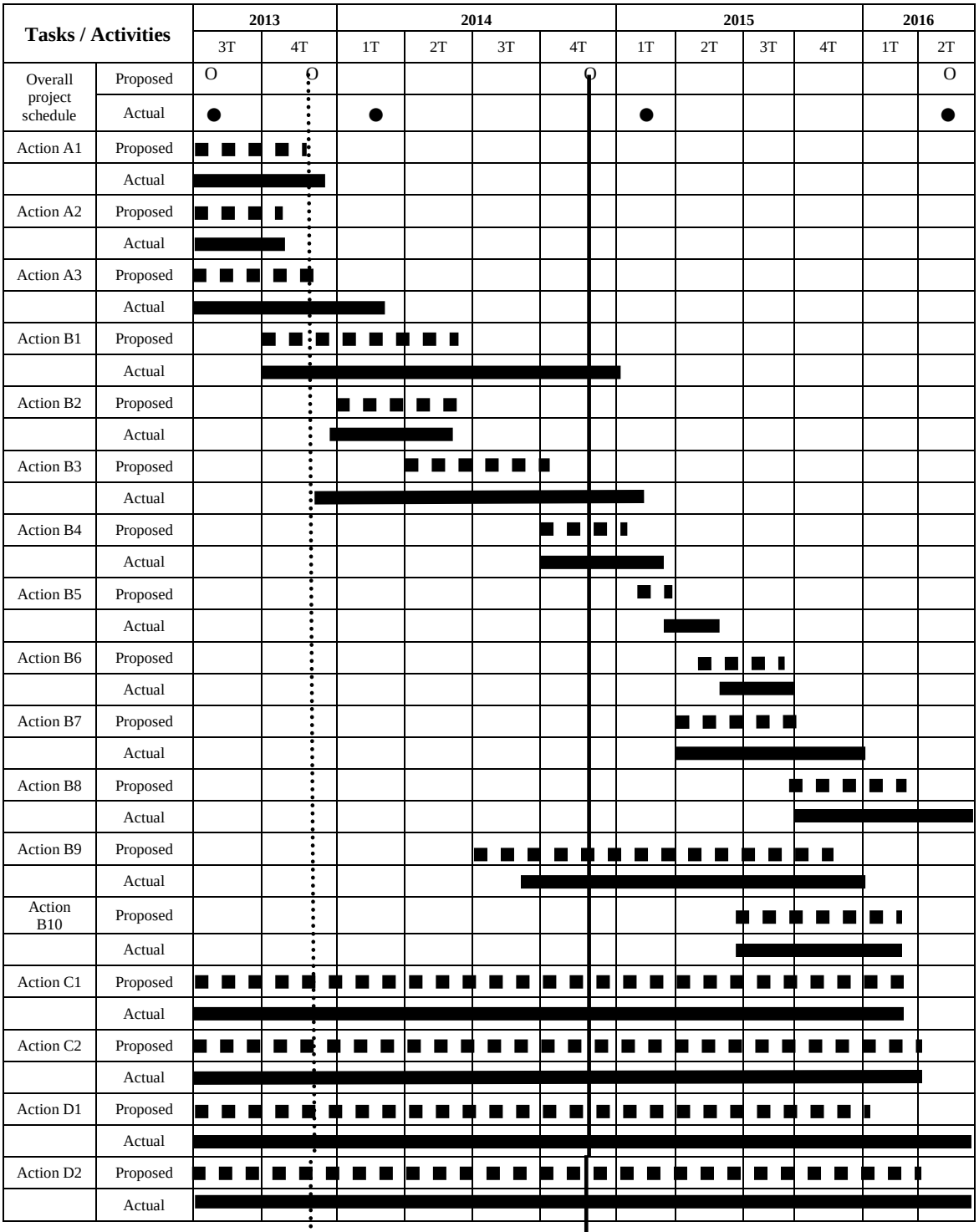
3.2 Evaluation of the management system

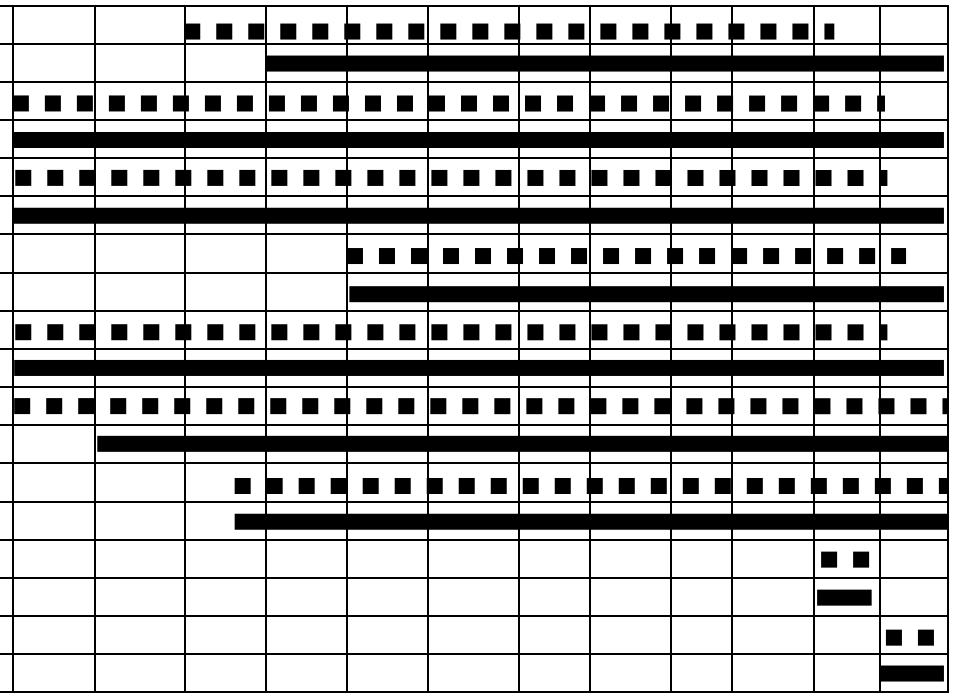
The general approach of the project's management, as already described in section 3.1, was considered successful. Any short delays were addressed instantly and the project has been completed as foreseen. The early nomination of the project's teams and the effective collaboration between the beneficiaries ensured the success of the project's implementation. The central point of the management system was the Project Coordination Team which was responsible for the communication with the Commission and the Technical Monitor (TMO), as well as for the successful management and administration of the project. However, some unexpected circumstances could not be prevented. These concerned the following:

a) The cessation of NTUA's administration actions for four months, owing to massive strikes of administrative personnel (from early September to early December 2013 and June 2014), as well as the suspension of almost half of the administrative staff limited the human and technical resources availability in SMME to the lowest possible level. However, this obstacle was overcome with lowest possible delays in the execution of the relevant actions.
b) The mobilisation of MoP's personnel exclusively for the Project was slower than initially anticipated, due to certain constraints. In fact, due to the current limitations of employing personnel in the public sector, municipalities all over Greece have

difficulties to employ new personnel and the current procedure of employment (even for a certain period) is far more bureaucratic. The MoP finally managed to achieve agreement with the Government for assigning temporary personnel exclusively to the Project.

The above difficulties created some minor delays in the time schedule of certain actions, mostly in an earlier stage of the project's duration but did not affect the attainment of the project's overall targets. A Gantt chart of the project is given below.



Action D3	Proposed	
	Actual	
Action E1	Proposed	
	Actual	
Action E2	Proposed	
	Actual	
Action E3	Proposed	
	Actual	
Action E4	Proposed	
	Actual	
Action E5	Proposed	
	Actual	
Action E6	Proposed	
	Actual	
Action E7	Proposed	
	Actual	
Action E8	Proposed	
	Actual	

O = Inception report (31/12/2013), Midterm report (31/12/2014), Final Report (30/09/2016)

● = Completed, …. = Inception report line, __ = Midterm report line

4. Technical part

4.1. Technical progress, per task

4.1.1. Action A1. Consolidation of the international experience in LFM

Foreseen start date: 7/2013 **Foreseen end date: 11/2013**

Actual start date: 7/2013 **Actual end date: 12/2013**

Description of the action:

The Analysis Team (ENVECO S.A.) assessed all available information regarding recent and past international applications of landfill or waste mining, in order to present an extended report on the objectives, the methods, the machinery used, as well as the results and needs for further improvements. This assessment was used as a basis for knowledge dissemination and for the project's detailed design.

The assessment included extensive data mining on the literature, the machinery market and the experience of landfill operators on technical and operational aspects of regulated and unregulated landfills, such as: fluctuations in MSW waste quality; mixing of specific types of MSW; potential hazards and economic data. Furthermore, consultations with local authorities served by the selected landfills took place. The main workload was a desktop analysis, but there was also a considerable amount of travelling for meetings and exchange of experience.

During the elapsed period, several trips to EU countries and national destinations were performed in order to exchange ideas and practices on landfilling and LFM. The assessment was held mostly in Greece, especially for the desktop study, but a few trips to international destinations took place in order to consolidate the experience on the LFM field. The focus for the international trips was on specific countries, namely Belgium, Spain and the Netherlands. Since LFM is not well known as a concept in Greece, for the national trips several waste management authorities were chosen in Western Macedonia region (Kozani), Attica (Athens) and Crete (Amari).

Each trip included meeting with local stakeholders (organizations/authorities and/or private companies) and most of them included visits to waste management facilities, such as brownfields with LFM activities, landfills with LFM activities, waste treatment facilities (separation, composting, valorisation). The minutes and other documentation are provided in *IncR-Annexes 7a and 7b*.

The core aim of international trips for the life reclaim representatives was to disseminate the scope and the expected results of the Project, and to receive information (scientific and practical) on past and current LFM applications, as well as on the future prospects, as perceived by LFM pioneer groups.

The core aim of national trips was the initiation of a discussion on LFM and exchange of information on separation techniques, treatment techniques, pre-LF actions and after-LF actions. In all meetings, EU legislation was discussed as a solid basis for the future of waste

management. It was evident from our communications with various landfill managers that LFM is not known in Greece, even as a concept, something that was also clear during site visits and meetings. Therefore, it was decided that further elaboration on meetings and site visits in Greece would not result in any useful outcome, while more effort in the scientific part of the LFM would be more useful for the successful elaboration of this Action.

Furthermore, on the scientific part of LFM, the scope of the Action was to assess all available information regarding recent and past international applications of landfill or waste mining, in order to present an extended report on the objectives, the methods, the machinery used, as well as the results and needs for further improvements. This assessment will be used as a basis for knowledge dissemination and is expected to assist project detailed design. To this effect, the Project Team worked extensively on an LFM report comprising current and future considerations on LFM in EU and in Greece. The report, which also incorporates findings from the international trips, was included in the IncR. After the Commission's comments on the submitted report, it was reviewed by the Project Team and the specific information asked was also included, thus, this updated version is submitted again in Annex 4 of this report.

The main difficulty in realising this Action was the constraints of scheduling meetings with international stakeholders. Two kinds of problems were identified. The first problem was the bureaucratic procedures followed by various public organizations (e.g. waste management authorities) and the second was the relative difficulty in approaching private companies, which either practiced LFM (and they prefer not to reveal their techniques) or did not find any interest in LFM, so they preferred not to spend time on the subject.

In relation to our effort to contact UK stakeholders, various obstacles were met:

(a) Waste management organizations in areas where landfill mining had been reportedly taking place, did not respond to our correspondence and telephone communications despite our persistent effort to establish communication.

(b) The only organization that showed interest in our project was Zero-Waste-Scotland, but they have decided that they "have no plans to progress any further research or work programme on this subject at this time", thus they did not facilitate a meeting with the Project Team.

(c) Key-players in LFM, such as the University of Cardiff and private companies like Ricardo-AEA and SITA, were supposedly willing to exchange information on the subject, but actually never agreed on a meeting, despite our persistent efforts.

After much consideration, it was decided that the current state of play in the UK should include reporting based only on recent literature and phone interviews.

The Project Team came into contact with scientists and organizations related to the latest publications on LFM, such as the KU Leuven (Catholic University of Leuven, Flanders), Deltares (institution of the Netherlands), University of Cardiff and private companies like Ricardo-AEA, Pollux, SITA, etc.

Time schedule:
The action started according to the timetable and was completed one month later than scheduled (12/2013). The short delay worked to the advantage of the Project, owing to better facilitation of visits to both EU and Greek destinations, without compromising the submission of the Report (deliverable) along with the Inception report. Moreover, as per request of the EU letter of 02/07/2014, the technical report produced regarding the landfill mining techniques and potential in Greece and EU has been reviewed by the personnel of ENVECO during the period October-December 2014.

Implemented by: ENVECO S.A.

Deliverables:
One technical report on landfill mining techniques and potential in Greece and EU (Reviewed and resubmitted: Executive Summary added) (Annex 4).
Memo for four international trips (*IncR-Annex 7a*)
Memo for three national tips (*IncR-Annex 7b*)

Changes in the Technical Part of the action:
A field trip to the UK was also planned in the initial project proposal but it was not realised during the Action due to the aforementioned reasons. The experience in the country was documented through phone interviews and the relevant literature.

Changes in the Financial Part of the action:
Please note that the approved transfer of €772.00 from the category "travel" of Action A1 to the same category of Action B1 did not occur since the trip in Cyprus which would replace the trip in the UK was covered by the initial travel budget of Action B1.
However, the need for reviewing the first deliverable of the action (for a three month period), as requested in the EU letter of 2/7/2014, resulted in a slight increase of the personnel costs (i.e. €330.00 more than the foreseen action's budget) which were proposed to be transferred from the category travel of Action A1.
Finally, the amount of €3,955.00 was transferred from the category "travel" of action A1, in order to cover extra personnel expenses in Action A3. As described in detail in §4.1.3 (Action A.3), some extra personnel time was required for the reviewing of the deliverable, as requested in the EU letter of 2/7/2014.

Expected results:

- The aforementioned "Technical report on landfill mining techniques and potential in Greece and EU" of Annex 4.

- Knowledge on state-of-the-art regarding landfill mining was gathered during the National and International trips and the desktop study, readily available for dissemination.

4.1.2. Action A2. Permitting of additional activities inside Polygyros Landfill (PL)

Foreseen start date: 7/2013 **Foreseen end date: 10/2013**

Actual start date: 7/2013 **Actual end date: 10/2013**

Description of the action:

During this Action, the Project Team took all the necessary steps to ensure that the activities of the LIFE reclaim DU would be officially permitted by the relevant Greek permitting authorities. Since the PL was already permitted for its construction and operation, the law (Law 4014/2011) requires an amendment to the existing permit, through standard procedures which usually require some months.

Despite the difficulties and delays which arose during the process such as the re-organisation of the Directorate of Environment and Spatial Planning of Central Macedonia Regional Authorities and then the diverting of the procedure to another level of the Public Administration, the dossier was resubmitted and the approval-permit was finally received on the 27th of March 2014. All relevant documents and a thorough description of the process and difficulties were provided with the Inception report.

Time schedule:

The action completed according to the timetable (submission of the dossier: 10/2013). As mentioned above the environmental permit for the additional activities inside the PL was finally acquired in March 2014, 27 days later than the estimation given in the approved proposal. The short delay did not affect the implementation of the project.

Implemented by: ENVECO S.A.

Deliverables:

One dossier for permitting of additional activities (Reviewed and resubmitted: Executive Summary added) (Annex 5).

One Approval of permit for the Demonstration Unit activities and relevant documentation (*Mid-Term report Annex 5*)

Expected results:

Environmental Permitting of the planned activities of the DU: the environmental permit of the PL remained unchanged but an additional permit was issued, specifically for the construction and operation of the DU.

4.1.3. Action A3. Baseline environmental and social conditions

Foreseen start date: 7/2013 **Foreseen end date: 12/2013**

Actual start date: 7/2013 **Actual end date: 3/2014**

Description of the action:

The objective of the Action was to provide the baseline environmental conditions (status quo) of the Project area.

The assessment and evaluation has covered the environmental conditions of all media (air, water, land, soil, ecosystems), as well as information about the manmade environment, collected through census data for the Project Area and the wider region of Central Macedonia. The data was compared to national and EU census data in order to enable evaluation of social status. Furthermore, data on social welfare, social services, as well as data on public expenditure of the last decade were collected to provide a clear insight on the social profile of the area. Finally, the presentation of data on public infrastructure and services, such as water, sanitation, waste management, transportation was used to enable the analysis of the potential for improvement.

During the elaboration of the assessment, the following steps were taken:

1. Assessment of related literature about the study area.
2. Site visits in the wider area.
3. Collection of primary data (climate, soils, vegetation, census) from relevant databases and organizations.
4. Consultations with relevant authorities (forest services, archaeological services, the municipality, the regional authorities etc).
5. Final assessment and reporting.

The main finding of the assessment was that the project site is located amidst a forest area of great environmental and ecosystem value. Also, there are many pending steps that could be taken to improve the social and environmental status in the area and future spatial plans could transform the Town of Polygyros as a hub for the growth of activities and services, related especially to tourism. Finally, the specific environmental and social pressures of the area encourage the adoption of innovative actions in the field of water resources, waste and land use management. The results of the Environmental and Social baseline served as the basis for (i) the Environmental Impact Assessment Study (Action B9) and for the project impact monitoring actions (Actions C1 and C2)

The Report was reviewed according to the comments of the EU letter of 02/07/2014 and included up-to-date information on the meteorology and the census data of the study area. It was also reviewed again according to the comments of the EU letter of 30/06/2015 (executive summary added and some figures were corrected) and it is resubmitted.

Time schedule:
The coordination of this Action was part of the work of NTUA which faced some administrative obstacles, during the initial period of the project. Consequently, the assessment of the available information, the meetings with the authorities related to environment (forest services, archaeological services, municipality etc) and the final version of the deliverable resulted in an extension of the deliverable by three months (until 3/2014), as reported in the IncR. Similarly to Action A1, the assessment produced had to be reviewed by ENVECO's personnel during the period October-December 2014.

Implemented by: ENVECO S.A. (responsible beneficiary), SMME

Deliverables:
Technical report on baseline environmental and social conditions (Reviewed and resubmitted: added Executive Summary and requested reviews) (Annex 6).

Changes in the Financial Part of the action:
Regarding the Beneficiary ENVECO, some extra personnel time was required for the reviewing of the deliverable (EU letter of 2/7/2014). The requested updates on the meteorological and census data demanded extensive data mining (online databases, lengthy communications with the relevant authorities, etc.) and processing, resulting in an increase of "personnel" costs of €3,955.00 from the initial budget. This "personnel" cost was transferred from the category "travel" of action A1 and did not affect the total project budget while it was within the thresholds set by the EU.
Moreover, the amount of €2,500.00 and €500.00 was transferred from the category "travel" of Action A3 to the categories "travel" and "consumables", respectively, of Action E1 (Beneficiary ENVECO). The abovementioned costs concerned expenses which were not foreseen, such as costs of the management team visits to the associated beneficiaries and to the project area, as well as consumables costs like dissemination material postage, expenses for meetings between the beneficiaries etc.

Expected results:
Description of the existing (baseline) environmental and social conditions of the study area.

4.1.4. Action B1. Landfill inventory

Foreseen start date: 10/2013 **Foreseen end date: 6/2014**

Actual start date: 10/2013 **Actual end date: 2/2015**

Description of the action:

RECLAIM assesses and evaluates a new approach concerning the management of waste disposal sites, following the principles of sustainable mining and presents excavated waste as valuable resource. Until today, such sites have been seen rather as final destinations for waste and not as an intermediate step before valorisation. In this context, the creation of an integrated inventory of landfills and dumpsites in Greece and parts of the EU was elaborated to assess the available waste material stored in disposal sites.

As a full scale operation in Europe was estimated to be time and money consuming, operations to selective regions were chosen instead to provide relevant information which are representative, i.e. Greece and two south European countries (Spain and Cyprus), one country in central Europe (Belgium) and two countries in northern Europe (UK and the Netherlands). All selected countries have previous experience with waste management and faced similar problems with uncontrolled waste disposal, pressing space and land use problems related to municipal waste.

Towards data collection three different actions were taken:

(i) Compilation of a questionnaire on landfill information, distributed to a targeted audience of institutions and public bodies in the selected areas.

(ii) Collection of existing information on landfill locations and characteristics from in existing literature and on-line databases.

(iii) Participation in the newly established landfill mining consortium (i.e. EURELCO) to exchange information on landfills and waste valorisation potential.

In total, questionnaires were sent to more than 140 recipients which were identified both through research at this stage and from previous actions (mainly Action A.1). Also, even though complementary activities were planned to secure quick response by parties (i.e. telephone follow-ups, e-mailing of templates and more communication actions), the Project Team faced many delays in receiving the requested information.

One main conclusion is that there is limited analysis and availability of data on both operational and closed waste disposal sites in EU countries and there is limited information, especially on quantities and the content of waste. However, after long delays and follow-ups, a large amount of information concerning more than 22,000 landfill sites was collected and processed, in order to be included in the Landfill Inventory.

In parallel, the construction of the database was carried out, with the accompanying online web-GIS application, supported under Action D2 (website development). The database supports storage and maintenance of data, queries, publication and visualisation of

information through the web interface. It was published in November 2014 and since then it is being updated and enriched as the Project Team regularly receives new landfill data.

The Inventory provides the necessary infrastructure for storing detailed data for each site and in cases where such data are missing, necessary assumptions were made, documented in detail using a Dataset Checklist.

The inventory for Greece was based mainly on a desktop study and only two field trips were realised, namely one in Cyprus, where a short trip was carried out to visit the Waste Management Authorities and one in Polygyros. More national field trips were foreseen in the project proposal but the Project Team decided that they were not necessary for the implementation of the Action, as all the required data which was going to be retrieved through these visits was provided from the official database of the national

In particular, the Team collected data from:

- Existing inventories of Greek regions that have already been realised within the scope of other projects or plans, such as the reports of the Greek Water Districts on the application of the Water Framework Directive (WFD), the Waste Atlas of the D-Waste group, pollutant inventories etc.
- Official lists of landfills from the Ministry of the Environment and Energy
- Lists from organizations related to MSW management in Greece (e.g. the Hellenic Solid Waste Management Association, etc.) and in the EU (e.g. Municipal Waste Europe, FEAD, CEWEP etc).

Finally, according to the project planning, a Technical report on the Inventory of Landfills of areas of interest to Landfill Mining in Greece and selected EU countries was prepared, which presents in detail all the steps of the Action and the main conclusions on the potential of Landfill Mining in Greece and these selected areas (Annex 7).

Time schedule:

The Project Team considers this Action to be of the greatest importance for the dissemination of information of the LIFE reclaim project and for the project's afterlife value. Thus, to ensure the quality of these outputs, there was some extension of the initially anticipated period for the implementation of this Action, due to the following distinct issues:

- Due to long communications with relevant parties and authorities, the distribution of the questionnaires took more time than it was expected.
- There is limited analysis and availability of specific data in EU countries on the old LFs and Uncontrolled LFs, such as limited data on the quantities and the content of waste and as a result more effort was required for finding those data.
- In most cases, there were several delays and follow ups until the Project Team finally received the required data, owing to rigid regulations and slow procedures of the responsible organisations.

- Many organisations were reluctant to fully disclose data about landfills and dumpsites, even closed ones and as a result there was a lot of debate about the final scope of this action in order to persuade them to provide us the data.
- For searching, downloading, bringing them into the appropriate form and incorporating landfill information from online inventories and available publications, it was necessary that the Project Team spent more time during the desktop study than it was expected.
- The final amount of the data gathered – more than 22,000 landfill sites – was overwhelming and the processing of the data for their incorporation to the Landfill Database and the online Web-GIS application took more time than it was estimated.

Implemented by: ENVECO S.A.

Deliverables:
One technical report on the inventory of landfills of interest to landfill mining in Greece and selected EU countries (Reviewed and resubmitted in Annex 7).
One digital inventory of landfills of interest to landfill mining in Greece (available online at http://reclaim-gis.gr).

Changes in the Technical Part of the action:
Some national field trips were planned to take place for collection of data. However, most of these trips were considered unnecessary and only a field trip to Polygyros occurred, as the necessary information was gathered by the Greek authorities, relevant publications and online landfill inventories.
Furthermore, a trip to Cyprus took place in order to gather information on the municipal waste management and particular data on landfill and dumpsites of the country. The Project Team was given the chance to give a presentation about the LIFE reclaim project and Landfill Mining activities to the representatives of the Cypriot Ministry of Interior.

Changes in the Financial Part of the action:
The action exceeded the foreseen personnel costs by €3,595.00 due to the fact that more time was required for the completion of the project than what has been anticipated. This amount was proposed to be covered by transferring funds from the "travel" category of action B1.

Expected results:
- Detailed assessment of the potential for development of landfill mining in Greece and Europe.
- Web GIS application for the geographical presentation of landfills and dump-sites with a significant potential for landfill mining.

4.1.5. Action B2. Exploitation plan development

Foreseen start date: 1/2014 **Foreseen end date: 6/2014**

Actual start date: 1/2014 **Actual end date: 6/2014**

Description of the action:

Within the Action, the Analysis Team (ENVECO S.A.) along with the NTUA members of the Application Team prepared a detailed technical plan and design for the mining procedure of the Polygyros Landfill (PL). This plan includes the following:

- Detailed Technical description of the PL,
- Technical Alternatives for the mining of waste in the PL,
- Selection of the suitable alternative solution and
- Specifications for machinery, equipment and personnel necessary.

This analysis was based on the existing design data of the PL, as well as on technical knowledge by the NTUA (SMME) on mine exploitation and relevant machinery.

Furthermore, experts from the NTUA (SMME) examined the geotechnical conditions of the ground of the PL during the first field trips and set out the guidelines for Sampling and Test Excavation procedures envisaged to provide a more in depth knowledge of the waste characteristics. The results from the Sampling and Test Excavation were taken into account in both for Actions B.2 and B.3.

The NTUA scientists provided the technical assistance and were responsible for providing the technical guidelines on which the exploitation plan will be based. ENVECO personnel were responsible for the assessment and the design of the proposed activity.

During the Action, the following tasks were elaborated:

1. Literature review on waste extraction options,
2. A preliminary market survey on available machinery,
3. Site inspection and waste "mapping", according to waste-age,
4. Design of waste sampling methodology,
5. Execution of waste Sampling in PL,
6. Excavation test for the examination of waste stability and properties,
7. Collection of information regarding other available sources of waste in the area, such as old unregulated dumpsites.
8. Elaboration of a technical report by NTUA/SMME on methods and exploitation plan guidelines,
9. Overall waste mining development plan.

Two field trips were conducted to the PL:

- In May 2014, the experts from the NTUA/SMME visited the landfill and collected information which was necessary for the elaboration of the design of the landfill mining process and the preparation of Sampling and Test excavation guidelines.

Through discussions with the staff of the PL and also on-site investigation, the following elements of the landfill were examined:

- the geometry of the cell,
- the age of the landfilled waste
- the available machinery and manpower and
- the typical composition of the waste.

Also, many photographs of the site were taken to help with the design of the exploitation plan.

- The Project Team revisited the PL in July 2014 and conducted some test excavations, using a backhoe excavator. A pit of more than $10m^3$ volume and 2m depth was opened, to reach a layer of older wastes, providing information about the duration of the excavation, the level of the degradation of the waste as well as the difficulty of the excavation process.

During the Action, the Project Team had to face one issue: the PL was also receiving waste from other regions as well during the summer months of 2014 and the unexpected increase in the volume of incoming waste caused changes in the geography of the PL cell. Thus, the Technical Plan and design for mining waste in PL was adjusted accordingly.

Apart from the elaboration of the technical plan for mining waste in the PL, the added value of the Action deliverable lies in the presentation of the most suitable available mining techniques that can be selectively applied in future Landfill Mining projects, supporting the replicability of the project.

Time schedule:
The action was successfully implemented within the foreseen timeline (January 2014 – June 2014).

Implemented by: ENVECO S.A. (responsible beneficiary), SMME

Deliverables:
The technical report for the development plan (Annex 8) has been amended according to the comments sent by the Commission and is resubmitted with the Final report. More specifically, the revised report is mostly based on former Ch. 4, as suggested. Moreover, Ch. 1-3 has been significantly shortened and all sources are properly cited. Finally, the list of abbreviations, the executive summary and the annex "Expert report by the NTUA scientists" have been added.

Changes in the Financial Part of the action:
The amount of €250.00 was proposed to be transferred from Action B3 to Action B2, in the category "Personnel", for the Beneficiary ENVECO. This extra cost derived from the

unexpected task of the adjustment of the Technical Plan and design for mining waste in PL due to changes in the geography of the PL cell.

Expected results:
A Technical Plan and design for mining waste in PL was prepared, which will enable the preparation of subcontracting procedures and guide the landfill mining activities.

4.1.6. Action B3. Design of waste treatment process

Foreseen start date: 4/2014 **Foreseen end date: 10/2014**

Actual start date: 12/2013 **Actual end date: 3/2015**

Description of the action:

The scope of the action was to design an efficient Demonstration Unit (DU), with a MSW treatment line which includes separation of waste, processing and pre-treatment, as well as a beneficiation phase, where a concentrate of metals was produced.

The DU design has been conducted by the Analysis Team (ENVECO S.A.) with contributions from NTUA (SMME) scientists on certain technical aspects of the project, namely pre-treatment and beneficiation of special waste streams, such as electrical and electronic equipment waste stream, as well as from the technical personnel of Helector S.A.

The field trips to the PL (in May and July 2014), organised by the NTUA team, covered the sampling of the waste which was needed to familiarise the project team with the expected composition of waste within the landfill, which was processed by the DU. Other information which was taken into account during the design of the DU was:

- International studies and previous scientific knowledge on relevant issues,
- Tested and effective techniques from integrated MSW treatment,
- Techniques from the recycling industry,
- Beneficiation applications from the mining industry, especially on noble metals separations,
- Technological issues from the waste-to-energy industry, especially regarding waste types and granulations.

The study also includes a report on the necessary Occupational Health and Safety and Environmental Health and Safety (OHS/EHS) measures required for the DU and presents the stages of the waste treatment process where environmental monitoring is needed, including the design of the monitoring network to be placed in the PL during the DU operation. The OHS/EHS analysis, which resulted to an addition to the PL's standard OHS/EHS volume, also followed the guidelines of the relevant legislation in Greece including existing infrastructure and public networks, unavoidable hazards, alternative working patterns, protection measures, health-threatening construction materials and procedures for handling operational health and safety issues, related to operation, modification and maintenance of the DU.

During the elaboration of the design of the waste treatment process, a number of issues were raised concerning various parameters of the process design. Among them, the most critical was the applicability of the beneficiation process in the DU. In particular the following obstacles may prevent the implementation of the beneficiation process on site:

1. During the field trips (May and July 2014) and the sampling process, no Waste of Electrical and Electronic Equipment (WEEE) was found in the landfilled waste. WEEE was estimated to be less than 0.1% of landfilled waste and from this, only the electrical boards are needed to retrieve the valuable rare metals. Thus, based on the outcome of the sampling activities, there were strong indications that the amount of WEEE in the mined waste would not be sufficient to support the use of a pilot scale implementation unit.
2. An extensive market search was conducted, which was supported under Action B4 (Sub-contracting procedures for Demonstration Unit) showed that it would be extremely difficult to acquire the relevant equipment for the small quantities of material to be processed.

Based on the above mentioned and the relevant internal discussions among the project team, which included consultation with the experts of the SMME/NTUA, it seemed that for the beneficiation of special waste streams such as WEEE, laboratory tests would be a more feasible solution for providing sufficient conclusion of the applicability of the methods used. Nevertheless, since the amount of waste collected during the sampling activities was not very high, it was decided that the final decision about the scale of the beneficiation unit (DU or laboratory) will be made during the initial period of mining of waste, when the real size of the relevant waste stream will be revealed. The actual works of the DU showed that this was true; almost no WEEE could be reclaimed through the Landfill Mining activities, thus this was the course of action which was followed.

The final design of the DU is described in detail in the Technical report (Annex 9), accompanied with the necessary specifications which were used during the sub-contracting procedure of Action B4 (attached as a separate Appendix of the report). Beyond the PL pilot unit, the waste treatment methods review of the deliverables can serve as a manual on the waste separation methods that can be used in other Landfill Mining projects. Many of these methods are presented in the "Expert report by the scientists of SMME and HELECTOR", attached in Annex 10.

Time schedule:

Even though the Action had an early start, as mentioned in the IncR, some delays occurred, mainly due to the reasons below:

- Previous tasks (waste sampling) were carried out later than planned and as a consequence, the Technical report was also delayed.
- Extensive and very specific market research,
- Selection of Alternative solutions for the separation of waste, the granulation and the beneficiation stage.

This did not affect the project's continuation, except for some short postponement (approximately 1-2 months) in the end of action B4 and the commencement of actions B5 and

B6. To overcome the effect of these delays, the Project Team mobilised more members to cover some of the time while working on these Actions, with a view to having the least delay possible on their deliverables.

Implemented by: SMME (responsible beneficiary), ENVECO S.A., HELECTOR S.A.

Deliverables:
Technical report of the final design for the waste treatment Demonstration Unit (Reviewed and resubmitted in Annex 9).
Expert report by the scientists of SMME and HELECTOR (Annex 10)

Changes in the Financial Part of the action:
The amount of €250.00 was proposed to be transferred from ENVECO's "personnel" budget to the same category of action B2 (see §4.1.5).

Expected results:

- Final design of the waste treatment DU.
- OHS/EHS report.
- Procurement specifications for DU machinery.

4.1.7. Action B4. Sub-contracting procedures for Demonstration Unit

Foreseen start date: 10/2014 **Foreseen end date: 1/2015**

Actual start date: 10/2014 **Actual end date: 3/2015**

Description of the action:

This Action followed the specifications that were produced in the previous Action (B.3) and was running in parallel since the creation of the first draft DU design report.

The tasks elaborated during this Action were the following:

- Consultation of the Green Procurement Toolkit, developed by the EU, especially about legal and practical issues,
- Extensive Market research about the specialised equipment which covers the needs of the DU,
- Elaboration of a Call for Proposal for the renting of the equipment of the waste separation DU,
- Issuing of the Call for Proposals for tender on the provision and installation of necessary machinery and equipment and sending it to a number of potential candidates.
- Receiving and evaluating of the Proposals,
- Negotiations between the Management Team and the most suitable candidate and
- Signing of the contract.

In parallel, HELECTOR also conducted market research to find the best candidates regarding the rental contracts for the rest of the equipment and services needed, in order to prepare the site for the installation and smooth operation of the DU.

Time schedule:

The main reason for the delay of this Action is the delay of Action B.3, as they are connected to each other. Furthermore, another issue that was faced was the limited availability of businesses carrying the basic equipment which was hired from the market, as identified in the proposal, which led to a longer market research and a limited availability of candidates.

Implemented by: ENVECO S.A. (responsible beneficiary), HELECTOR S.A.

Deliverables:

One contract for the provision and installation of the Demonstration Unit equipment and all relevant documentation (Annex 11)

Changes in the Financial Part of the action:

Regarding the beneficiary “HELECTOR” a change has been made, as far as it concerns the junior project manager’s rate, which was lower than the rate submitted in the financial proposal. Consequently, the personnel cost for this action had to be modified (€2,565.00). The remaining amount of €2,185.00 was transferred to the category “travel” of Action E3, since the Beneficiary “HELECTOR” did not foresee the necessary trips for the implementation of their actions.

Expected results:

One or more sub-contracts for the provision and installation of the Demonstration Unit equipment.

4.1.8. Action B5. Pilot-scale Demonstration Unit installation

Foreseen start date: 2/2015 **Foreseen end date: 3/2015**

Actual start date: 3/2015 **Actual end date: 5/2015**

Description of the action:

Within this Action the Demonstration Unit was installed in the Polygyros Landfill. The installation was carried out by the sub-contractors appointed under Action B.4, and by personnel belonging to HELECTOR S.A., collaborating with and supervised by other members of the Application Team from NTUA-SMME and ENVECO S.A.

Through a series of organisational meetings, the installation activities schedule was created and specific roles and responsibilities were appointed to all Team members. Three construction crews were formed, the first belonging to the sub-contractors under the supervision of HELECTOR and ENVECO (responsible for connecting and installing the provided machinery) the second consisting of HELECTOR personnel under the supervision of ENVECO (responsible for preparing and connecting the power and water infrastructure needed for the equipment installation, installation of the liner membrane, etc.) and the third belonging to NTUA (responsible for setting-up the Environmental Monitoring network). The three crews cooperated closely in order to install the Demonstration Unit and test the machine array for final adaptations to achieve the most efficient operating system and its correct monitoring. Also, during this stage the day-to-day works of the DU were finalised and a special Record Sheet Template was created to monitor the activities, the inputs and the outputs of the Unit.

The Action was documented in an installation report which describes the necessary preparation for the connection of the power, the water and terrain infrastructure, as well as the installation of the machinery. It also describes in detail the environmental monitoring equipment set up for the assessment of the air quality on site and the noise measurements. Furthermore, all the issues that were encountered during the installation works and the deviations from the design of the Unit (Action B3) are also depicted in the report along with the measures taken for their settlement. Consequently, this Action followed and documented the installation process and the adaptation of the DU from its design to the real conditions, providing interesting insight for future LFM projects.

Time schedule:

The Action had a starting delay of around two months. The delay concerned only the time schedule due to the delay of the prerequisite actions (B3 and B4) and it did not affect the technical works of the action.

Implemented by: ENVECO S.A. (responsible beneficiary), SMME, HELECTOR S.A.

Deliverables:
Technical report of the Installation of the Pilot Demonstration Unit (Annex 12).

Changes in the Technical Part of the action:

The main changes which occurred in the DU in comparison to the design stage were the following:

- The beneficiation phase of the Unit is the part of the processing where reclaimed WEEE would be dismantled, broken down and reduced in size to a powder. Then a metal concentrate would be extracted with a float-sink tank, used mainly in metallurgy. The tests required at least 10kg of Printed circuit boards (PCBs) from WEEE. Originally, during the design stage of the Unit (Action B.3.), the Team made an effort to implement the Beneficiation stage on-site, in the Polygyros Landfill, but during the next stages of the project, it was decided that laboratory tests at the SMME/NTUA would be a more suitable solution to provide conclusions on the applicability of the methods used, based on a number of reasons. The lack of substantial quantities of WEEE in the PL, as none was recovered during the sampling trips, did not justify technically and financially the installation of a Beneficiation stage at the pilot unit. Also, special waste such as sludge could have been produced that would need complicated arrangement in the Unit site to handle and dispose of. Thus, the Beneficiation tests were conducted ex-situ, at the laboratory of SMME/NTUA, with a sample of 13.4kg of PCBs. These were retrieved from a source-separation WEEE collection point which exists inside the Polygyros Landfill.
- During the final days of the installation of the demonstration unit, the first waste processing tests took place. They showed that some adaptations to the procedure were necessary to ensure optimal productivity in order to achieve the target waste volume within the available timeframe. Thus, the materials recovered from the excavated waste were separated into 8 categories, which included hard plastics (PET, HDPE and PP), soft plastics (FILM), glass, aluminium, ferrous metallic items, residual waste, stones and the smaller fraction (<70mm, separated by the trommel, with soil material, garden waste, small items and fragments of paper, plastic, glass, etc.). The smaller fraction would then be sieved again with a 10mm sieve to recover the Soil Material (<10mm fraction).
- Additionally, some more supporting machinery (excavator, platform tractor, etc.) were necessary for the LFM activities in the Unit, to increase productivity within this limited timeframe without interfering with the daily landfilling activities of the Polygyros landfill, so they were leased for this purpose.
- Moreover, many heavy rocks were discovered among the excavated waste and a member of the staff was responsible to remove them so that they would not damage the mechanisms by falling on the membrane.

- To optimise the management of the daily activities of the Unit, the following adaptations also took place:
    - A dedicated storage space was selected for the separated materials which were stored into tarpaulin Big Bags.
    - A set of metal “knives” were installed inside the trommel cylinder to help with tearing up the plastic bags of the excavated waste.
    - A dedicated resting area for the staff was also created, as the landfill offices were far from the PDU installation site.
    - Shading net was installed above the Unit to protect the staff from sunlight.

For more details on the changes from the design of the Unit, see ch. 5.3. of the Technical report, attached in Annex 12.

Expected results:

The Demonstration Unit was installed and was ready for operation at the end of the Action.

4.1.9. Action B6. MSW mining, operation and testing

Foreseen start date: 4/2015 **Foreseen end date: 9/2015**

Actual start date: 5/2015 **Actual end date: 9/2015**

Description of the action:

This was the core Action of the landfill mining operations and consisted of several tasks, related to the operation of the DU, its monitoring and the beneficiation as well as the sample tests.

i. Waste mining activities (on site): The activities were realised using personnel from HELECTOR, ENVECO and the subcontractors, as well as rented and existing equipment inside the PL. The excavated waste was around 1300m^3 (580tn) and the LFM activities were carried out for 45 days, during June and July 2015, according to the availability of the subcontractor machinery, established during Action B4. The DU activities included: Extraction of waste with excavator and transportation with truck to the Unit location, regular weighting of inputs and outputs, feeding of waste to the Unit assembly using a backhoe loader, separation of smaller waste fraction and soil from larger waste using a Trommel sieve, hand-sorting of waste (hard plastics, plastic bags, aluminium cans, glass, electrical waste, etc.), magnetic separation, washing of the waste in small batches and temporary storage of the materials. All activities were logged in the special Record Sheet (created during Action B5). The material separation resulted in 1612kg of Aluminium, 6220kg of Ferrous metallic materials, 19470kg of Plastic Bottles (PET, HDPE, etc.), 1680kg of Glass, 32570kg of Soft Plastic (FILM, etc.), 28700kg of soil material (material fraction of <10mm size) and 131710kg of residue material. The rest of the material (358585kg) was of a smaller fraction (between 70mm-10mm) and it was not suitable for hand-sorting.

ii. Field Monitoring Measurements: Monitoring commenced at the start of the operation of the DU, targeted at the areas where the main works (waste mining and processing) were taking place. The monitoring plan was designed to quantify the expected environmental impacts and concentrated on the site's air quality (gas emissions/odours as well as dust problems), other nuisance issues (noise problems) and finally the waste generation relating to the processing and valorisation actions taken place there (waste sampling). Special attention was given to the safety of the workers and to the minimisation of the impacts to the environmental condition of the neighbouring areas.

The PM-10 measurements were made over a total period of more than 1 month, in June and July of 2015, resulting in more than 30 24-h air samples. The background value was rather low, at 8.2 μg/m^3, while the overall average daily value (24h) of PM-10 was also low, calculated at 9.3 μg/m^3. The monitoring relating to odours and other gaseous emissions (CO, CO_2, CH_4, NO_x, H_2S), did not yield any significant results. The sound level measurements were made to assess the overall noise from the LFM pilot application. The background noise

levels at the PL site is $L_{eq(A)\_back}$=58.6 dB(A) and can be characterised as "typical" for a rural area. The average for the operating unit is $L_{eq(A)\_oper}$=77.6 dB(A).

A series of water samples were collected and analysed in order to characterise the leachates derived from the Washing Tests of recovered waste. One sample was also collected from the rainwater collection tank which was installed in the area of the Pilot Demonstration Unit. It was found that most of the samples could enter directly to the secondary treatment stage of a biological treatment facility, due to the relatively low BOD, COD and solids concentrations. Also, the samples were investigated for metals and metalloids (As, Cd, Cu, Mn, Pb, Fe, Ni, Zn and Cr), which were generally low. Only one sample was found to exceed the proposed limit values of the national legislation for Mn and Zn concentrations exceeded the proposed limit values. For more information, see ch.6 of the Technical report of Action B.6 (Annex 15).

iii. Beneficiation tests: Recycling of electronic and electrical devices started along with the operation of the Polygyros Landfill. As a result, during the sampling trips in May 2014 and the LFM works, no electrical or electronic waste was found. A sample of e-waste (13.4 kg of electrical and electronic boards) was taken from the dismantled WEEE, which was found in the e-waste dedicated disposal facility of the landfill. The boards underwent size reduction and sorting. From this sample, 13.4kg of pulverized printed circuit boards (PCBs) were used for the flotation tests. The samples were analysed and found to contain Arsenic (As), Cadmium (Cd), Copper (Cu), Manganese (Mn), Lead (Pb), Iron (Fe), Nickel (Ni), Zinc (Zn), Chromium (Cr), Palladium (Pd), Silver (Ag), Platinum (Pt) and Gold (Au).

The flotation tests were conducted using a Denver "Sub-A" flotation machine of the Laboratory of Mineral Processing (NTUA). The designed flotation tests were conducted in three different stages successively and involved twelve different tests. The test procedures applied are presented in detail in ch. 5 of the Technical report of Action B.6. (attached in Annex 14).

Plastics and lightweight material are easily removed with the "floats". From the precious metals, Au and Pd tended to "float" and Ag to "sink", while the other metals of economic value (Cu and Fe) go to the "floats" or the "sinks", respectively. Ag presents an indifferent behaviour between the "floats" and the "sinks".

After flotation, the recovery of the metals achieved was: Au 80.5%, Pd 83.0%, Ag 37.5% and Fe 76.3% in the "floats", while for Cu 74.0% and Ag 46.4% in the "sinks".

iv. Post-assessment of results: Around 20% of the excavated waste was reclaimed as separated materials from the Unit. This is a modest rate of recovery and it could be increased for larger-scale applications with a few technical modifications to the unit, such as the addition of an air-separator, an Eddy-current separator, etc. Additionally, the use of innovative technological elements such as sensors could maximise the material reclamation. As for the LFM method in general, it seems that larger and older landfills would have much greater recovery rates than the Polygyros Landfill as they contain more recyclable materials.

The Monitoring of the air, dust, odours, noise and water emissions during the LFM activities showed that there was no significant impact to the environment. However, this is attributed to the specific characteristics of the PL, which is a landfill with rather new waste (operational since 2009) and it could vary in other cases. Consequently, future LFM projects should also monitor closely their impacts. Finally, the Beneficiation lab tests revealed that flotation could facilitate WEEE recycling and increase recovery of metals, although more research is necessary to determine the full potential of the method at larger scale.

Time schedule:
The action started with a one month delay, following the delay of actions B3, B4 and consequently B5. However, this did not affect the technical results and it was completed according to the timetable.

Implemented by: ENVECO S.A. (responsible beneficiary), SMME, HELECTOR S.A.

Deliverables:

- Technical report for MSW Mining, Treatment and Tests Assessment (Annex 13)
- Results from beneficiation tests of concentrates (Annex 14)
- Results from air and water monitoring activities (Annex 15)

Changes in the Technical Part of the action:

- At the design period (Action B3), it was proposed that the final quantity of processed waste would reach 2000m^3, instead of 1000m^3, which was mentioned in the LIFE reclaim Grant Agreement in the beginning of the project. This larger sample would serve to reach to firmer conclusions about the contents of the landfill and the operation of the DU. However, even though the Unit was designed to process 2000m^3, due to many issues and delays during the processing of the waste, the productivity of the Unit was far lower than it was initially expected. To increase productivity, many changes to the machinery, adaptations and optimizations to the Unit were realized, whilst trying to keep the cost within the budget. These steps helped to reach up to around 1300m^3 (580tn) of mined and processed waste, a quantity which might be lower than the proposed one but it was decided amongst the experts of the Project Team that it would be sufficient so that specific conclusions about LFM could be drawn.
- The weather proved to be one of the most unexpected and productivity-lowering challenges of both the mining and the processing works. Out of the 45 total days of operation (as per contract) almost 20 of were rainy. Rain would altogether halt the processing procedures, thus the mining works would have to be stopped as well. Also, the stock area should have been covered, at least during rainy days and for a few times a plastic sheet was used as temporary cover. Otherwise, the stock waste was also wet

during the next day after heavy rainfall, causing many problems to the DU and decreasing the productivity of the Unit. On the other hand, the high humidity content of the waste limited the potential dust emissions during LFM activities.

- For the Beneficiation tests, the major difficulty was the absence of WEEE from the landfill excavated waste. Thus, a sample of PCBs from e-waste (13.4 kg of electrical and electronic boards) was taken from dismantled old electrical and electronic waste, which were found in the disposal of electrical and electronic devices facility of the landfill, was used for the beneficiation process in an attempt to assess the most promising method to recover/reuse the valuable materials.
- During the design stage (Action B3) it was decided that it would be better to monitor the pollution in the ambient air by means of continuous ambient air-quality monitoring equipment, namely the Ambient Particulate Mass Monitor - TEOM™ 1400ab (Rupprecht & Patashnick Co. Inc.). Continuous real-time monitoring of the PM-10 concentration offered considerable advantages over intermittent average sampling. The continuous monitor assisted in obtaining information on peak PM-10 concentrations during the operation works within short time sampling periods and gave a much better picture of the true impacts of LFM operations. Given that the recorded concentrations were much lower than the relevant standards there was no need to collect any air samples.

Changes in the Financial Part of the action: Please note that for the Beneficiary SMME-NTUA, the personnel budget between Actions B5 and B6 was spent reversely, due to a proposal mistake. The larger amount of work had to be done for Action B6 instead of Action B5, as it was initially calculated.

Expected results:

- *Processing of at least 1000m^3 of waste*: The DU processed around 1300m^3 (580tn) of waste
- *At least 20 laboratory beneficiation tests:* In total, twelve floatation tests were conducted given that the pulverized PCBs used derived from a relatively homogenous sample of obsolete electronic equipment. To counterbalance the deviation from the original design more samples were chemically analyzed for a number of metals (commons and precious) and metalloids, and the pulps obtained, after filtration of the flotation products, were investigated for the presence of metals and metalloids and were characterized from an environmental viewpoint.
- *At least 30 samples of on-site and laboratory tests of air and water samples (in total):* More than thirty ambient air samples equivalent to 24h intermittent samples were collected on-site, and a number of measurements were conducted by means of personal monitoring units to detect gaseous emissions during the excavation and the processing of the waste. In addition, fourteen water and pulp samples were chemically analyzed and

were characterized from an environmental viewpoint and a number of measurements took place in the vicinity of the excavation and of the processing unit to record the sound levels for occupational hygiene purposes, as well as in the greater area of the site to assess possible impacts to the environment.

4.1.10. Action B7. Environment rehabilitation plan

Foreseen start date: 4/2015 **Foreseen end date: 10/2015**

Actual start date: 4/2015 **Actual end date: 1/2016**

Description of the action:

The main objective of this Action was the presentation of the options for rehabilitation of landfills after landfill mining, the way to decide on the most suitable one and the necessary steps towards the clearance, consolidation and final rehabilitation. This report can serve as a helpful resource for future LFM projects as it provides examples of many different alternatives for rehabilitation and it follows the complete process towards deciding the most appropriate, based on the key characteristics of each site. It also follows in detail the final procedure which could be used to choose the best fitting alternative, using a Multi-criteria Analysis decision tool.

The Project Team elaborated an extensive research on the national and international experience of landfill and dumpsite rehabilitation, as well as the Multi-Criteria Analysis methodology and applied it to present a proposal for the rehabilitation of the Polygyros Landfill, taking into account the peculiarities of the project. These are the main steps that were followed during the course of this Action:

1. Elaboration of a national and international literature review covering the legal framework and rehabilitation plans related to landfill or waste mining, using peer reviewed papers, congress publications and other resources.
2. Presentation of landfill rehabilitation alternatives relative to the Greek reality and selection of alternatives based on the main characteristics of the site: location, topography, demographic data, natural environment, etc. Then, the specific characteristics of the Polygyros landfill were examined and a set of alternatives were chosen for its rehabilitation after a potential complete landfill mining project: Return to Natural state, Commercial/Industrial use, Recreational area, Industrial Composting Facility, Construction and Demolition (C&D) Waste Recycling and Disposal Facility.
3. Development of the RECLAIM-hab, a Multi-Criteria analysis decision tool, based on the Analytic Hierarchy Process methodology, to facilitate the assessment and the evaluation of the rehabilitation alternatives. The tool was used as it can make pair-wise comparisons between qualitative criteria which constitute a hierarchy, so that each alternative option can be compared to one another using this structure. The main criteria used in this process were the Environmental factor, the Financial factor and the Social factor.
4. Selection of the better suiting alternative for the PL, using the RECLAIM-hab tool: through the comparison of the proposed alternatives, the better suiting choice was found to be the reclamation of the landfill site to construct a Composting Facility.

5. Creation of a virtual rehabilitation of the Industrial Composting Facility in the PL, using 3D design technology. The selection of this approach owes to the fact that PL is still in operation and it was not possible to rehabilitate it in reality. However it serves as a rehabilitation proposal for the future of the site, after the PL reaches the end of its lifetime.
6. After the virtual rehabilitation was elaborated, it was uploaded online, on the project website www.reclaim.gr.

Among the other results of the project, the technical report, the RECLAIM-hab tool and the proposed rehabilitation plan for the PL of this Action were presented to all interested stakeholders and policymakers during the third conference of the LIFE reclaim project, the "2nd National Conference in Landfill Mining and Alternative Waste Management Methods" (15&16/6/2016) in Athens. Additionally, they were also showcased through the project's newsletter.

Time schedule:
The action started on time with the literature research (04/2015). However, some delays occurred during the design of the 3D model and the virtual video, as some reviews were necessary to get the best results. Thus, it was completed during early January 2016.

Implemented by: ENVECO S.A.

Deliverables:

- Rehabilitation Plan Technical Report (Annex 16)
- 3D virtualization of the PL landfill rehabilitation (available on the Reclaim website and in the attached DVD disk, in the folder Annexes-DVD)

Expected results:

- One (1) rehabilitation plan for the PL, complete and provided in the Technical Report of the Action.
- One 3D virtualization of the PL landfill rehabilitation, live on website.

4.1.11. Action B8. National Action Plan elaboration

Foreseen start date: 10/2015 **Foreseen end date: 3/2016**

Actual start date: 10/2015 **Actual end date: 6/2016**

Description of the action:

The main objective of this Action was the evaluation of the opportunities, the scope of the implementation of Landfill Mining at a National Level and the elaboration of a proposed National Action Plan for the introduction of Landfill Mining in Greece.

The current policies and strategies on waste management of Greece were firstly evaluated. The relevant legislation was analysed and the current National Waste Management Plan was presented on which the Regional Waste Management Plans of each region of Greece are based. Also, the presentation of the various objectives, the technical aspects and specifications of the Landfill Mining method are discussed and the results of the LIFE reclaim DU are briefly presented. Additionally, the main reasons for the potential of LFM in Greece are examined:

- The vast number of illegal dumpsites, which are already closed or are in the process of being covered
- The significant number of Landfills near or within urban areas where there is a high demand for land reclamation
- The increased pressure to extend the lifetime of landfills in many areas

The main Goals of the National Action Plan were developed, divided into Environmental and Socio-economic. The Environmental Goals include land remediation, recycling of resources and the reduction of buried wastes, whereas the Socio-economic Goals include the protection of human health, the increase of land value, the economic growth opportunities for new businesses and new jobs, as well as a continuing information and education of all interested parties.

Furthermore, the potential Landfill Mining Policy alternatives were described and assessed with qualitative criteria to choose the best option for Greece. The specific alternatives examined for Greece are: A. Landfill Mining for Resources Recovery, B. Landfill Mining for Energy Recovery, C. Landfill Mining for Land Reclamation/Extending the Lifetime of a Landfill and D. Landfill Mining for Remediation of Contaminated Lands. The evaluation suggested the alternatives C and D as the better suiting ones for the National Action Plan. A complete Landfill Mining Policy was elaborated on the selected alternatives with key objectives land reclamation and the extending of landfill lifetime in specific cases as well as restoring contaminated sites and eliminating the negative impact on the environment when a waste disposal site is a proven source of pollution to soil and groundwater. The proposed method is using traditional Landfill Mining technology and taking each case individually.

Subsequently, a Road Map was created which consists of the three following steps for the implementation of the National Action Plan: Institutional consolidation of LFM in Greece, Selection of landfill sites for LFM, Elaboration of LFM projects The specific tasks (Actions) for the elaboration of the Plan were also provided, along with suggestions about the specific authorities responsible for each Action and an indicative time-schedule.

The NAP is also equipped with the assessment of all the available alternative financial instruments that can be used for the implementation of the National Action Plan and the LFM applications. These include several subsidies, the Green Fund and many other financial tools. Finally, Monitoring Indicators for the implementation of the Plan are provided, inspired by the LIFE reclaim project indicators and they fall in the main categories of Waste Minimisation, Materials Recovery, Climate Change, Energy, Water Resources, Raw Materials, Human Health-Environment-Quality of Life, Land Recovery, Economic Indicators, Social Indicators and Socioeconomic Indicators.

The NAP report was elaborated in Greek to facilitate the potential application of the Plan by the Greek authorities. It has been uploaded online and it will be communicated to all relevant authorities as part of the After-LIFE Communication Plan actions to promote the implementation of LFM in the country in a systematic and regulated manner. Also, as an action of the After-LIFE Communication Plan, a supporting tool for policy change will be created to guide the policy-makers through the NAP and help them to understand the benefits of the proposed policy amendments.

In particular, the Team intents to carry on with the dissemination of the project results, based upon its network of contacts from the project Actions and events (Conferences, meetings, workshops, etc.) and inform the policy makers about the National Action Plan with targeted actions to all the three territorial levels of policy-makers: national, regional and local. The successful adoption of the NAP lies with its endorsement by the Ministry of Environment and Energy as well as the Ministry of Interior and Administrative Reconstruction and for this purpose meetings with the two Ministers will be arranged to inform them personally about the project results and the opportunities and limitations of LFM. Also, the Team will contact the SACEP (Special Agency for Coordination of Environmental Projects) which can assist the promotion of the implementation of the National Action Plan. Furthermore, several meetings with representatives from regions and Municipalities have already begun to take place as they have approached the project Beneficiaries expressing their interest in conducting LFM projects in their area. The efforts towards realizing these projects, emerging from pressing local issues, can reach to the ministerial level via a bottom up approach and promote policy change.

Additional actions have been scheduled which can also promote policy change and influence policy-makers via different routes. Within this context, ENVECO will take advantage of its active membership to the EURELCO group, a EU-wide network of stakeholders interested in LFM with the main purpose to promote LFM and influence policy

change at the level of the Commission. ENVECO will observe closely EURELCO's ongoing effort to establish a LFM policy, which will eventually influence policy change at a national level as well. Moreover, the contacts network established during the project (more than 1500 newsletter subscribers, attendees to the conferences, etc.) will be used to continuously inform the policy makers, the scientific community, the business sector and the general public via the project website, the newsletters and the project's social media accounts on the policy change progress towards implementation of LFM and any other relevant news. From these contacts, professional interest has already begun and many new applications of the method are emerging in Greece, thus, the need for a concrete and integrated national framework for LFM is more pressing.

The results from this Action are also valuable at other EU countries which face similar conditions in the waste management sector as Greece and the NAP could be easily adapted according to their specific needs. Finally, it can serve as a LFM policy suggestion to the Commission itself, as a way to increase resource recovery, waste valorisation and circular economy.

Time schedule:
The action commenced according to the timetable (October 2015). Some delays occurred during the hiring of the necessary temporary personnel for this action by the Municipality of Polygyros but after these administrative obstacles were resolved, the Plan was completed during June 2016.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP

Deliverables:
Technical report of the Action Plan (Annex 17).

Expected results:
The expected results in the Grant Agreement included the coverage of all regions of Greece excluding islands, as regards their potential from landfill mining and the reclamation of value from old landfills and dump-sites still in operation. However, during the course of the project, the Team was contacted by many different island regions which wanted to learn more about LFM and there was an increased interest as to how it could be applied to the numerous waste issues faced on the islands. Thus, the National Action Plan was elaborated for the whole of Greece to cover for all 13 Regions of the country.

4.1.12. Action B9. Financial and socioeconomic analysis

Foreseen start date: 7/2014 **Foreseen end date: 12/2015**

Actual start date: 9/2014 **Actual end date: 1/2016**

Description of the action:

The scope of the Action was to conduct a complete financial and socioeconomic analysis for the landfill mining process, using PL as a case study. These results were also used as a reference in the process of creating an analysis tool for similar future projects on policy and economics. During the course of the Action, the following tasks were elaborated:

I. Non-market valuation research, which included:

- Literature review on environmental economics applications in waste management and estimation of environmental and social externalities by means of secondary methodologies (benefits transfer).
- Design for two (2) primary surveys aiming at the valuation of society's WTP for supporting landfill mining projects (survey instrument design, focus groups, testing and survey organization).
- Conduction of two field-surveys at local (i.e. in the project area) and at national level.
- Analysis of the surveys' results by means of statistics and econometric modelling methods.
- Reporting on the surveys.

II. Financial analysis of LFM process at local and national level, which included: construction of alternative scenarios, gathering of financial data for the PL and the DU to form a coherent financial plan for effective landfill mining, communication with market experts, forecasts of cash-flows for alternative LFM scenarios, estimation of appropriate economic indicators, i.e. Net Present Value (NPV) and Internal Rate of Return (IRR), uncertainty analysis (i.e. sensitivity analysis and probabilistic risk models), and relative reporting.

III. Cost – Benefit Analysis of LFM process at local and national level, which was based on the financial analysis after appropriate adjustment of the financial cash flows in order to reflect the external socioeconomic effects of LFM. The adjusted cash flows (social cash flow) were then used in order to estimate the Social NPV and the Social IRR of the project. To this end, the European Union's guidelines were followed, taking into consideration the following adjustments:

- fiscal corrections;
- conversion from market to shadow prices;
- evaluation of non-market impacts and correction for externalities.

The shadow wage approach was adopted for the direct employment effects. The environmental externalities were estimated using the results of the primary valuation studies conducted at local and national level, and an appropriate social discount rate was selected according to the European Commission's recommendations. Finally, uncertainty analysis (i.e. sensitivity analysis and probabilistic risk models) was conducted and the results were reported.

IV. Policy and economics analysis tool for future landfill mining projects, which consisted of the elaboration of a technical handbook on best practice for valuing costs and benefits from landfill mining projects and an interactive tool for handling the environmental economics of landfill mining (valuations, financial calculations, important variables etc).

Time schedule:

There have been some delays in this Action and in particular to its first phase (local survey) due to the fact that the data from the questionnaire of the Action B9 would be very much affected by the national Greek elections. Thus, the Project Team decided that this Action had to be postponed until the socioeconomic conditions were once again been stabilised. Moreover, it seemed to be best if the interviews of the local survey were carried out at the same time with the national survey (during March-April 2015). However, even though the socioeconomic conditions of Greece remained unstable through the next months (e.g. the Greek Referendum, Capital Controls, etc.), the local and national surveys were carried out during April-July 2015, so that there wouldn't be any compromising delays to the Action, as the difficult situation seemed to be long-lasting. Hence, the Action was completed with just a short delay in January 2016.

All in all, this Action is one of the most important of the project, as it provides a detailed analysis on the financial and socioeconomic aspects of LFM, which was absent from the relevant literature. What is more, it examines the method's application in different scenarios, all adapted to the Greek reality, exploring a number of different options (e.g. in landfill size, equipment and personnel use, etc.) and presenting a detailed analysis which can help inform the decision makers in order to adopt a policy for the use of LFM in the country.

Implemented by: SMME (responsible beneficiary), ENVECO S.A.

Deliverables:

- Technical report for local survey (Annex 18)
- Technical report for national survey (Annex 19).
- Policy and economics analysis tool (Annex 20).
- Technical report for the socioeconomic analysis (Annex 21).

Expected results:

This Action provided a quantification of the socioeconomic impact of landfill mining at local (i.e. project area) and national level. The results provided a valuable insight into the degree of social acceptance of LFM, the potential financial and social costs and benefits, and, consequently the financial and socioeconomic feasibility of LFM projects. Therefore, this Action offered useful information for practitioners and policy-makers about the 'dollar-based' benefits of LFM. Additionally, it is the first time that the financial and social costs and benefits of LFM were successfully estimated in quantitative terms, in Greece. The analysis is based on the data gathered during the first pilot application of LFM in Greece, i.e. the results derived from the Polygyros case study. Nevertheless, the analysis extends beyond the Polygyros Landfill site by means of different evaluation scenarios, in order to increase its usefulness. All in all, this Action aimed to fulfil the following two objectives:

(a) To evaluate technical, economic, environmental and sociological issues associated with the feasibility of LFM in Polygyros area and in Greece.
(b) To draw conclusions and make recommendations on the basis of this study for the critical factors affecting the feasibility of LFM projects, in general.

4.1.13. Action B10. Strategic Environmental Assessment Study

Foreseen start date: 7/2015 **Foreseen end date: 3/2016**

Actual start date: 7/2015 **Actual end date: 3/2016**

Description of the action:

Taking into account information from various stages of the project, the Action included the elaboration of a Strategic Environmental Assessment (SEA) for the implementation of the National Action Plan (NAP) of Action B8. The SEA consists of a system of incorporating environmental and social considerations into policies, plans, programs and strategies. It encourages an 'opportunities and constraints' type approach to development, where such things as natural resources and ecosystem services at landscape scale define the 'framework' within which development can take place and the types of development that could be sustained. The SEA report was elaborated in Greek to facilitate its reception and examination by the relevant authorities and subsequently the implementation of the NAP. The Action included three main stages for the preparation of the SEA:

Stage 1: Establishment of the SEA context – Screening phase: Screening involved the assessment of Greek legislation regarding SEA (Joint Ministerial Decision 107017/2006) and the definition of the exact aspects of the NAP that fall into the provisions for conducting the assessment.

Stage 2: Implementation of the SEA:

- **Scoping phase:** During this stage, the content of the SEA was established, setting the relevant criteria for assessment, recommending alternatives to be considered, suitable methods for analyses of key issues and sources of relevant data. Through this procedure, the necessary specifications for the Environmental Report emerged.
- **Environmental Report:** The collection of existing baseline information followed, which are needed for a thorough understanding of the potentially affected environment and social systems. It involved data gathered during the Preparatory Phase and also baseline data on the environment in the Greek territory. The relevant Environmental sectors which were studied were: climate, water bodies and resources, air, soil, noise, ecosystems-flora-fauna, as well as manmade environment (settlements, socioeconomic characteristics, etc.). This information was used as a base to support alternative selection and impact assessment. During this stage, a number of reasonable alternatives of the proposed plan as well as a counterfactual scenario were considered and assessed based on the smallest expected environmental footprint.
- **Programme detailed description:** Based on the alternatives examination, the final solution was presented in detail, taking into account the findings of previous Actions.
- **Impact assessment:** Based on a desktop study that included report impacts in the literature, the main characteristics of the final solution which could potential yield any

impacts on the baseline conditions were identified. Then, the environmental impacts were estimated for every environmental sector. The driving forces stemming from all the proposed activities of the NAP were determined and the related pressures were analysed: air and noise emissions, wastewater, waste residues, etc. The significant impacts were defined and were also rated according to their significance, probability of appearance and duration. All significant impacts were presented in the relevant report.

- **Mitigation:** a series of measures were proposed for mitigating the recognised impacts. These include: selection of areas based on nuisances prevention, transport minimization schemes, maintenance / improvement of the equipment, control of the EU certifications for noise and air emissions, selection of treatment technologies for the reduction of the residue, design of effective seal system and collection of leachate, law implementation and legislative interventions or amendments. The aim was to develop "win-win" situations where multiple, mutually reinforcing gains can strengthen the economic base, provide equitable conditions for all and protect and enhance the environment.

Stage 3: Informing decision making: The final stage of the preparation of the SEA consisted of a concise Briefing Note which was created to ensure that decision makers are fully aware of the key environmental issues linked to the proposed programme.

Through this Action, the research, assessment and elaboration that a SEA requires was conducted. The ending report can be used to further inform the policy-makers on LFM and the NAP proposed by LIFE reclaim. Finally, it facilitates the implementation of a LFM policy as when the Action Plan is adopted, the SEA will be available to be put to use as it is or with any needed amendments.

Time schedule:
The action started as foreseen and was completed within the proposed timeline.

Implemented by: ENVECO S.A.

Deliverables:
SEA report on the National Action Plan (Annex 22).

Expected results:

- Strategic Assessment of Impacts from the National Action Plan on landfill mining and proposed measures
- Communication Plan for the public consultation procedure (this procedure was not included in the Project, but is available for use by the Greek authorities and will be promoted through the After-LIFE Communication Plan)

4.1.14. Action C1. Monitoring the environmental impact of project Actions

Foreseen start date: 7/2013 **Foreseen end date: 5/2016**

Actual start date: 7/2013 **Actual end date: 5/2016**

Description of the action:

The objective of the Action was to monitor and document the impact of the Project to the environment, using suitable and comprehensible indicators. The objectives of the project were related to the following environmental sustainability sectors:

- Recovery of Metals,
- Recovery of recyclable Materials,
- Recovery of energy materials,
- Land reclamation and rehabilitation,
- Life-time extension for landfills.

Parallel to this, the Project is considered to be related to water (through potential water use and/or wastewater discharges) and to air (through possible air emissions). Within this context, the Project Team established suitable indicators, which were presented in *IncR-Annex 12*.

The Action was running in parallel to the other Actions. It was designed to produce two Annual Technical reports of the Environmental Impact Evaluation of the LIFE reclaim project, one in 2015 and the second in 2016. However, as it was mentioned in the EU letter of 30/06/2015, the pilot Demonstration Unit was installed and operated during May-July 2015 and its impact was documented on the 1st Annual report. The 2nd Annual report follows on the Impacts of the project on several different Environmental aspects concerning the reclaimed soil material and its use as landfill daily cover as well as the residue material and its handling and disposal. Both Annual reports are provided with the Final report in Annex 24 and Annex 25 respectively.

Time schedule:

The action started as foreseen and was completed within the proposed timeline.

Implemented by: ENVECO S.A.

Deliverables:

Establishment of Environmental performance indicators - *IncR-Annex 12*.

Baseline evaluation of the Project, by means of the Environmental performance indicators (Added Findings section and resubmitted in Annex 23)

Technical report of the 1st Annual Environmental Impact evaluation of the project (Annex 24).

Technical report of the 2nd Annual Environmental Impact evaluation of the project (Annex 25).

Expected results:

- *A minimum of six environmental performance indicators* (29 Environmental Impact Indicators were developed).
- One (1) Baseline evaluation of the Project, by means of the environmental performance indicators.
- Two (2) Annual evaluations of the Project, by means of the environmental performance indicators.

4.1.15. Action C2. Monitoring the socioeconomic impact of project Actions

Foreseen start date: 7/2013 **Foreseen end date: 6/2016**

Actual start date: 7/2013 **Actual end date: 6/2016**

Description of the action:

The scope of the Action was to provide the necessary input and evaluation of the Project impact to society, in both economic and socio-cultural terms, through monitoring of socioeconomic impacts, based on predefined indicators.

This Action was running in parallel to Action B.9, directing the scheduled surveys and the extensive socioeconomic investigation of the acceptance and value of waste valorisation as well as incorporating the final findings of the reports of B.9 towards estimating the socio-economic impact of the project.

The definition of the relevant indicators involved social issues related to waste management and local environmental conditions & impacts, such as:

- Perception of waste values,
- Perception of the state of the environment,
- Waste management facility acceptance level,
- Perception of the environmental impacts of landfills.

Within this context, the Project Team established suitable indicators, which were presented in *IncR-Annex 13*. These indicators were reviewed according to the comments of the EU letter on 02/07/2014 and provided with the *MTR-Annex 11*.

Time schedule:

The action started as foreseen and was completed within the proposed timeline.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP

Deliverables:

Establishment of socioeconomic performance indicators (*MTR-Annex 11*).

Baseline evaluation of the Project, by means of the socioeconomic performance indicators (*MTR-Annex 12*).

Technical report of the 1st Annual Socioeconomic Impact evaluation of the project (Annex 26).

Technical report of the 2nd Annual Socioeconomic Impact evaluation of the project (Annex 27).

Expected results:

- A minimum of four socio-economic performance indicators (16 Socioeconomic Impact Indicators were developed).
- One (1) Baseline evaluation of the Project, by means of the socioeconomic performance indicators.
- Two (2) Annual evaluations of the Project, by means of the socioeconomic performance indicators.

4.1.16. Action E5. Training, workshops, meetings

Foreseen start date: 7/2013 **Foreseen end date: 6/2016**

Actual start date: 10/2013 **Actual end date: 6/2016**

Description of the action:

The role of the Action was to establish a network with other waste-related running LIFE+ Projects, as well as holding informal meetings with national stakeholders. In this scope, the following tasks took place:

- The Project Team realised a trip to Thessaloniki at the end of January 2014 and met with the Secretary General of the Decentralized Administration of Macedonia-Thrace. It was a chance to give a presentation about the LIFE reclaim project, as well as to discuss how it could affect the region. Finally, the discussion was also focused on the project's then pending environmental permit (the Minutes of Meeting were provided in *MTR-Annex 13*).
- Since the LIFE reclaim project started, the Polygyros Waste Authority was absorbed into the Unified Body of the Municipal Waste Management of Central Macedonia (FODSA), due to administrational changes. The Project Team arranged a formal meeting with the Chairman of the body to discuss the LIFE reclaim project and ensure their support (the Minutes of Meeting were provided in *MTR-Annex 13*). Also, the local Workshop at Polygyros was conducted on the 15/09/2014, where the local community was informed on the Landfill Mining concept and the content and progress of the LIFE reclaim project (implemented within Action D.3, see §4.2.2.3). Relevant material (presentations, photos and participation list) was attached in *MTR-Annex 24*.
- The Project Team also engaged Hellas Gold into the conversation about Landfill Mining, one the biggest mining company in Chalkidiki. A trip to the company's headquarters was realised in May 2015 to inform them about Landfill Mining, the LIFE reclaim project and the installation of the Demonstration Unit in Polygyros as well as the opportunities that arise for a traditional mining company in this field (the Minutes of Meeting are provided in Annex 28). Hellas Gold has remained a strong supporter of the project by promoting news and publications online and participating actively in the project's Conferences.
- To inform the local stakeholders about the operation of the Demonstration Unit and provide an opportunity for a visit to the Unit's location, an info-session event was organised in the Polygyros Town Hall, on the 10/6/2015, within the framework of this Action. The event included a general introduction about Landfill Mining and a specific presentation of the Demonstration Unit, as well as a closing visit to the PL. It was attended by 18 people (the Minutes of Meeting are provided in Annex 28).
- The Project Team also met with representatives of the Special Waste Association of the Region of Attica (EDSNA), in Athens, which is responsible for the management of the biggest landfill in Greece. The meeting took place in late 2015 and the main target was to

inform them in detail about Landfill Mining, the LIFE reclaim project and its results so far, as well as to discuss the opportunities for Landfill Mining in the Attica Region (the Minutes of Meeting are provided in Annex 29).

– The Project Team also had the opportunity to meet with representatives from the project "*Recording and initial evaluation of risk for polluted sites of Greece*", which is coordinated by the Ministry of Environment and Energy. The meeting was attended by representatives of the Operational Programme "Environment and Sustainable Development" (EPPERAA), the Coordinating Office for Addressing Environmental Damage (SYGAPEZ), the department of Solid Waste Management of the ministry and the environmental consultancy companies ENVIROPLAN and EPEM. It took place in early 2016 and it included the information of the participants about Landfill Mining and the LIFE reclaim project, as well as how the method could be used for the rehabilitation of contaminated sites from waste (the Minutes of Meeting are provided in Annex 29).

Furthermore, throughout the project's progress, the Project Team contacted other relevant LIFE projects and exchanged information and knowledge, such as the LIFE EnergyWaste (LIFE09 ENV/GR/000307), LIFE EMARES (LIFE12 ENV/IT/000411), LIFE BIOWASTE (LIFE10 ENV/GR/000605), LIFE EWAS (LIFE13 ENV/ES/000725), LIFE ISWM-TINOS (LIFE10ENV/GR/000610), LIFE LIVE-WASTE (LIFE12 ENV/CY/000544), LIFE PAVEtheWAySTE (LIFE14 ENV/GR/000722), LIFE ReWeee (LIFE14/ENV/GR/000858) and LIFE Infocycle (LIFE13 INF/GR/001342). The continuous support to these projects is also realised through Links in the LIFE reclaim Website.

Time schedule:
The action was running throughout the total duration of the project.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP

Deliverables:
(2) Minutes of meetings (1st year) (*MTR-Annex 13*)
(2) Minutes of meetings (2nd year) (Annex 28)
(2) Minutes of meetings (3rd year) (Annex 29)

Expected results:

- Establishment of an informal network, including full contact list of all Life+ running projects related to waste.
- Local informal meetings with national stakeholders and scientist from waste and mining sectors (at least 2 per year, 6 in total).

4.1.17. Action E6. Participation and networking

Foreseen start date: 3/2014 **Foreseen end date: 6/2016**

Actual start date: 3/2014 **Actual end date: 6/2016**

Description of the action:

The Action included participation to national and international conferences by members of the Project Team, in order to present the project results and gain valuable feedback from national and international audience.

Apart from the Dissemination Events organised by the LIFE reclaim project, the Project Team has also participated to the following:

- In March 2014, LIFE reclaim joined forces with other organisations and projects and co-founded the EURELCO Group, an international consortium based in Flanders, Belgium, which promotes the ideas of Enhanced Landfill Mining. This meeting took place at the offices of OVAM, the environmental agency of Flanders, where a presentation on the LIFE reclaim project was given to the other partners. Joining EURELCO was a strategic networking action of the LIFE reclaim project, creating chances of after-life activities and long-term benefits, such as:
    - the project being promoted by the EURELCO website,
    - a networking bond was created between experts in the LFM field,
    - the Dissemination actions of LIFE reclaim had more impact as they were reaching more stakeholders in the EU and finally
    - experts from EURELCO participated in Conferences and Events of the LIFE reclaim project, sharing their knowledge and expertise in the LFM sector.
- During 3-5 June 2014, the Project Team attended the Green Week, on *Circular economy – saving resources, creating jobs,* in Brussels, Belgium. It was a great opportunity to present the LIFE reclaim project and engage into networking activities with the 3,100 participants of this massive event.
- On the 14th June 2014, the Project Team joined the *Athens 2014 2nd INTERNATIONAL CONFERENCE on Sustainable Solid Waste Management,* organised by the Athens BIOWASTE LIFE project. An oral presentation about the early results of the project was given and a relative paper was also submitted.
- During 14-17 April 2015 members of NTUA team attended the 24th International Mining Congress and Exhibition (IMCET2015) that was held in Turkey in order to present the core and the first results of the RECLAIM project. They communicated and discussed project aims and results to mining academics and practitioners, who are still not fully aware of landfill mining but they are crucial stakeholders and without their collaboration project initiatives are likely to have limited effects. It is important to note that two persons participated given that the Technical Program included 328

papers, presented in 66 sessions covering a range of topics from technical to business, scientific to socioeconomic related to extraction and processing of minerals and waste. Permission was granted for participating to this event outside EU, in order to maximise the project's dissemination, as the Congress gathered a wide variety of EU experts.

- During 5-8 May 2015 a member of the NTUA team participated in the Conference for Conveying and Handling of Particulate Solids (CHOPS2015) that was held in Israel to present results related to conveying and handling of waste. Permission was granted for participating to this event outside EU, in order to maximise the project's dissemination as the Conference gathered a wide variety of EU experts.
- During 2-4 July 2015 a member of the NTUA team participated in the 3rd International Conference on Sustainable Solid Waste Management (TINOS 2015), in Tinos Island, Greece, to present the first part of the research findings of the empirical study on the environmental economics applications in solid waste management. It is worth mentioning that the TINOS 2015 Conference was organised under the umbrella of the "ISWM-TINOS" (http://iswm-tinos.uest.gr) LIFE+ Environment Policy and Governance Project. To this end, there was an opportunity to encourage cross-communication between the two LIFE+ projects and the partners involved in them and consequently, to maximise the expected benefits given that both projects lied in the field of Integrated Solid Waste Management.
- On December 2015, members of the NTUA team published a scientific paper entitled "Monetizing the social benefits of landfill mining: Evidence from a Contingent Valuation survey in a rural area in Greece" in the journal "Waste Management" (http://www.sciencedirect.com/science/article/pii/S0956053X15302464).
- On February 2016, members of the NTUA team published a scientific paper entitled "How much are people willing to pay for efficient waste management schemes? A benefit transfer application" in the journal "Waste Management & Research" (http://wmr.sagepub.com/content/34/4/345.abstract).
- During 22-26 May 2016 two members of the NTUA team participated in the 3rd Symposium on Urban Mining and Circular Economy (SUM2016) that focused on the concept of Urban Mining and was held in Italy. Two different presentations were given with respect to the results of the RECLAIM project, in general and the recovery of metals from the pulverized Printed Circuit Boards (PCBs) by flotation, in particular.
- During 22-26 June 2016, two members of the Project Team attended the 4th International Conference on Sustainable Solid Waste Management (CYPRUS2016) that wishes to make a step forward in the field of solid waste management through the promotion of innovative technologies and effective practices. The Conference was organised within the LIFE+ LIVEWASTE project and the participation offered an

opportunity for cross-communication between the two LIFE+ projects and the partners involved in them.

All of the publications that were presented are duly annexed in the Deliverable of the Action in Annex 30.

Time schedule:
The action was running throughout the total duration of the project.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP, SMME

Changes in the Financial Part of the action:
Regarding the Beneficiary MoP, the action had no budget on the category "travel" since a mistake has been done on the Financial approved proposal (Form F2). The amount of €1,300.00 was pre-destined for action E2 and not for action E6.

Deliverables:
Report of Action E6, with the papers presented duly annexed (Annex 30).

Expected results:

- *At least 3 papers accepted for presentation in national and international conferences*: 8 papers and one presentation in international conferences, additionally to the presentations of the events of Action D3.
- *At least 5 attending individuals in national/international conferences*: 12 participations in conferences/Green Week/workshops, etc.

4.1.18. Action E7. After-life communication plan

Foreseen start date: 1/2016 **Foreseen end date: 3/2016**

Actual start date: 1/2016 **Actual end date: 3/2016**

Description of the action:

Through this Action the most appropriate means for the continuation of the positive feedback of the Project and for the generalisation of the results was defined. The Project Team designed a separate After-life Communication Plan so that the dissemination of the results and outcomes after the end of the project will continue. It targets three specific levels of audiences: Policy-Makers (Ministry of Environment and Energy and the Ministry of Interior and Administrative Reconstruction), Waste Management Authorities (Regional authorities, Solid Waste Management Associations and Municipalities) and the Market (Businesses from the Waste, Recycling and Mining sector, consultancy firms, scientific community, etc.).

The After-life Communication Plan is scheduled for a five years period and is considering the perspectives of Landfill Mining implementation within Greece and the EU, focusing on three main actions:

1. Promote Policy Change: To successfully support the amendment of the current waste management policy so that it includes Landfill Mining as an alternative method, the Team will elaborate a supporting tool for policy change to aid the decision-makers in understanding the context of the proposed policy in the National Action Plan and facilitate the adoption of the proposed policy. Such a Tool provides a simple and useful way to grasp the main context, dimensions and dynamics of the policy, its benefits and limitations.

   Then, the Team will proceed to inform national policy-makers on the Landfill Mining National Action Plan and its key elements via this supporting documentation. For this reason, specific meetings will be arranged, targeted at a national level, with representatives from the Ministry of Environment and Energy as well as the Ministry of Interior and Administrative Reconstruction, to discuss with them in person about the opportunities which arise from the endorsement of a Landfill Mining policy.

   Furthermore, ENVECO will maintain its active membership in the EURELCO network, an EU-wide network of stakeholders interested in LFM with the main purpose to promote LFM and influence policy change at the level of the Commission. Through the work of this group, the Team will follow closely the developments in the Landfill Mining sector, both at a technological and policy level.
2. Increase Visibility of Landfill Mining: To Increase the Visibility of Landfill Mining, the Team will use its virtual media to promote any news on the field, both in Greece and abroad. The project's website, social media accounts (in Facebook and LinkedIn), newsletters and forum will be used as a platform to inform waste management

authorities, the business sector and all stakeholders interested in the subject. Also, the online access to all the project deliverables, including technical reports, informative material, etc. will remain active.

Moreover, the elaboration of more paper publications in peer reviewed journals within the next period, as well as presentations in forthcoming scientific events will keep the interest of the scientific community and could be assisting to the development of the technological aspects of the method. A "References" section with available literature on Landfill Mining will also be added to the project website, to further facilitate research.

3. Support Future Landfill Mining Projects: The Beneficiaries are willing to pursuit the replicability of the project by participating in new waste mining projects, both in Greece and the EU. In fact, many stakeholders have already come across to express their interest to use Landfill Mining as a tool to mitigate local issues such as limited landfill disposal space and groundwater pollution due to leachate leaks.

   Additionally, the Team will be involved in the elaboration of proposals to receive funding for more Landfill Mining applications through programs such as INTERREG. This can lead to large-scale implementation of the method and transfer of the knowledge created by LIFE reclaim to other regions.

Time schedule:
The action started as foreseen and was completed within the proposed timeline. The actual After-life Communication Plan is scheduled to run for a five years period after the end of the LIFE reclaim project.

Implemented by: ENVECO S.A.

Deliverables:
One After-Life communication plan (Annex 31).

Expected results:
A future communication plan was finalised that includes substantial actions on behalf of the Beneficiaries, without generating cost for the EU and at the same time effectively promote the developments established through the Project.

4.1.19. Action E8. External audit & bank guarantee

Foreseen start date: 4/2016 **Foreseen end date: 6/2016**

Actual start date: 4/2016 **Actual end date: 6/2016**

Description of the action:

The audit report has been carried out by the Certified Accountants Company "SOL S.A., Georgios Sgouros and is given in Annex 32.

Time schedule:

The action started as foreseen and was completed within the proposed timeline.

Implemented by: ENVECO S.A.

Deliverables:

One Financial Audit Report from the external auditor for all the Beneficiaries (Annex 32).

Expected results:

All Project financial data have been properly audited for the project's final payment.

4.2 Dissemination actions

4.2.1 Objectives

The aim of the dissemination actions was to produce the necessary material, online resources and events to inform the public on a local, national and international level throughout the project duration. Also, these actions were focusing at engaging the scientific community, the business sector and the regional and national authorities into the conversation about Landfill Mining and its potential in Greece and in the EU.

Dissemination Actions were implemented by the Communication Team and particularly by ENVECO S.A., MoP and SMME-NTUA. The Team views the Dissemination Actions as a key to the LIFE reclaim long-term benefits. Taking into account that the Landfill Mining is an unknown alternative waste management practice in Greece, by informing the public about this method and its potential value is the only way to ensure that it could become applicable in the future.

4.2.2 Dissemination: overview per activity

4.2.2.1. Action D1. Dissemination Material

Foreseen start date: 7/2013 **Foreseen end date: 3/2016**

Actual start date: 7/2013 **Actual end date: 6/2016**

Description of the action:

The aim of this action was to produce all necessary material to inform the public, throughout the project duration. It was implemented by the Communication Team (in particular by ENVECO S.A. and MoP) and the following tasks have been carried out:

- The project 'identity' was prepared and submitted with the IncR (*IncR-Annex 4)*.
- A Media kit of the Project was prepared and submitted with the MTR (*MTR-Annex 15*). It was also released through the website and was updated following the project progress (updated version is attached in Annex 37).
- Newsletters: nineteen (19) bi-monthly newsletters and five (5) biannual Special Edition newsletters have been released. All Newsletters are accessible through the LIFE reclaim website and are available both in English and Greek (*MTR-Annex 16* and Annex 33).
- Leaflets and Posters: A set of printed dissemination materials have been designed (*MTR-Annex 17*, Annex 34 and printed copies are also included in the FR package):
    - Local Workshop and 1st National Landfill Mining Conference (15/09/2014 and 16/09/2014, in Polygyros and Thessaloniki, respectively):
        - A general informative leaflet on the LIFE reclaim project (in Greek).

        - Invitations to the Local Workshop in Polygyros, Greece (printings) and invitations to the 1st National Landfill Mining Conference in Thessaloniki, Greece (in pdf format, sent via newsletters).
        - A leaflet and a poster covering the Local Workshop and the 1st National Landfill Mining Conference.
        - Paper folders, designed especially for the 1st National Landfill Mining Conference and participant tags for both the Local Workshop and the 1st National Landfill Mining Conference.
        - A certificate of attendance for the 1st National Landfill Mining Conference.
    - Athens 2015 International Landfill Mining Conference (24 & 25/9/2015, in Athens):
        - A general informative leaflet on the LIFE reclaim project (in English).
        - A poster covering the International Conference.
        - Two roll-up banners placed in the Conference area.
        - Programs with the scheduled presentations.
        - Folders, pens and blocks, designed for the International Conference.
        - Participant tags with lanyards and certificates of attendance.
    - 2nd National Conference in Landfill Mining and Alternative Waste Management Methods (15 & 16/6/2016, in Athens):
        - A poster covering the 2nd National Conference.
        - Two roll-up banners placed in the Conference area.
        - Programs with the scheduled presentations.
        - Bags, pens and blocks, designed for the International Conference.
        - Participant tags with lanyards and certificates of attendance.
    - Forty (40) printed caps and forty (40) yellow jackets with the LIFE reclaim logo for the Project Team to use during field trips and works inside the PL.
- Notice boards: Three (3) Notice boards were created and installed locally in Polygyros: one on the town's main square, outside the Town Hall, one on the main road to Polygyros, on the turn where the PL is located and one on the entrance of the PL. The Image printed on the boards and photos of them were provided in *MTR-Annex 18*.
- Thirteen press releases were sent during the implementation of the project (Annex 35).
- Eight papers and one presentation were presented in Scientific Conferences, two papers of which were published in scientific journals. One more scientific paper which was presented in CYPRUS 2016 4th International Conference on Sustainable Solid Waste Management is under review (Annex 30).
- Two official LIFE+ reclaim accounts were created to inform the public about all the news and updates of the LIFE reclaim project and the developments of Landfill

Mining sector: one on Facebook and one on LinkedIn, with a considerable number of visits.

- Layman's report: One hundred copies of the Layman's report were produced in paper and electronic format in English and Greek presenting the Project. The copies were distributed locally in Polygyros area, as well as to the beneficiaries of the Project (Annex 36).
- DVD with a video from the implementation of the project during on site activities. The video has both Greek and English subtitles (included in the DVD disk).

Additionally, four TV reportage were screened in local channels showing the project's activities. Moreover, 43 internet articles were posted and five articles in the national press were published.

Please note that the LIFE logo and EU contribution are mentioned in every report, newsletter, map, board, dissemination material or any other document issued by the beneficiaries (leaflets, newsletters, etc).

Time schedule:

The works of Action D1 were successfully completed by the end of the project.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP

Deliverables:

One (1) Project 'identity' (*IncR-Annex 4*)

One (1) layman's report in two languages (Greek and English) (Annex 36)

Eight (8) paper publications, three of which addressed to thematic journals on waste and/or economics (Annex 30)

One (1) DVD with a video from the implementation of the project (Annexes-DVD)

Volume of project media releases (Annex 35)

Expected results:

One (1) Project 'identity'

Two (2) media kits: one in the beginning and one in the end of the Project (Annex 37)

Two (2) series of newsletters: 15 bimonthly (total sent: 19 newsletters) and 6 biannual (total sent: 5 newsletters)

Four (4) series of Leaflets and posters

Three (3) notice boards

Six press releases (total sent: 13)

One (1) layman's report in two languages (Greek and English)

Three (3) draft papers addressed to thematic journals on waste and/or economics

One (1) DVD with a video from the implementation of the project

4.2.2.2. Action D2. Website development

Foreseen start date: 7/2013	**Foreseen end date: 6/2016**
Actual start date: 7/2013	**Actual end date: 6/2016 (plus 5 years after the end of the project)**

Description of the action:

The website of the project (www.reclaim.gr) was launched in the first week of January 2014 and it has been regularly updated since then with news related to the Project progress, new sections and downloadable material. In particular, the LIFE reclaim website includes all the Newsletters in Greek and English, all the Deliverables of the Project, useful links, a Landfill Mining World Map, an online forum and all the dissemination material and it is linked to an online web-GIS application.

Even though most of the online dissemination tools of the LIFE reclaim project were successful, the forum did not achieve its goals in engaging interested stakeholders in the discussion about Landfill Mining. The Team took note of the limited traffic to the forum's pages and made efforts to promote it in meetings, networking opportunities and events. Still, the traffic remained less than expected. This could be attributed to a number of reasons including the reluctance of the stakeholders to express themselves openly about waste mining, their preference to discuss any ideas on the subject orally (in person, via telephone or through the events of the project) instead of writing them and also their hesitation to create an account and logging in the forum to write their thoughts or questions on the method.

In order to minimise this communication gap, the team focused in other dissemination activities, such as the activation of the project's official social media accounts in Facebook (www.facebook.com/LIFEreclaim) and LinkedIn (www.linkedin.com/LIFE-reclaim) to further spread the project results as well as share news on LFM. Moreover, the website was updated regularly with news about the project and the Team was constantly striving to increase the newsletter subscribers (up to 1,503 by the end of the project's duration).

Time schedule:

The action started as foreseen and the website will be available for five years after the end of the project.

Implemented by: ENVECO S.A. (responsible beneficiary), SMME

Deliverables:

Volume with design specifics and the manual for the website (*MTR-Annex 5*)

Web-GIS database dedicated web-page (www.reclaim-gis.gr)

Three (3) web statistics reports (*MTR-Annex 21* and Annexes 38 and 39).

Expected results:

One (1) website.

One (1) forum on landfill mining active on the website.

Three (3) web statistics reports.

Support for the web-GIS database on the website.

4.2.2.3. Action D3. Dissemination Events

Foreseen start date: 1/2014 **Foreseen end date: 3/2016**

Actual start date: 4/2014 **Actual end date: 6/2016**

Description of the action:

The Project Team organised special events in order to actively inform the public on three separate levels (local, national and international). In particular, the following tasks have been elaborated until the end of the project:

- The Project Team successfully organised the Local Workshop in Polygyros entitled "Polygyros Workshop: Landfill Mining, a new Approach to Waste Management" on the 15th of September, 2014. The workshop program covered a presentation of the LIFE reclaim project and discussions on Landfill Mining and its different aspects such as mining of waste, processing the excavated material and potential uses of the method. In total 32 people from the local community attended the workshop, with diverse backgrounds such as waste contractors, recycling associations and municipal councillors.
- Furthermore, the 1st National Landfill Mining Conference, held on the 16/09/2014 in Thessaloniki, Greece, was a big success. It was attended by more than 150 people from the academic community, the private sector and the public authorities. The Conference had a great impact on the media as many journalists covered the event. Both the project and the Conference received very positive feedback and it became apparent that there is real interest in Greece around the subject of waste and Landfill Mining, in particular. A Book of Abstracts was also created including abstracts from the Conference's presentations (*MTR-Annex 22*).
- The "Athens 2015 International Landfill Mining Conference" held on 24 & 25/9/2015 in Athens and it was a great success with more than 210 attendants and 28 speakers, both from Greece and abroad. The Conference was attended by representatives of the public authorities, the academic community, as well as the private sector and was very well promoted by the communication sponsors and the press. A Book of Abstracts was created including abstracts from the Conference's presentations (Annex 40).
- The "2nd National Conference in Landfill Mining and Alternative Waste Management Methods" held on 15 & 16/6/2016 in Athens. It was attended by 264 people from the academic community, the private sector, the public authorities and the general public and 21 speakers presented subjects related to waste management. The LIFE reclaim project results were presented during the conference and an interesting discussion on the potential of Landfill Mining in Greece followed.

Time schedule:
The events of the project took place in accordance to the project's progress in order to succeed the major participation and the most effective dissemination of the project's works and results.

Implemented by: ENVECO S.A. (responsible beneficiary), MoP

Deliverables:
One (1) digital volume with the proceedings of the 1st National Conference (Book of Abstracts) (*MTR-Annex 22*).
One (1) digital report with photos, material and the minutes of the 1st National Conference (*MTR-Annex 23*).
One (1) digital report with photos, material and the minutes of the Local Workshop (*MTR-Annex 24*).
One (1) digital report with photos, material and the minutes of the International Conference (Annex 41).
One (1) digital report with photos, material and the minutes of the 2nd National Conference (Annex 43).
One (1) digital volume with the proceedings of the International Conference (Annex 40).
One (1) digital volume with the proceedings of the 2nd National Conference (Annex 42).

Changes in the Financial Part of the action:
As mentioned in the MTR, two papers for 'Exploring the feasibility of LFM' were translated from English to Greek for the first national conference of the project and were charged to the beneficiary ENVECO. The amount of €400.00 needed to be transferred from the category "travel" of Action D3 to the category "external assistance" of the same action to cover the cost of the translation and proofreading.
Moreover, a small amount of approximately €1,500.00 was transferred from the category personnel to the category travel, for the Beneficiary MoP in order to cover the needs of MoP staff to participate to the international conference of the project, which was not foreseen.

Expected results:
- 10 stakeholders in the local workshop.
- 200 local participants informed.
- 500 attendees in the national conferences.
- 250 attendees to the international conference.
- 10 international expert speakers of the waste –industry in the international conference.

4.3 Evaluation of Project Implementation

The project has been completed on time and its main objectives were successfully achieved. The main conclusions about the implementation of the project Actions include the following:

- The implementation of the Actions faced some difficulties (i.e. the slower mobilisation of the MoP personnel, the delay with the permission for the activities in the Polygyros Landfill, the weather conditions and most important the capital controls applied in Greece). However, the above obstacles were treated promptly by the Coordinating Beneficiary in collaboration with the Associate Beneficiaries using relevant corrective actions, which were described in the previous chapters.
- The preparatory actions of the project were successful in setting the ground for the implementation of the DU. The appropriate knowledge about LFM and the study area was gathered and the legally required environmental permit was obtained.
- The implementation actions were successfully carried out and the Landfill Mining pilot DU was designed, installed and operated in the Polygyros Landfill, incorporating the available experience from relevant applications in other countries. Through these steps, the DU was tested as a tool for the recovery of useful materials (ferrous and non-ferrous metals), landfill space, soil material, recyclable materials and land.
- Also, the introduction of innovation elements from the mining industry was achieved through the project Actions with the Sink-float Beneficiation tests on the e-waste material, bringing some promising results for the recovery of precious metals from printed circuit boards.
- The assessment of the Environmental and Social Impacts of the project, by means of the Environmental and Socioeconomic performance indicators identified in the beginning of the project, was carried out based on the preliminary assessment of the Baseline Environmental and Social conditions of the area. Furthermore, it provided the baseline to draw conclusion about the environmental and social impacts of LFM in general.
- LFM was unknown in Greece and its future implementation depends on the collaboration of the scientific community, the business sector, the public authorities and the general public alike. Thus, great importance was given to the dissemination actions of the project which managed to initiate the discussion about the future of disposed waste and build a wide network of stakeholders and specialists interested in landfill mining applications.
- The cooperation between the Beneficiaries, the administrative organisation and the project management through ENVECO ran smoothly. This was very important for the implementation of the project and the proposed activities.

The main objective of the project was to use LFM as a tool for the recovery of valuable resources included in the disposed waste, land and energy and at the same time to inform the public about the issue of old waste post-disposal processing and the potential of the procedure for metal recovery, resulting in a cleaner environment and rational management of controlled or uncontrolled landfills (focusing on old ones). In the context of the project, an innovative LFM pilot application was installed and operated in Polygyros Landfill. The main objective of the project was successfully achieved and an extensive work package including both literature and technical information is fully prepared for any future LFM application.

The core action of the project along with the rest of the project's activities succeeded in suggesting a wider programme of post-disposal processing through the creation of a National Action Plan for the integration of the method in the systematic solid waste management of the country.

As mentioned above, LFM was unknown in Greece. The second main objective of the project achieved through the organisation of plenty of successful dissemination actions which led to the initiation of the discussion and sparked the interest to the relevant stakeholders about the project's benefits.

The following table summarises every action and task and compares the expected with the actual results. The results of the actions are considered successful, in quantitative and qualitative terms:

Task	**Foreseen in the revised proposal**	**Achieved**	**Evaluation**
Consolidation of the international experience in LFM (Action A.1)	1 Technical report on LFM Techniques and Potential in Greece and EU 4 international field trips (Spain, Belgium, The Netherlands and the UK) 2-3 national field trips to waste disposal sites	1 Technical report on LFM Techniques and Potential in Greece and EU 3 out of 4 (not in the UK) 3 field trips to Kozani, Athens and Crete (Amari)	*Successfully completed*
Permitting of additional activities inside PL (Action A.2)	1 Dossier (Technical report) for submission to the authorities Permit Acquisition	1 Dossier (Technical report) for submission to the authorities Permit Acquisition	*Successfully completed*
Baseline environmental and social conditions (Action A.3)	1 Technical report describing the existing environmental and social conditions 1 Field-work trip	1 Technical report describing the existing environmental and social conditions 1 Field-work trip	*Successfully completed*

Task	Foreseen in the revised proposal	Achieved	Evaluation
Potential for development of LFM in Greece and Europe (Action B.1)	1 Detailed Assessment on the Potential for development of LFM in Greece and Europe 1 Online Web GIS application, linked to the LIFE reclaim webpage	1 field trip to Cyprus 1 Detailed Assessment on the Potential for development of LFM in Greece and Europe 1 Online Web GIS application, linked to the LIFE reclaim webpage	*Successfully completed*
Actions for the design of the mining and the DU (Actions B.2, B.3)	1 Technical Plan and design for mining waste with accompanying maps. (Action B.2) 1 Technical report for the design of the DU with accompanying maps of the proposed installation of the DU (Action B.3) 2 field trips, 4-6 people (Actions B.2, B.3)	1 Technical Plan and design for mining waste with accompanying maps. (Action B.2) 1 Technical report for the design of the DU with accompanying maps of the proposed installation of the DU (Action B.3) 2 field trips, 4-6 people (Actions B.2, B.3)	*Successfully completed*
Actions related to the DU (Actions B.4, B.5, B.6, B.7)	1 or more sub-contracts for the provision and installation of the DU equipment (Action B.4) 1 Demonstration Unit ready for operation (Action B.5) 2 Technical reports for the Installation and Operation of the DU (Actions B.5 and B6) 1 Report of air and water testing results (Action B.6) 1 Report of beneficiation tests of concentrates results (Action B.6) 1 Rehabilitation plan (Action B.7) 1 3D virtualization of the PL landfill rehabilitation, live on website (Action B.7)	Two sub-Contracts for the provision and installation of the DU equipment (Action B.4) 1 Demonstration Unit ready for operation (Installation of the DU) (Action B5) 2 Technical reports for the Installation and Operation of the DU (Actions B5 and B6) 1 Report of air and water testing results (Incorporated as an Annex in Action B6 Report) (Action B.6) 1 Report of beneficiation tests of concentrates results (Action B.6) 1 Rehabilitation plan (Action B.7) 1 3D virtualization of the PL landfill rehabilitation, live on website (Action B.7)	*Successfully completed*
Other implementation Actions (Action B.8, B.9, B.10)	1 National Action Plan (Action B.8) 2 Technical reports for the local and the national survey (Action B.9) 1 Policy and Economics Tool (Action B.9) 1 Technical report for the Socioeconomic analysis (Action	1 National Action Plan (Action B.8) 2 Technical reports for the local and the national survey (Action B.9) 1 Policy and Economics Tool (Action B.9) 1 Technical report for the Socioeconomic analysis (Action	*Successfully completed*

Task	Foreseen in the revised proposal	Achieved	Evaluation
	B.9) 1 SEA report on the National Action Plan	B.9) 1 SEA report on the National Action Plan	
Monitoring of the impact of the project actions (Actions C.1 and C.2)	6 environmental and 4 socioeconomic performance indicators, at least (Actions C.1 and C.2) 2 Baseline evaluations of the Project, by means of the environmental and socioeconomic performance indicators 4 Annual evaluations of the Project, by means of the socioeconomic and environmental performance indicators	29 environmental and 16 socioeconomic performance indicators were identified (Actions C.1 and C.2) 2 Baseline evaluations of the Project, by means of the environmental and socioeconomic performance indicators 4 Annual evaluations of the Project (socioeconomic and environmental)	*Successfully completed*

Task	Foreseen in the revised proposal	Achieved	Evaluation
Communication and dissemination actions (Actions D.1, D.2 and D.3)	1 Project "Identity Manual" (Action D.1)	1 Project "Identity Manual" (Action D.1)	*Successfully completed*
	1 Website Manual report (Action D.2)	1 Website Manual report (Action D.2)	
	3 Annual web-statistics reports (Action D.2)	3 Annual web-statistics reports (Action D.2)	
	1 Web-GIS dedicated webpage (Action D.2)	1 Web-GIS dedicated webpage (Action D.2)	
	2 Media Kits: one in the beginning and one in the end of the Project (Action D.1)	2 Media Kits (Action D.1)	
	2 Sets of Newsletters: one bi-monthly (15 in total) and one bi-annual (6 in total) (Action D.1)	19 bi-monthly and 5 bi-annual Newsletters (Action D.1)	
	4 series of Leaflets and posters (Action D.1)	4 series of Leaflets and posters (Action D.1)	
	3 Notice Boards (Action D.1)	3 Notice Boards (Action D.1)	
	6 Press Releases (Action D.1)	13 Press Releases (Action D.1)	
	1 Local Workshop (Action D.3)	1 Local Workshop, attended by 32 people (Action D.3)	
	2 National and 1 International Conferences (Action D.3)	1st National Conference, attended by 150 people, 1 International Conference attended by 210 people, 2nd National Conference attended by 264 people (Action D.3)	
	4 Digital reports with photos, material and the minutes of the Local Workshop, the National and the International Conferences (Action D.3)	4 Digital reports with photos, material and the minutes of the Local Workshop, the National and the International Conferences (Action D.3)	
	3 Digital volumes with the proceedings of the National and the International Conferences (Action D.3)	3 Digital volumes with the proceedings of the National and International Conferences (Action D.3)	
	3 papers submitted for publication in Journals (Action D.1)	8 papers and one presentation were presented in scientific conferences, 2 papers of which were published in scientific journals and one paper was submitted for publication and it is under evaluation (Action D.1)	
	Media exposure	Media exposure (printed and electronic press, TV, radio, events, social media)	
	1 video from the implementation of the project in DVD (Action D.1)	1 video from the implementation of the project in DVD (Action D.1)	

Task	Foreseen in the revised proposal	Achieved	Evaluation
	1 Layman's report in two languages (Action D.1)	1 Layman's report in two languages (Action D.1)	
Project management Actions (E.1, E.2, E.3 and E.4)	1 Inception Report (Actions E.1, E.2, E.3 and E.4) 1 Mid-Term Report (Actions E.1, E.2, E.3 and E.4) 1 Progress Report (Actions E.1, E.2, E.3 and E.4) 1 Final Report (Actions E.1, E.2, E.3 and E.4)	1 Inception Report (Actions E.1, E.2, E.3 and E.4) 1 Mid-Term Report (Actions E.1, E.2, E.3 and E.4) 1 Final Report (Actions E.1, E.2, E.3 and E.4)	*Successfully completed*
Training, workshops, meetings, participation and networking Actions (E.5 and E.6)	6 Minutes of meetings (Action E.5) 1 Report of Action E.6, with all the publications and papers presented	6 Minutes of meetings (Action E.5) 1 Report of Action E.6, with all the publications and papers presented	*Successfully completed*
After-life communication plan (Action E.7)	1 Report of the After-Life communication plan	1 Report of the After-Life communication plan	*Successfully completed*
External audit & bank guarantee (Action E.8)	4 Financial Audits from independent auditors	1 Consolidated Financial Audit from independent Auditors	*Successfully completed*

4.4 Analysis of long-term benefits

The successful implementation of the project promoted the LFM concept both in Greece and abroad and suggested its introduction into the integrated waste management system at a national and regional level. This offers many advantages, as LFM is in accordance with the resource efficiency priorities set by the EU. Some of the benefits of LFM can include effective reclamation of various materials and most importantly rehabilitation of the land of a previous waste disposal site and reclamation for other land uses. Many of the project results and deliverables could have a great number of long-term benefits which include:

- The Technical Report of Action A.1 which can be used as a manual about LFM, analysing it in great detail and consolidating the international experience in the sector, from information collected through extensive literature research and international trips.
- The Landfill Inventory Web GIS application is an online tool, available to the general public, with detailed information on over 23,000 waste disposal sites in certain areas of the EU and can be a source of information used for estimating the LFM potential of a site as well as for various other studies on diverse subjects. Together with the accompanying Detailed Assessment on the Potential for development of LFM in Greece and Europe of action B.1, they become a valuable tool for the identification of the best options for LFM, through a broader geographical perspective.

The socioeconomic benefits of LFM can also be multiple, as the results of the project showed. The most immediate are the avoidance of landfill after-life monitoring costs, the creation of business and job opportunities and the increase of the land value in the immediate area. Specifically:

- The Financial and socioeconomic analysis, conducted through action B.9 sets the framework for future assessment of every potential LFM application, as it is the only available resource which examines this aspect of LFM in such detail.
- The National Action Plan of action B.8 and the accompanying Strategic Environmental Assessment Study of B.10 present the necessary policy changes and support them through setting the right goals so that LFM can be implemented into the integrated waste management system of the country.
- The After-LIFE communication plan sets long-term goals for the continuation of the dissemination of the project results and outlines the necessary follow up activities.
- Also, through the Dissemination actions, the knowledge and the experience of the project was properly propagated and publicised among stakeholders and interested audiences, both before and after the operation of the DU. The material produced through the actions and events (e.g. conference presentations, posters, flyers, etc) will remain available online and for everyone interested even long after the termination of the project.

5. Comments on the financial report

Project declared costs for the project period (July 2013 to June 2016) amount to a total of €1,299,563.71 (Annex 44-Standard Statement of project's Expenditure/Financial Reporting) covering a percentage of 94.4% of the total Project's budget (Table 1). The final eligible amount is 5.6% lower than the approved proposal budget mainly due to the category "travel" and "consumables". Particularly, during the implementation of the project, in some cases, contacts by phone appeared to be as efficient as travelling and at the same time much more direct and financially wise. Moreover, some of the trips and transportations for the project's needs were not charged to the project. Finally, part of the initial budget for consumable parts and lubricants for the Demonstration Unit was not spent, since the contract for the machinery renting included the consumables costs which led to a cost-effective result. In general, it is noted that the proposed actions of the project were undertaken as foreseen and the slightly reduced expenses did not have any impact in the scale, nature, scope or quality of the project activities and deliverables. The excel format of each Beneficiary's Financial Statement is attached in the DVD disk, in the folder "Financial Reporting".

Comments on the completion of the Financial Reporting forms:

Category Personnel:

- Lower hour rates for the personnel of the Beneficiary MoP due to the unitary salary system applied to the public services, led to lower than foreseen personnel costs. However, the quality of the work package was not affected by the reduced rates.
- As it has been already mentioned in the MTR, regarding the Senior Engineer Mr. Spyridon Papagrigoriou (Beneficiary ENVECO), as well as the Senior Project Manager Mr. Haralambos Sofianos (Beneficiary HELECTOR) the annual gross income declared in the financial reporting (column E in the personnel tab) has been deliberately underestimated since we did not wish to exceed the approved rate of the proposal. Thus, it was considered that the best solution would be to adjust the annual income to the actual total man-hours given in the monthly timesheets.
- As far as it concerns the personnel of the Beneficiary SMME, the hourly rates are higher than those presented in the approved proposal. The NTUA's Research Committee which is responsible for the financial issues of the Beneficiary SMME estimates personnel's rates yearly, depending on teaching hours and research projects that each member of staff participates. These rates which vary from year to year are used to fill in global timesheets of NTUA and cannot change for single projects. For the above reason, the financial form of SMME was filled in using the (higher) University's rates.

5.1. Summary of Costs Incurred

The costs incurred during the reference period are presented in Table 1. Column 1 shows the budget as approved in the proposal, while Column 2 presents the costs of the Project as declared in the Consolidated Financial Statement of the Project.

Some minor budget transfers between cost categories which did not exceed the 10% or 30.000,00 threshold were identified in the Mid-term report and were presented in detail (they are also mentioned in the FR). However, the payment of all the related costs with the termination of the project showed that the expenses of the proposed transfers were covered internally from the availability of the budget (e.g. less travelling covered other expenses; negotiations resulted in savings, etc). In conclusion, transfers were not required, taking also into consideration that the declared costs did not exceed the initial approved budget in none of the budget categories.

Table 1. Project's costs allocation.

PROJECT COSTS INCURRED			
Cost category	**Budget according to the grant agreement in € (Column 1)**	**Costs declared from 01/07/2013 to 30/06/2016 in € (Column 2)**	**%**
1. Personnel	899,520.00	899,407.09	99.9
2. Travel	86,200.00	45,712.09	53.0
3. External assistance	284,700.00	259,314.25	91.1
4. Durables: total non-depreciated cost			
- Infrastructure sub-tot.	-	-	-
- Equipment sub-tot.	-	-	-
- Prototypes sub-tot.	-	-	-
5. Consumables	13,000.00	7,413.47	57.0
6. Other costs	3,500.00	2,698.63	77.1
7. Overheads	90,084.00	85,018.18	94.4
TOTAL	**1,377,004.00**	**1,299,563.71**	**94.4**

5.2. Accounting system

The following accounting practices were applied:

- Time sheets: All partners used the timesheet template recommended by the LIFE+ unit. Man hours were recorded for the present project both in electronic and printed format. In addition man hours for the remaining activities of each member of personnel were recorded such that all hours worked in each beneficiary are accounted for. Time was registered every day and was signed and approved by each member's supervisor within the first 10 to 15 days of the next month.
- Costs: For all costs incurred that were payable to third parties, invoices and receipts were received as appropriate. Where required by internal rules proposal/tender procedures were followed. Original invoices and receipts included in the cost statement of the project were marked and stamped accordingly and are maintained in the regular accounting books of each Beneficiary. Each beneficiary created a separate cost account to register the Project's expenses. Copies of the invoices and receipts are kept at a separate project file to facilitate easy access and control. All costs were approved by the Head of each partner.
- Records: All documentation relevant to the costs incurred by the project was collected in a project specific file prepared by each organisation. A copy of this file was also provided to the Coordinating Beneficiary (CB) every three months, together with the Financial Reporting Form (in electronic format) in order to be checked by the CB and to be kept at their headquarters. The project files will be maintained at the Coordinating and Associated beneficiaries' offices in accordance with the LIFE+ rules.

5.3. Partnership arrangements

All partners have signed an agreement with the CB at the beginning stages of the project. Payments were made to the Associated Beneficiaries in line with each Partnership Agreement and according to the payments made by the EU to the CB. Partnership Agreements have been attached with *Annex 6-IncR*.

Each Partner prepared their individual cost statement and cost related documentation. The CB inspected and approved cost statements prior to making the relevant payments. Inspections included the following:

- Ensuring that declared costs are sufficiently verified with appropriate documentation and are relevant to the project,
- Communication with the technical coordinator of the project to ensure that the Partner has conformed to its work and deliverable requirements and that declared costs correspond to the work undertaken,
- Integration of individual cost statements and checking to ensure that total costs do not exceed the foreseen budget and that the overheads and 2% rules are fulfilled.

5.4. Auditor's report/declaration

The audit report has been carried out by the Certified Accountants Company "SOL S.A., Georgios Sgouros, SOEL Registration Number: 14631, Fokionos Negri 3, Athens, Postcode 11257, Company Registration Number: 125". The audit report is given in Annex 32.

5.5 Summary of costs per action

Table 2 presents an allocation of the costs incurred per action. The excel format of Table 2 is given in Annex 45 and it is included in the DVD disk.

Table 2. Cost per action table.

Action no.	Short name of action	1. Personnel	2. Travel and subsistence	3. External assistance	4.a Infra-structure	4.b Equipment	4.c Prototype	5. Purchase or lease of land	6. Consumables	7. Other costs	TOTAL
A1	**Consolidation of the international experience in LFM**	18500	5888,7	0	-	-	-	-	0	0	24388,7
A2	**Permitting of additional activities inside Polygyros Landfill (PL)**	24940	0	0	-	-	-	-	0	0	24940
A3	**Baseline environmental and social conditions**	38129,24	690	0	-	-	-	-	0	0	38819,2
B1	**Landfill inventory**	36296,68	1042,7	0	-	-	-	-	0	0	37339,4
B2	**Exploitation plan development**	38048,8	3080,4	0	-	-	-	-	0	0	41129,2
B3	**Design of waste treatment process**	69677,28	1153,3	0	-	-	-	-	0	0	70830,6
B4	**Sub-contracting procedures for Demonstration Unit**	11083,5	0	0	-	-	-	-	0	0	11083,5
B5	**Pilot-scale Demonstration Unit installation**	72953,1	1862,7	161263,15	-	-	-	-	0	0	236078,9
B6	**MSW mining, operation and testing**	120716,35	6982,1	0	-	-	-	-	7007,74	0	134706,2
B7	**Environment rehabilitation plan**	43165,7	0	0	-	-	-	-	0	0	43165,7
B8	**National Action Plan elaboration**	31510,81	729	0	-	-	-	-	0	0	32239,8
B9	**Financial and socioeconomic analysis**	103407,7	634,2	0	-	-	-	-	0	0	104041,9
B10	**Strategic Environmental Assessment Study**	47578,2	0	0	-	-	-	-	0	0	47578,2
C1	**Monitoring the environmental impact of project Actions**	15990	0	0	-	-	-	-	0	0	15990
C2	**Monitoring the socioeconomic impact of project Actions**	24699,19	0	0	-	-	-	-	0	0	24699,2
D1	**Dissemination Material**	22678,43	0	11747,2	-	-	-	-	0	0	34425,6

Action no.	Short name of action	1. Personnel	2. Travel and subsistence	3. External assistance	4.a Infra-structure	4.b Equipment	4.c Prototype	5. Purchase or lease of land	6. Consumables	7. Other costs	TOTAL
D2	**Website development**	25733,2	0	25729,4	-	-	-	-	0	0	51462,6
D3	**Dissemination Events**	34819,7	3401,4	55574,5	-	-	-	-	0	0	93795,6
E1	**Project management by ENVECO S.A.**	59492,13	2322,9	0	-	-	-	-	377,73	0	62192,7
E2	**Project management by MoP**	8725,83	0	0	-	-	-	-	0	0	8725,8
E3	**Project management by HELECTOR S.A.**	11002	4319	0	-	-	-	-	0	0	15321
E4	**Project management by SMME (NTUA)**	14676	0	0	-	-	-	-	28	0	14704
E5	**Training, workshops, meetings**	11837,80	2871,5	0	-	-	-	-	0	0	14709,3
E6	**Participation and networking**	13745,45	10734,19	0	-	-	-	-	0	2698,63	27178,3
E7	**After-Life Communication Plan**	0	0	0	-	-	-	-	0	0	0
E8	**External audit & bank guarantee**	0	0	5000	-	-	-	-	0	0	5000
Over-heads											85018,18
	TOTAL	899407,09	45712,09	259314,25	-	-	-	-	7413,47	2698,63	**1299563,71**

6. Annexes

List of Annexes submitted with the Inception Report

Annex 4 (IncR). Project identity manual.

Annex 5 (IncR). Volume with design specifics and the manual for the website

Annex 7a (IncR). Memo from International Trips.

Annex 7b (IncR). Memo from National Trips.

Annex 2 (IncR). Dossier for permitting of additional activities.

Annex 12 (IncR). Report on environmental indicators – Action C1.

Annex 13 (IncR). Report on social indicators – Action C2.

Annex 6 (IncR). Partnership Agreements.

List of Annexes submitted with the Mid-Term Report

Annex 1. (MTR) Organisation and Management Chart.

Annex 2. (MTR) Answers to the questions of the European Union (letters with reference number ENV E.4/AT/nl/Ares (2014) and ENV E.4/AT/PT/nl/Ares (2014)).

Annex 3. (MTR) Project personnel list.

Annex 4. (MTR) Technical report on landfill mining techniques and potential in Greece and EU (Reviewed).

Annex 5. (MTR) Approval of permit for the Demonstration Unit activities and relevant documentation.

Annex 6. (MTR) Technical report on baseline environmental and social conditions (Reviewed).

Annex 7. (MTR) Technical report on the inventory of landfills of interest to landfill mining in Greece and selected EU countries.

Annex 8. (MTR) Technical report for the development plan.

Annex 9. (MTR) Technical report of the final design for the waste treatment Demonstration Unit.

Annex 10. (MTR) Baseline evaluation of the Project, by means of the Environmental performance indicators.

Annex 11. (MTR) Establishment of socioeconomic performance indicators (Reviewed).

Annex 12. (MTR) Baseline evaluation of the Project, by means of the socioeconomic performance indicators.

Annex 13. (MTR) Minutes of meetings (1st year).

Annex 14. (MTR) Dissemination material of action E6.

Annex 15. (MTR) Media kit of the Project.

Annex 16. (MTR) Newsletters of the Project.

Annex 17. (MTR) Dissemination material of the Project.

Annex 18. (MTR) Notice boards.

Annex 19. (MTR) Press release about the local workshop and the 1st national conference.
Annex 20. (MTR) Paper for the early results of the Project.
Annex 21. (MTR) Web statistics report.
Annex 22. (MTR) Digital volume with the proceedings of the 1st national conference (Book of Abstracts).
Annex 23. (MTR) Digital report with photos, material and the minutes of the 1st national conference.
Annex 24. (MTR) Digital report with photos, material and the minutes of the local workshop.
Annex 25. (MTR) Standard Statement of project's Expenditure/Financial Reporting.
Annex 26. (MTR) Hourly rate calculation (NTUA-SMME).
Annex 27. (MTR) Decision of the NTUA Senate for the hourly rates.
Annex 28. (MTR) Cost per action table (excel format).

6.1 Administrative annexes

Annex 1. Organisation and Management Chart.
Annex 2. Answers to the questions of the European Union (letters with reference number ENV E.4 AT/Ares (2015) 2735155-30/06/2015, ENV E.4 AT/nl/ Ares (2015)-31/08/2015 and ENV-E-4 AT/KP/jcs Ares (2016) 5415920 - 16/09/2016).
Annex 3. Project personnel list.

6.2 Technical annexes

Annex 4. Action A1. Technical report on landfill mining techniques and potential in Greece and EU (Reviewed).
Annex 5. Action A2. Dossier for Permitting of additional activities (Reviewed).
Annex 6. Action A3. Technical report on baseline environmental and social conditions (Reviewed).
Annex 7. Action B1. Technical report on the inventory of landfills of interest to landfill mining in Greece and selected EU countries (Reviewed).
Annex 8. Action B2. Technical report for the development plan (Reviewed).
Annex 9. Action B3. Technical report of the final design for the waste treatment Demonstration Unit (Reviewed).
Annex 10. Action B3. Expert report by the scientists of SMME and Helector S.A.
Annex 11. Action B4. Subcontractor Contract and relevant Documentation
Annex 12. Action B5. Demonstration Unit Installation Report
Annex 13. Action B6. Technical Report for MSW mining, treatment and tests assessment
Annex 14. Action B6. Beneficiation tests of concentrates
Annex 15. Action B6. Results from testing of air & water samples
Annex 16. Action B7. Technical Report of the Rehabilitation plan

Annex 17. Action B8. Technical Report of the Action Plan
Annex 18. Action B9. Technical report for local survey
Annex 19. Action B9. Technical report for national survey
Annex 20. Action B9. Policy and economics analysis tool
Annex 21. Action B9. Technical report for the Socioeconomic Analysis
Annex 22. Action B10. SEA report on the National Action Plan
Annex 23. Action C1. Baseline evaluation of the Project, by means of the Environmental performance indicators (Reviewed).
Annex 24. Action C1. Technical Report of the 1st Annual Environmental Impact evaluation of the Project
Annex 25. Action C1. Technical Report of the 2nd Annual Environmental Impact evaluation of the Project
Annex 26. Action C2. Technical Report of the 1st Annual Socioeconomic Impact evaluation of the Project
Annex 27. Action C2. Technical Report of the 2nd Annual Socioeconomic Impact evaluation of the Project
Annex 28. Action E5. Minutes of meetings (2nd year)
Annex 29: Action E5. Minutes of meetings (3rd year)
Annex 30: Action E6. Report of Action E6, with the papers presented duly annexed
Annex 31: Action E7. Report of the After-Life communication plan
Annex 32: Action E8. Financial Audit from independent auditor

6.3 Dissemination annexes

Annex 33: Action D1. Newsletters of the Project
Annex 34: Action D1. Dissemination material of the Project
Annex 35: Action D1. Press Releases
Annex 36: Action D1. Layman's report
Annex 37: Action D1. Media Kit of the Project
Annex 38: Action D2. 2nd Annual Web Statistics Report
Annex 39: Action D2. 3rd Annual Web Statistics Report
Annex 40: Action D3. Proceedings of the International Conference
Annex 41: Action D3. Minutes of the International Conference
Annex 42: Action D3. Proceedings of the 2nd National Conference
Annex 43: Action D3. Minutes of the 2nd National Conference

Please find in electronic format (in the DVD disk which accompanies the FR) all the photographs produced during the project, as well as the dissemination material of the project in PDF format and the standard presentation illustrating the actions of the project.

7. Financial report and annexes

Annex 44: Standard Statement of project's Expenditure/Financial Reporting

Annex 45: Cost per Action table (excel format)

Annex 46: Output Indicators Table