Development of innovative integrated waste recycling schemes for remote areas


Friday, 24th June 2016
Limassol, Cyprus
THE PROJECT

Title:
Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas “LIFE PAVEtheWAYSTE” (acronym)

PROJECT LOCATION:
- Naxos & Small Cyclades [South Aegean] (Iraklia, Schinoussa, Koufonsissa and Donoussa)
- Ancient Olympia [Western Greece]

BUDGET INFO:
Total amount: 1,758,267 Euro
% EC Co-funding: 1,054,960 Euro (60% of total eligible budget)

DURATION:
Start: 01/09/2015 - End: 31/12/2018 (40 months)
LIFE PAVE the WAySTE: Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas

PROJECT PARTNERS

Coordinating Beneficiary

Municipality of Naxos & Small Cyclades Islands

Associated Beneficiaries

Municipality of Ancient Olympia

National Technical University of Athens

Centro Tecnológico CARTIF
PROJECT OBJECTIVES (1/2)

OVERALL SCOPE:
This project aims to facilitate the implementation of the Waste Framework Directive in remote areas, by enabling local and regional authorities to improve their municipal waste recycling performance and thus pave the way to high resource efficiency.

More specifically, it is in the scope of the project to:

- Establish an **integrated, replicable system** of **innovative** character for **source separation** and **treatment** of **MSW** for **remote areas** in Greece and EU;
- **Treat** MSW **at source** avoiding waste collection, transportation and treatment of MSW in **central recovery facilities**;
- **Recover** the **maximum possible resources** generating **more than five streams** of **clean materials**, while contributing to **diversion of waste from landfill**;
- **Inform** and **train citizens** on **how to sort different types of recyclable material** through the **set up of innovative prototype systems**, operated from **specially trained personnel**;
PROJECT OBJECTIVES (2/2)

- To **assess** the quality and the *marketability* of the *end products* in correlation with the local/regional *market specifications* and *industry specific standards*;

- To **make recycling** of waste an *economically attractive option* for remote areas, where *transportations costs predominate* (reduction of waste management cost by 50%);

- To **eradicate landfilling and** more importantly *illegal waste management practices* such as uncontrolled waste dumping, *currently applied in remote areas*;

- To **provide an integrated approach** for implementing the *targets of Union policy and legislation* in the area of *resource efficiency* through *sustainable management* of waste in remote areas.
OVERVIEW OF PROJECT ACTIONS

- **Preparatory actions** (Stakeholders consultation, Setting of ISWM strategy for remote areas)

- **Implementation actions** (Design, engineering, construction, installation, operation, optimization, evaluation of the demonstration phase of the innovative, prototype systems, suggestions for full-scale implementation of the project, replication of the project)
  - Duration: 36 months (01.01.2016 – 31.10.2018)

- **Monitoring of the impact of the project actions** (key performance indicators, monitoring protocol, current status assessment, environmental & socio-economic impact)

- **Public awareness and dissemination of results** (website development, LIFE Notice boards, communication plan, information & training activities, capacity building, layman’s report, networking with other LIFE and/or non-LIFE projects)

- **Project management and monitoring of the project progress** (project management & reporting to EC, monitoring & evaluation of indicators, After-LIFE Communication Plan, External Audit)
A. PREPARATORY ACTIONS

ACTION A1: STAKEHOLDERS’ CONSULTATION

Objectives:

• To make stakeholders understand the aim of the project and appreciate its significance for their own organization and clients;
• To establish and maintain dialogue with and between relevant stakeholders;
• To organize two stakeholder consultation events;
• To discuss and debate on the Integrated Solid Waste Management Strategy that will be developed for the targeted remote areas (Action A.2); and
• To engage stakeholders, including industry & SMEs, during the demonstration action (Action B.3)
• To determine the specific technical and quality specifications of the waste materials accepted by each company and, thus provide critical input for the design of the prototype systems
Step 1: **Determination of targeted waste materials according to European Waste catalogue categorization**

Basic MSW materials targeted:

- ✓ **Paper**
- ✓ **Glass**
- ✓ **Plastic**
- ✓ **Metal**
- ✓ **Organic fraction**

<table>
<thead>
<tr>
<th>Code (EWC)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>BASIC WASTE STREAMS</strong></td>
<td></td>
</tr>
<tr>
<td>15 01 01</td>
<td>Paper packaging</td>
</tr>
<tr>
<td>15 01 02</td>
<td>Plastic packaging</td>
</tr>
<tr>
<td>15 01 04</td>
<td>Metal packaging</td>
</tr>
<tr>
<td>15 01 05</td>
<td>Mixed packaging</td>
</tr>
<tr>
<td>15 01 07</td>
<td>Glass packaging</td>
</tr>
<tr>
<td>20 01 01</td>
<td>Paper/paperboard</td>
</tr>
<tr>
<td>20 01 02</td>
<td>Glass</td>
</tr>
<tr>
<td><strong>BIODEGRADABLE WASTE STREAMS</strong></td>
<td></td>
</tr>
<tr>
<td>20 02 01</td>
<td>Biodegradable waste</td>
</tr>
<tr>
<td>20 01 08</td>
<td>Biodegradable kitchen and canteen waste</td>
</tr>
</tbody>
</table>
Step 1: **Determination of targeted waste materials according to European Waste catalogue categorization**

Specific **special waste streams** were also considered, because:

- the existing alternative waste collection systems are not sufficiently extended in remote areas;
- the inclusion of the special waste streams will have a positive contribution to the overall recycling rates of the participating municipalities.

<table>
<thead>
<tr>
<th>Code (EWC)</th>
<th>Material</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SPECIAL WASTE STREAMS</strong></td>
<td></td>
</tr>
<tr>
<td>20 01 33, 20 01 34</td>
<td>Batteries and accumulators included in 16 06 01, 16 06 02 or 16 06 03 and unsorted batteries and accumulators containing these batteries</td>
</tr>
<tr>
<td>20 01 25, 20 01 26</td>
<td>Edible oil and fat</td>
</tr>
<tr>
<td>20 01 36, 20 01 21*, 20 01 35</td>
<td>Discarded electrical and electronic equipment other than those mentioned in 20 01 23 and 20 01 35</td>
</tr>
<tr>
<td>20 01 40</td>
<td>Metal scrap</td>
</tr>
<tr>
<td>20 01 39</td>
<td>Plastic scrap</td>
</tr>
</tbody>
</table>
Step 2: Survey methodology

2.1. Selection of interested stakeholders:

- Update of registry of waste recycling companies of the Greek Ministry of Environment
- Geographical limitation of investigation
  - Peloponnese
  - Cyclades islands
  - Attica region

2.1. Selection of communication means

- Phone survey
- E-mails
- Questionnaires
ACTION A1: STAKEHOLDERS’ CONSULTATION results

Step 3.1: Intermediate companies

In total, 436 stakeholders contacted:

- Companies for managing recyclable waste
- Recycling bodies

**Yes**
interested for information and potential active involvement in the project

**No:**
not interested

**Other:**
(i) the company does not exist anymore,
(ii) no reply to the phone survey & questionnaire,
(iii) their response is still pending from the relevant communication department
ACTION A1: STAKEHOLDERS’ CONSULTATION results

Step 3.1: Intermediate companies

Positive response per target waste material

- Paper: 37
- Glass: 28
- Plastic: 36
- Metal: 49
- Special waste streams: 8

Out of the total no. companies with positive response (64 companies)
ACTION A1: STAKEHOLDERS’ CONSULTATION results

Step 3.1: Intermediate companies

- The majority of stakeholders showed their interest towards the Municipality of Ancient Olympia due to the easier access compared to island regions.

- The stakeholders interested in waste collection from insular areas posed additional requirements, such as minimum quantity of source-sorted materials and limitations on collection frequency.

Out of the total no. companies with positive response (64 companies)

LIFE PAVEtheWaySTE: Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas
Step 3.1: Intermediate companies

Certain quality standards for targeted waste materials were examined, with respect to:

(a) separation of materials,
(b) reduction of transportation costs (volume reduction and/or baling)

Out of the total no. companies with positive response (64 companies): 94% separated materials and 6% did not separate materials.

- No separation (4 companies)
- Separation (59 companies)
**ACTION A1: STAKEHOLDERS’ CONSULTATION results**

**STEP 3.2: Recyclable materials’ processing industries**

With the aim of clarifying the material specifications, in addition to intermediate stakeholders, industries which receive recyclable materials for further processing and production of secondary materials were contacted.

Overall, **37 regeneration industries** of targeted waste materials throughout Greece were contacted.

More specifically:

- 12 plastic regeneration industries,
- 13 paper mills,
- 9 aluminum and metal industries
- 2 glassmaking industries

The **top prerequisite** of quality specifications was the purity level of waste materials, followed by compression and baling.
**ACTION A1: STAKEHOLDERS’ CONSULTATION results**

**Step 4: Determination of materials’ price**

According to data provided by a **Material Recycling Facility in Attica**, higher market values are presented for the following sorted materials:

- **Plastic** separated in sub-categories
- **Metal**

For this reason, source separation is considered very important to achieve better price in recycling market.

<table>
<thead>
<tr>
<th>Waste group</th>
<th>SELLING Price range (€/tonne)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paper</td>
<td></td>
</tr>
<tr>
<td>News &amp; PAMs</td>
<td>101 - 113</td>
</tr>
<tr>
<td>Mixed papers: domestic</td>
<td>63 - 67</td>
</tr>
<tr>
<td>Mixed papers: export</td>
<td>69 - 75</td>
</tr>
<tr>
<td>Plastic</td>
<td></td>
</tr>
<tr>
<td>Clear PET</td>
<td>238 - 288</td>
</tr>
<tr>
<td>Coloured PET</td>
<td>38 - 50</td>
</tr>
<tr>
<td>Mixed Bottles</td>
<td>63 - 151</td>
</tr>
<tr>
<td>Natural HDPE</td>
<td>428 - 440</td>
</tr>
<tr>
<td>Mixed HDPE</td>
<td>126 - 145</td>
</tr>
<tr>
<td>Other Plastic</td>
<td></td>
</tr>
<tr>
<td>LDPE 98/2</td>
<td>377 - 403</td>
</tr>
<tr>
<td>Ferrous metals</td>
<td></td>
</tr>
<tr>
<td>Grade 10</td>
<td>91 - 189</td>
</tr>
<tr>
<td>Non-ferrous metals</td>
<td></td>
</tr>
<tr>
<td>Copper dry bright wire</td>
<td>4349 - 4591</td>
</tr>
<tr>
<td>Aluminium pure cuttings</td>
<td>818 - 931</td>
</tr>
<tr>
<td>Lead batteries</td>
<td>503 - 579</td>
</tr>
<tr>
<td>Glass</td>
<td></td>
</tr>
<tr>
<td>Clear</td>
<td>31 - 44</td>
</tr>
<tr>
<td>Amber</td>
<td>33 - 44</td>
</tr>
<tr>
<td>Green</td>
<td>19 - 31</td>
</tr>
<tr>
<td>Mixed</td>
<td>25 - 31</td>
</tr>
</tbody>
</table>
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

A.2.1. Selection of installation sites for the innovative recycling systems in the target remote areas

- 4 systems to be installed in Donoussa, Schinoussa, Iraklia and Koufonisia (Municipality of Naxos and Small Cyclades Islands)

- 5 systems to be installed in the Municipal Department of Ancient Olympia

Assumptions for the siting of systems:

- Determination of the maximum walking distance to be covered by the population: 200 m.
- Identification and mapping of large waste producers e.g. hotels, restaurants, etc.
- Findings of public consultation with local communities and authorities for the finalization of the installation points
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

Municipality of Naxos & Small Cyclades: Donousa

- Population concentrated in the island capital
- Large waste producers

<table>
<thead>
<tr>
<th>Population (inhabitants)</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW production (tn/year) by 2020:</td>
<td>213</td>
</tr>
</tbody>
</table>

Indicative installation site
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

Municipality of Naxos & Small Cyclades: **Koufonisia**

- Population concentrated in the island capital
- Large waste producers

<table>
<thead>
<tr>
<th>Population (inhabitants)</th>
<th>398</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW production (tn/year) by 2020:</td>
<td>725</td>
</tr>
</tbody>
</table>

Indicative installation sites
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

Municipality of Naxos & Small Cyclades: Schinousa

- Population concentrated in the island capital
- Large waste producers

<table>
<thead>
<tr>
<th>Population (inhabitants)</th>
<th>210</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW production (tn/year) by 2020:</td>
<td>233</td>
</tr>
</tbody>
</table>
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

Municipality of Naxos & Small Cyclades: Irakleia

- Population concentrated in the island capital
- Large waste producers

<table>
<thead>
<tr>
<th>Population (inhabitants)</th>
<th>117</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW production (tn/year) by 2020:</td>
<td>156</td>
</tr>
</tbody>
</table>
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

Municipality of Ancient Olympia: **Municipal Department of Ancient Olympia**
Local Communities: Ancient Olympia, Drouva, Pelopio, Platanos

<table>
<thead>
<tr>
<th>Population (inhabitants)</th>
<th>3108</th>
</tr>
</thead>
<tbody>
<tr>
<td>MSW production (tn/year) by 2020:</td>
<td><strong>1697</strong></td>
</tr>
</tbody>
</table>

- Population distributed in low populated communities, distant with each other
- Large waste producers

Indicative installation sites
A.2.2. Organization of the Integrated Solid Waste Management schemes for the target remote areas

✓ Identification of the need for ISWM in the selected communities of the participating municipalities

• Both target remote areas are tourist destinations with significant seasonal waste production fluctuations
• Current waste management relies on waste disposal in uncontrolled landfills
• No or limited recycling rates due to prohibitive transportation costs
• Integrated, sustainable waste management solutions are of imperative need to protect the environment and allow for the development of local economy
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

A.2.2. Organization of the Integrated Solid Waste Management schemes for the target remote areas

MSW composition analysis of examined remote areas

Municipality of Naxos & Small Cyclades Islands

- Biowaste: 40%
- Paper/paperboard: 25%
- Plastic: 14%
- Glass: 3%
- Metal: 3%
- Rest waste: 15%

Biowaste & Recyclables: 82.5% of MSW = 1095 tn/yr

Municipality of Ancient Olympia

- Biowaste: 54%
- Paper/paperboard: 18%
- Plastic: 11%
- Glass: 3%
- Metal: 3%
- Rest waste: 11%

Biowaste & Recyclables: 85% of MSW = 1438 tn/yr
A.2.2. Organization of the Integrated Solid Waste Management schemes for the target remote areas

- Planning of the MSW source separation and treatment scheme

**Proposed ISWM scheme for the remote areas**

- Temporary Storage
  - Paper
    - Print paper
    - Paperboard
    - Mixed paper
  - PET
    - PET - white
    - PET - coloured
  - HDPE
  - LDPE
  - PP/PS
  - Glass - clear
  - Glass - coloured
  - Ferrous metals
  - Non-ferrous
  - Organics
    - Used cooking oils
    - WEEE
    - Batteries and accumulators
    - Lamps
    - CDs
    - Metal scrap
    - Plastic scrap
  - Intermediate companies
  - Recycling industries
  - Alternative waste collection systems (ΑΦΗΣ, ΦΩΤΟΚΥΚΛΩΣΗ ΕΤC)
ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

A.2.2. Organization of the Integrated Solid Waste Management schemes for the target remote areas

✓ Planning of the communication strategy

Project website: www.pavethewayste.eu

Project notice board

E-newsletters

Project LOGO

Networking workshops

1st leaflet
B. IMPLEMENTATION ACTIONS

ACTION B1: Design of a prototype, innovative system for source separation and treatment of MSW

**Objective:**
The design of a prototype system which will be able to facilitate the recovery of materials of high quality and purity from MSW **at community level**
ACTION B1: Design of a prototype, innovative system for source separation and treatment of MSW

Operational Specifications

The recycling center consists of the following areas:
- **Reception area** of pre-sorted waste (plastic, glass, metal, paper, special waste streams) of the citizens to the user – operator of the innovative system (1 person)
- **Space area for further separation** of waste into subcategories (PET, HDPE, LDPE, Aluminium, tinplate, PVC, etc.) by the user-operator,
- **Processing area - compression of materials** susceptible to such treatment,
- **Storage area** of pre-sorted materials

System Plan and space arrangement of 20m³ container,

(6.058m x 2.591m x 2.438m)
ACTION B1: Design of a prototype, innovative system for source separation and treatment of MSW

Volume reduction of materials

• **Target materials:** Aluminium, Ferrous metals, HDPE, PET, PS/PP, Paper, Tetrapak

• The *compressor* is divided into five different compartments and has five identical containers. The compression pad is moved along two beams/columns and compresses the respective bin, according to the choice of the operator.

• A study on compression tests was carried out with different pre-sorted materials so as to determine:
  - compressibility of the material,
  - strength of the piston,
  - bending loads etc.
ACTION B1: Design of a prototype, innovative system for source separation and treatment of MSW

Storage area of materials:

Materials to be stored in special bins/baskets/containers:

(a) Basic waste materials: Paperboard/cartons, Print paper, Glass, LDPE (film)
(b) Special waste streams: Batteries, WEEE, Lamps, Used cooking oils, Metal & plastic scrap

Storage of secondary materials and additional bins
ACTION B1: Design of a prototype, innovative system for source separation and treatment of MSW

Additional compartments/modules
- Conveyor for accelerating the separation of recyclables
- Weighing scale
- Operator’s position
- Bench for further separation of materials
- Temporary storage container, in case of high incoming waste streams
- Port for receiving waste
- Door for operator of the system
LIFE PAVE the WAySTE: Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas

**METHODOLOGY OF IMPLEMENTATION STEPS – FORTHCOMING ACTIONS**

1a. Stakeholders Consultation and recording of the existing status of the market for recyclable waste (ACTION A1)

1b. Setting the Integrated Solid Waste Management (ISWM) Strategy for the remote municipalities of Naxos and Ancient Olympia (ACTION A2)

2. Design and construction of the innovative systems for the source separation and treatment of municipal solid waste (ACTIONS B1, B2)

3. Operation, optimization and demonstration of the innovative systems in selected areas of the participating municipalities (ACTION B3)

4. Monitoring the environmental and socio-economic impact of the project (ACTIONS C1, C2, C3, C4)

5a. Evaluation of the results of implementation through Life Cycle Analysis (ACTION B4)

5b. Assessment of end-products marketability (ACTION B4)

6. Suggestions for full-scale implementation of the project - Replicability of the project in remote areas of Greece, Spain and other countries in Europe (ACTION B5)
The project’s results are expected to have an added value, both locally and at European level, contributing to more efficient use of local resources, economic and energy savings.

This way, isolated areas such as remote and island regions shall apply sustainable waste management schemes and shift from the linear to circular economy.
Thank you for your attention!

For more information, visit the project website: 

www.pavethewayste.eu