

# reclaim reclaim

With the contribution of the LIFE  
financial instrument of the European Union  
Total budget: €1.377.004,00  
EU Contribution: 50%





# The Project



## The Project

Landfill Mining

Preparatory Actions

Polygyros LFM Pilot Unit

Parallel Actions

Conclusions

**Project code:** LIFE12 ENV/GR/000427

## Project Title:

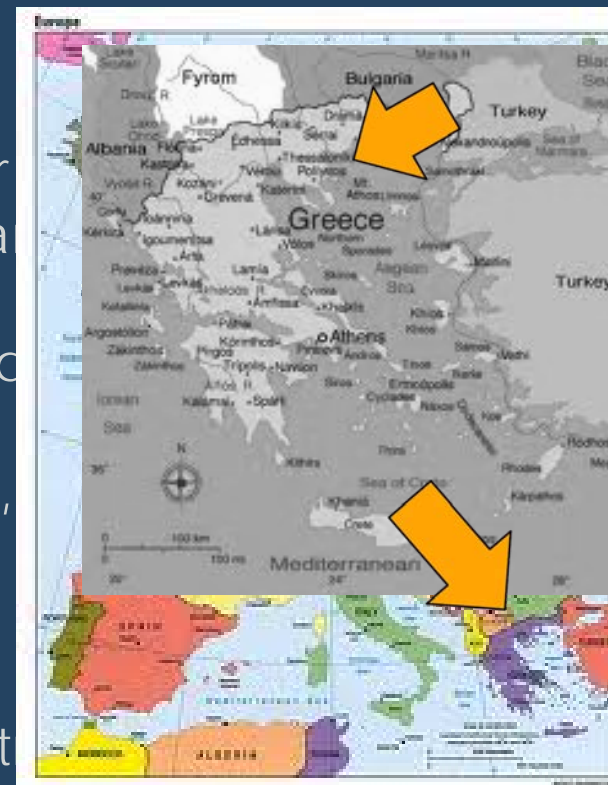
“Landfill mining pilot application for invaluable metals, materials, land a

**Project Location:** Polygyros (Chalkid

**Beneficiaries:** ENVECO , HELECTOR,

**Start – End:** 01/07/2013 – 30/6/2016

**Budget:** €1.377.004,00 (50% EU cont





# The Project

## Landfill Mining



The Project

**Landfill Mining**

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# The Project

## Landfill Mining



The Project

Generic definition:

“the extraction of resources from landfills”

Landfill Mining

→ Definition varies according to:

Preparatory Actions

**Who** (*issues of ownership & needs*)  
(public vs private bodies)

Polygyros LFM Pilot Unit

**What** (*issues of technology & methods*)  
(in situ vs ex situ, direct vs indirect, materials vs other)

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**Where** (*issues of legislation*)  
(EU vs everywhere else)

Conclusions

**Why** (*issues of motivation & efficiency*)  
(for profit or social benefit)





# The Project

## Landfill Mining



### Procedure:

**Waste mining:** open-pit mining with mechanical means

**Loading and transportation** to the processing unit location

**Processing of waste:** separation of materials - sieving, hand-sorting, magnet, etc.

**Results:** recovery of materials, land, energy, etc.

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# The Project

## History of LFM



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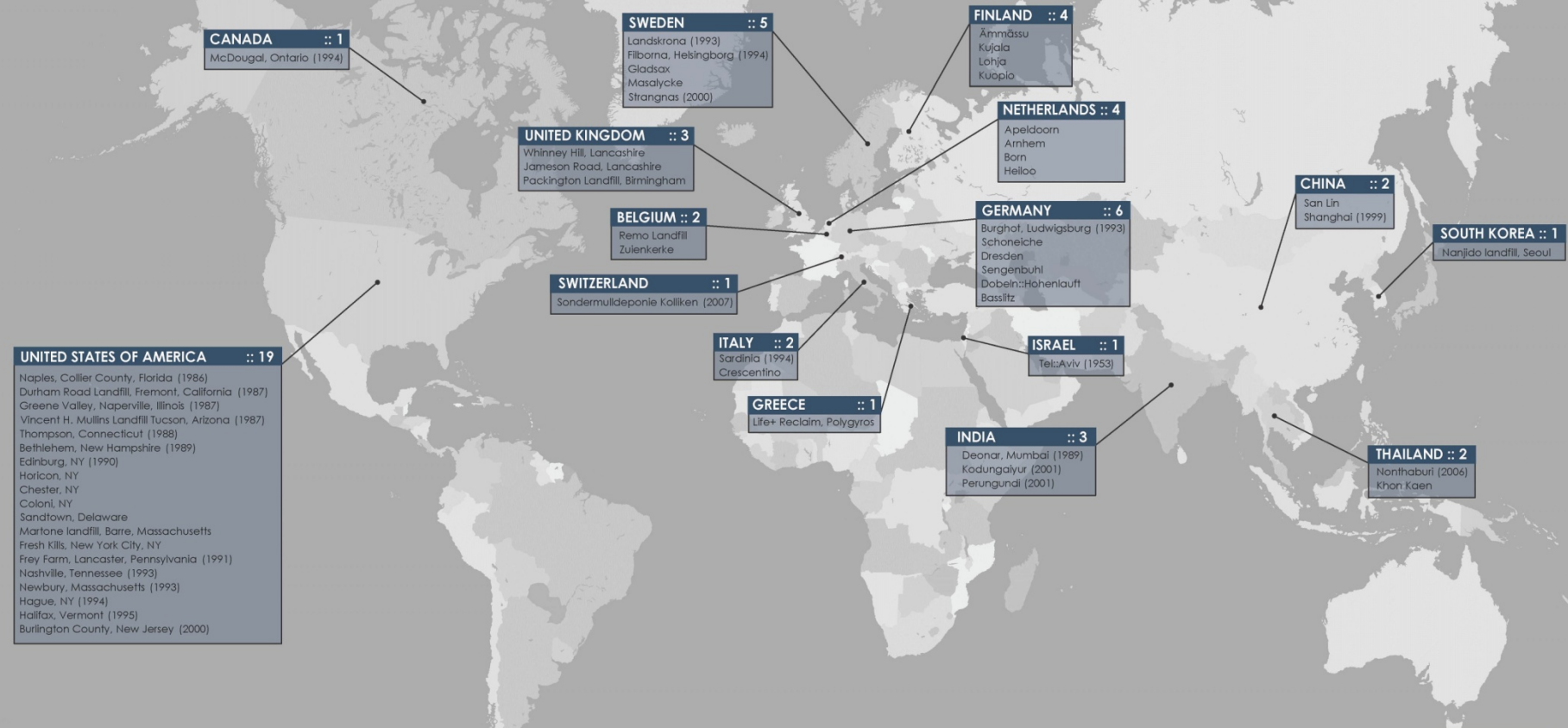
Polygyros LFM Pilot Unit

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- **First** Landfill Mining application: Israel, 1953
- **United States**: Many pilot studies and full-scale projects during 80's-90's
  - Introduced in the **EU later**, with fewer full scale applications in Germany, the Netherlands, Sweden, Finland.
  - Some attempts in the **UK** were abandoned.
- **Asia**: Several studies on Landfill Mining owing to population issues, mainly in India and China.
- Currently raised interest in **Belgium** (Flanders): research, publications and the EURELCO consortium

# LFM applications around the World





# The Project

## Preliminary Actions



Το Έργο

Εξόρυξη Αποβλήτων

Προκαταρκτικές  
Δράσεις

Μονάδα Πολυγύρου

Παράλληλες Δράσεις

Συμπεράσματα

### Action A1: Review of the **international LFM experience**

- International literature review (*congresses, papers, studies*)
- Waste legislation review (*EU, greek*)
- **Stakeholder meetings** with national and international experts (*Belgium, Spain, Netherlands, UK*)

### Action A2: **Permitting** of LFM activity in Polygyros LF

- Description of current activity of the **Polygyros Landfill**
- **Preliminary description** of LFM activity
- **Submission of permit dossier** and contact with the authorities

### Action A3: **Baseline** environmental & social conditions

- **Data collection:** field visits, meetings
- **Reporting** on the Baseline conditions





# The Project

## Investigation of the potential of LFM



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### Action B1: Landfill Inventory

- Covering **Greece** and **selected EU territories**: Cyprus, UK, Belgium (Flanders), Spain, the Netherlands, and others
- Construction of **questionnaire** (landfill characteristics)
- Communications with **authorities** responsible for waste management
- Additional data from national studies and **the literature**
- Data assessment and preparation (**Database construction**)
- **Web-GIS creation** and update: over than **23,000 sites**

<http://reclaim-gis.gr>



"Our Waste...  
...Our treasure"



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Map Files Help About

Options

General

Search

Map Layers Tree

Add Remove

Layers

Source Services

Layers

Base Layers

- ☒ OpenStreetMap
- ☐ Google Physical
- ☐ Google Hybrid
- ☐ Google Streets
- ☒ Google Satellite

WMS Services

Reclaim Data

- ☐ Dominant land use
- ☐ Dominant slope class
- ☐ European river catchments
- ☐ Full Soil Code 1985 FAO
- ☐ Full Soil Code 1990 FAO
- ☐ Maximum elevation above sea
- ☐ Minimum elevation above sea
- ☒ River basin districts
- ☒ Uncontrolled Landfills
- ☒ Sanitary Landfills

Greek



Quick Search to visible layers



<http://reclaim-gis.gr>

Bookmarks

GREECE

CYPRUS

UNITED KINGDOM

SPAIN

NEDERLANDS

BELGIUM

EUROPE

Legend

500 km





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OpenStreetMap

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Dominant land use

Dominant slope class

Minimum elevation above sea

River basin districts

Sanitary Landfills

European river catchments

Full Soil Code 1990 FAO

Maximum elevation above sea

Uncontrolled Landfills

Full Soil Code 1985 FAO



Greek



Quick Search to visible layers

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Legend







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WMS Services

Reclaim Data

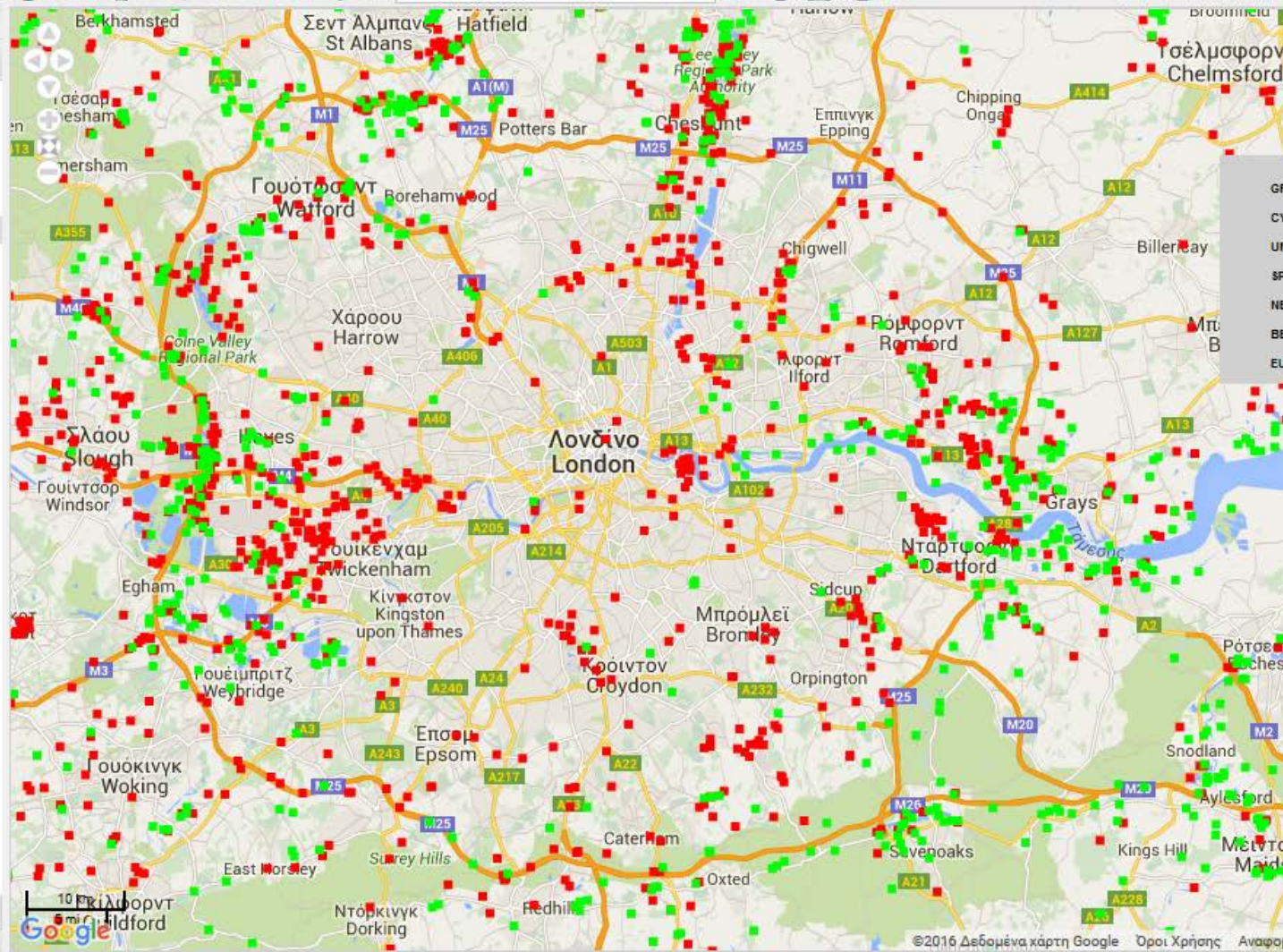
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- ☐ Full Soil Code 1985 FAO

Legend

Google Geocoding

Selected (0)

Settings



Zoom to scale: Current Scale: 1:545978 | Basemap Projection System: EPSG:900913 | Mouse Position Coordinates (EPSG:4326): -0.02, 51.45 | GET SDI Portal is





# The Project

## Preparation for the Polygyros LFM Pilot Unit



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### Action B2: **Exploitation Plan** Development

- Available **technologies & methods**
- Visits to **Polygyros Landfill**
- Identification of **target areas** (waste age & content)
- **Mining scheme** – resources & operation details
- **Environmental Monitoring** system proposal

### Action B3: **Design of waste treatment** process

- Waste **sampling** missions (2)
- Waste treatment **methods review**
- **Adaptation** of the proposed methods to sampling findings
- Design of the Pilot Demonstration Unit: **type of machinery** to be used, calculation of **productivity** and **procedure of processing**.









# The Project

## Sampling in Polygyros



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### Overview:

- 50% **soil material** (soil and rocks)
- High percentage of **plastic** and **recyclable materials** (bottles, cans, etc.)
- Very small percentage of **metals**
- Few **glass** items
- Many **bulky** items



# The Project

## Preparation for the Polygyros LFM Pilot Unit



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### Action B4: **Sub-contracting procedures** for Demonstration Unit

- Invitation for proposals and final contract for the supply and installation of the necessary equipment and machinery

### Action B5: Pilot-scale Demonstration **Unit installation**

- Defining roles and responsibilities
- Preparation of the **Unit location** (landscaping and drainage system)
- **Delivery and installation** of the machinery and equipment
- Adjustments on the **day-to-day activities**
- Creation of a custom **template to record production**
- Installation of **Environmental Monitoring** equipment









# The Project

## Polygyros LFM Pilot Unit Operations



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### Action B6: **Landfill Mining**, waste processing and beneficiation tests

- 45 days (June – July 2015)
- Extraction of waste with **excavators** & transportation with **trucks** to the Unit location
- Regular **weighting** of inputs and outputs
- Waste fed to the Unit assembly using a **backhoe loader**
- A **Trommel sieve** separates smaller waste and soil from larger waste
- **Hand-sorting of waste**: Hard plastics, plastic bags, aluminum cans, glass, e-waste
- **Magnetic** separation
- Other features of the Unit: Washing Machine, Storage of waste
- Total mined & processed waste: about **1300m3 (580tn)**
- **Beneficiation tests**: ex situ (SMME/NTUA laboratory)



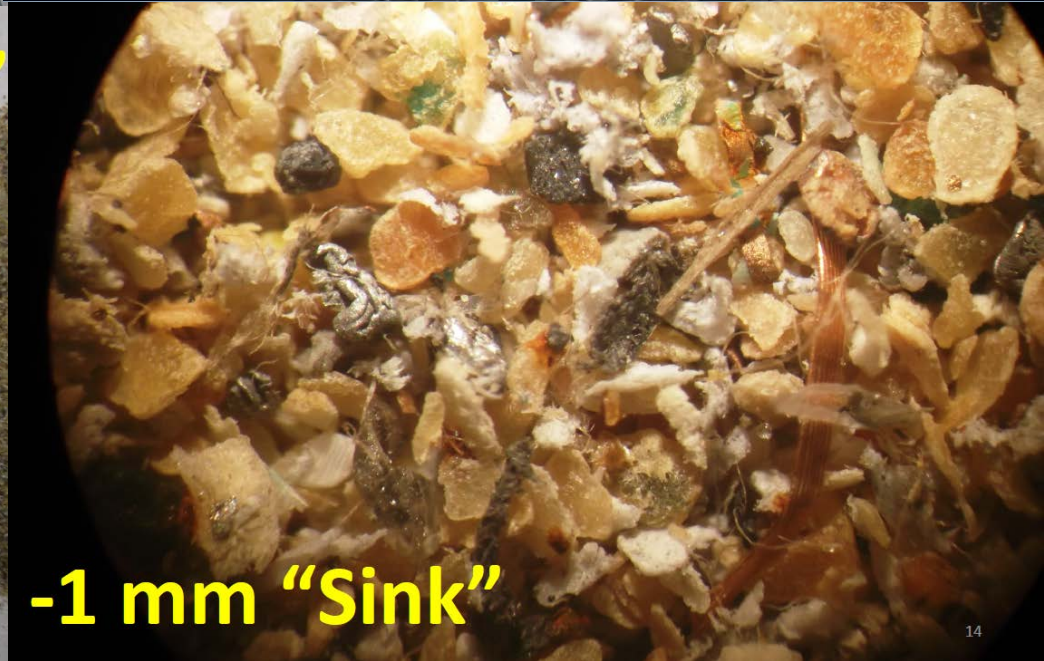








13



14





# The Project

## Summary of Polygyros Unit Results



The Project

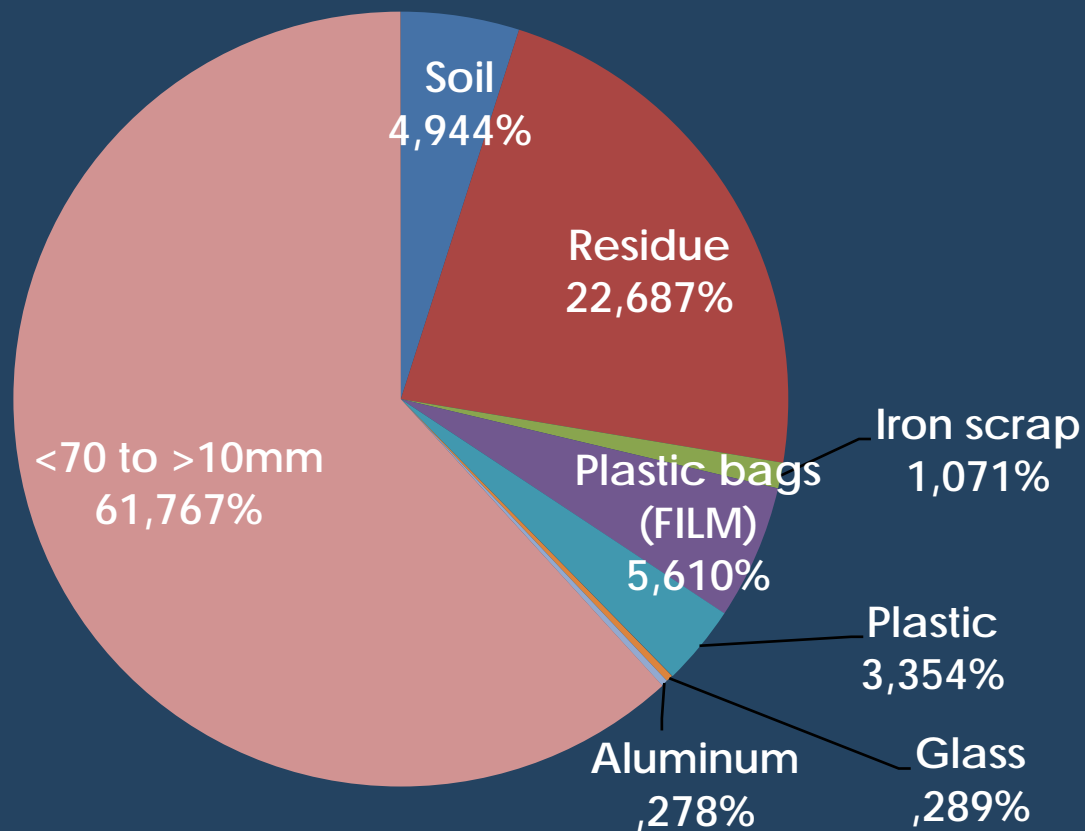
Landfill Mining

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# The Project

## Parallel Actions



The Project

Landfill Mining

Preparatory Actions

Polygyros LFM Pilot Unit

**Parallel Actions**

Conclusions

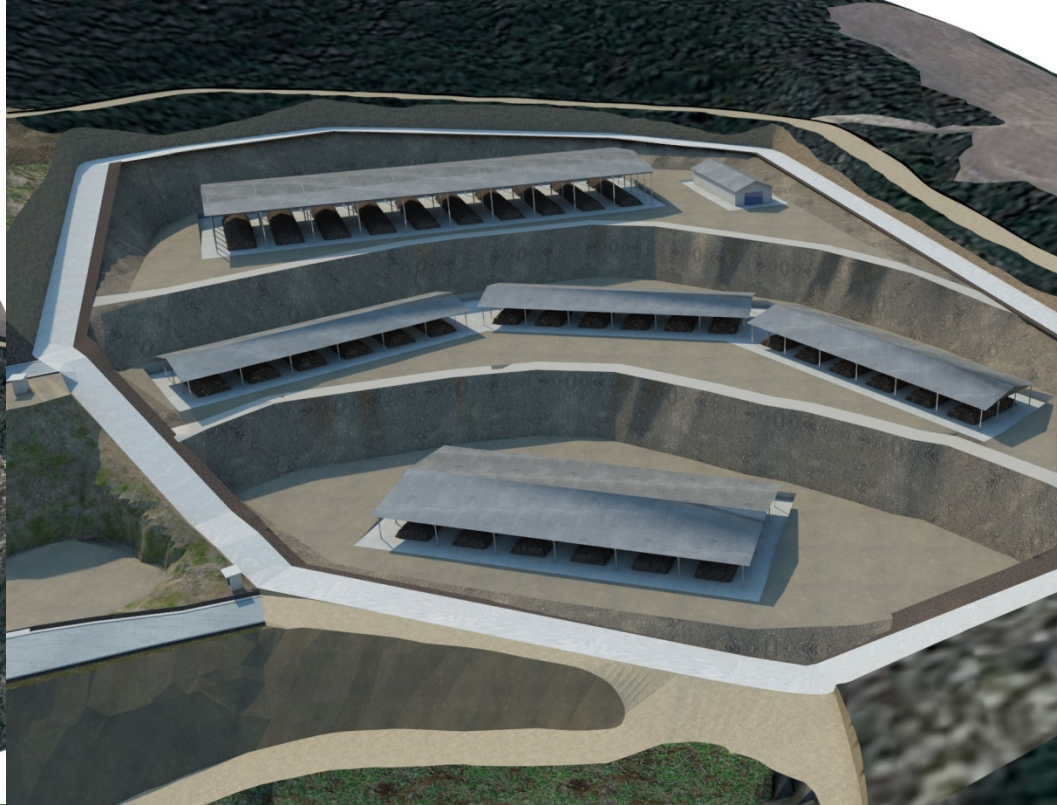
### Action B7: **Σχέδιο Αποκατάστασης** Περιβάλλοντος

- Literature review (congresses, papers, studies)
- Selection of **alternatives** for the Polygyros Landfill after a complete Landfill Mining project
- Development of the **RECLAIM-hab** tool to ease the selection process of the best option (Multi-criteria analysis)
- **Design of a 3D model** of the chosen rehabilitation plan

### Action B9: **Financial and Socio-economic** Analysis

- Development of a socioeconomic survey **questionnaire**
- Polygyros survey April-June 2015 (**286 local residents**)
- National telephone survey: April-July 2015 (**392 Greek households**)
- **Socioeconomic analysis:** positive findings for LFM in the case of using "own resources" (equipment & personnel).
-







# The Project

## Parallel Actions



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### Action B8: **National Action Plan**

- Opportunities, scope and feasibility for **LFM in Greece**
- Description and assessment of **policy alternatives**
- Description of **Road Map** for achieving goals
- **Assessment of:** available means, objective setting, intermediate goals, prioritization, timeline, need for capacity building and proposed funding schemes for project implementation

### Action B10: Strategic **Environmental Assessment Study**

- For the **Implementation of the NAP**
- Establishing the **context of the SEA**
- **Environmental Baseline** assessment
- Consideration of **Alternatives** and **Impact Assessment**
- **Mitigation measures** proposal





# The Project

## Parallel Actions



### Actions C1 & C2: Monitoring impacts (environmental & social)

Environmental Indicators main categories	Social Indicators main categories
Waste minimization	Economic
Material resources	Socioeconomic
Soil degradation	Social
Climate change	
Energy resources	
Water resources	
Human health	
Land use	

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# The Project

## Communication Actions



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### Actions D1, D2 & D3

- Notice boards, posters, leaflets
- Press releases, newsletters, special edition **newsletter**
- Social Media accounts(**LinkedIn, Facebook**)
- **Media communication** (wide impact magazines, online newspapers and blogs, local TV channels, etc.)
- Project website development **www.reclaim.gr**
- Development of an official **FORUM** about Landfill Mining
- Polygyros Local Workshop (September 15<sup>th</sup> 2014)
- 1st National LFM Conference (September 16<sup>th</sup> 2014)
- Athens 2015 International Landfill Mining Conference (September 24<sup>th</sup>-25<sup>th</sup>, 2015)
- 2<sup>nd</sup> National LFM Conference (June 15<sup>th</sup> –16<sup>th</sup> June 2016)





# Conclusions



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1. Landfill mining is **still evolving** (technology and process advances)
2. Need for **standardisation**; not only individual case applications
3. Implementation of a National Action Plan for the
4. Εφαρμογή του **Εθνικού Σχεδίου Δράσης** to strengthen the technical and legal framework
5. Involvement of the **public sector** will affect the Solid waste management at a National level
6. More **LFM applications in larger-scale** are needed and for longer period of time



# Thank you very much!

Zoi Gaitanarou

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With the contribution of the LIFE financial instrument of the European Union  
Total budget: €1.377.004,00 – EU Contribution: 50%



Municipality  
of Polygyros



NTUA  
School of  
Mining &  
Metallurgical  
Engineering