



LIFE 14 ENV/GR/000722

# Development of innovative integrated waste recycling schemes for remote areas

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## CYPRUS 2016

4<sup>th</sup> International Conference on Sustainable Solid Waste Management



# 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]

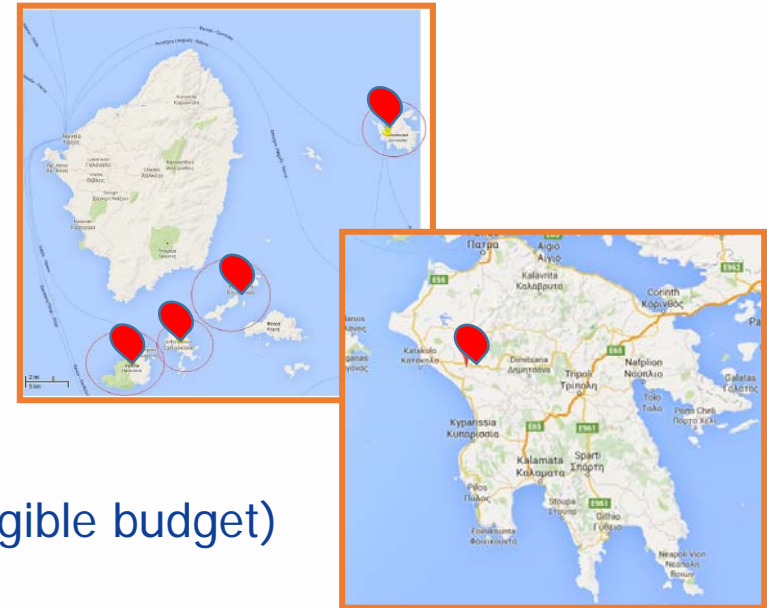
## BUDGET INFO:

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**)



## 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 (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

A

- **Preparatory actions** (Stakeholders consultation, Setting of ISWM strategy for remote areas)
- Duration: 4 months (01.09.2015 – 31.12.2015)

B

- **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)

C

- **Monitoring of the impact of the project actions** (key performance indicators, monitoring protocol, current status assessment, environmental & socio-economic impact)
- Duration: 40 months (01.09.2015 – 31.12.2018)

D

- **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)
- Duration: 40 months (01.09.2015 – 31.12.2018)

E

- **Project management and monitoring of the project progress** (project management & reporting to EC, monitoring & evaluation of indicators, After-LIFE Communication Plan, External Audit)
- Duration: 40 months (01.09.2015 – 31.12.2018)

# 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**



## ACTION A1: STAKEHOLDERS' CONSULTATION results

### Step 1: Determination of targeted waste materials according to European Waste catalogue categorization

Basic MSW materials targeted:

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

Code (EWC)	Material
<b>BASIC WASTE STREAMS</b>	
15 01 01	Paper packaging
15 01 02	Plastic packaging
15 01 04	Metal packaging
15 01 05	Mixed packaging
15 01 07	Glass packaging
20 01 01	Paper/paperboard
20 01 02	Glass
<b>BIODEGRADABLE WASTE STREAMS</b>	
20 02 01	Biodegradable waste
20 01 08	Biodegradable kitchen and canteen waste



## ACTION A1: STAKEHOLDERS' CONSULTATION results

### 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.

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

# ACTION A1: STAKEHOLDERS' CONSULTATION results

## 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

The image shows two sample questionnaires. The left one is titled "1\* ΕΡΩΤΗΜΑΤΟΛΟΓΙΟ για τη συλλογή πληροφοριών από τους ενδιαφερόμενους φορείς ανακύκλωσης υλικών" and contains sections for identifying the stakeholder, their contact information, and their role. The right one is titled "ΒΕΛΤΙΣΤΗ ΕΠΙΧΕΙΡΗΣΗ 2. ΑΠΟΤΥΠΩΣΗ ΕΝΔΙΑΦΕΡΟΝΤΟΣ" and contains sections for identifying the stakeholder, their contact information, and their role in the waste management process.

## 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

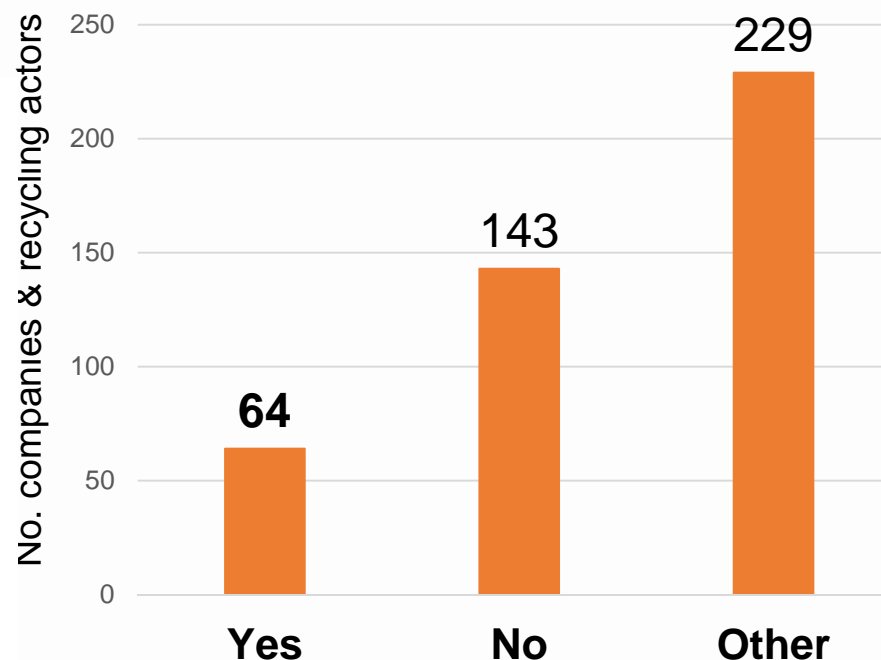
#### **No:**

not interested

#### **Other:**

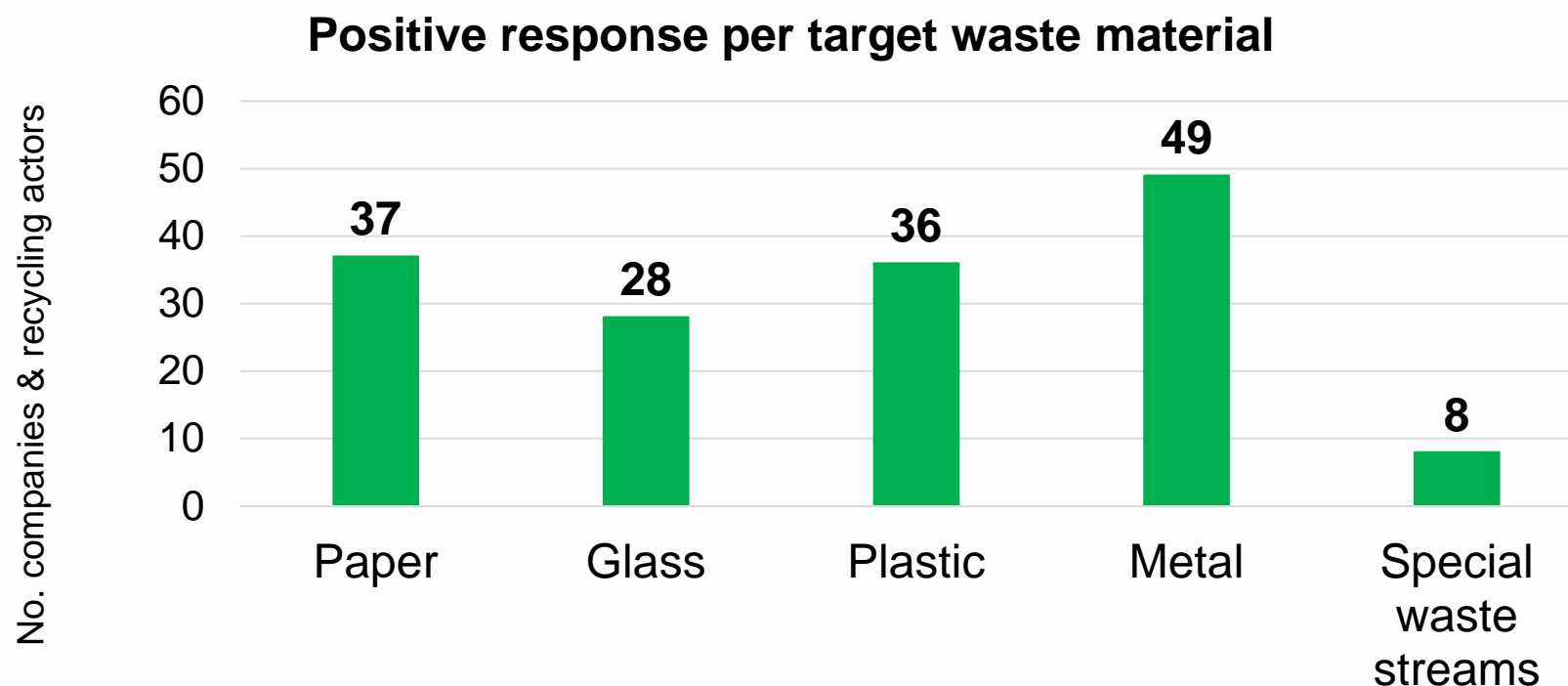
- (i) the company does not exist anymore,
- (ii) no reply to the phone survey & questionnaire,
- (iii) their response is still pending from the relevant communication department

**Reconding of interest**



## ACTION A1: STAKEHOLDERS' CONSULTATION results

### Step 3.1: Intermediate companies



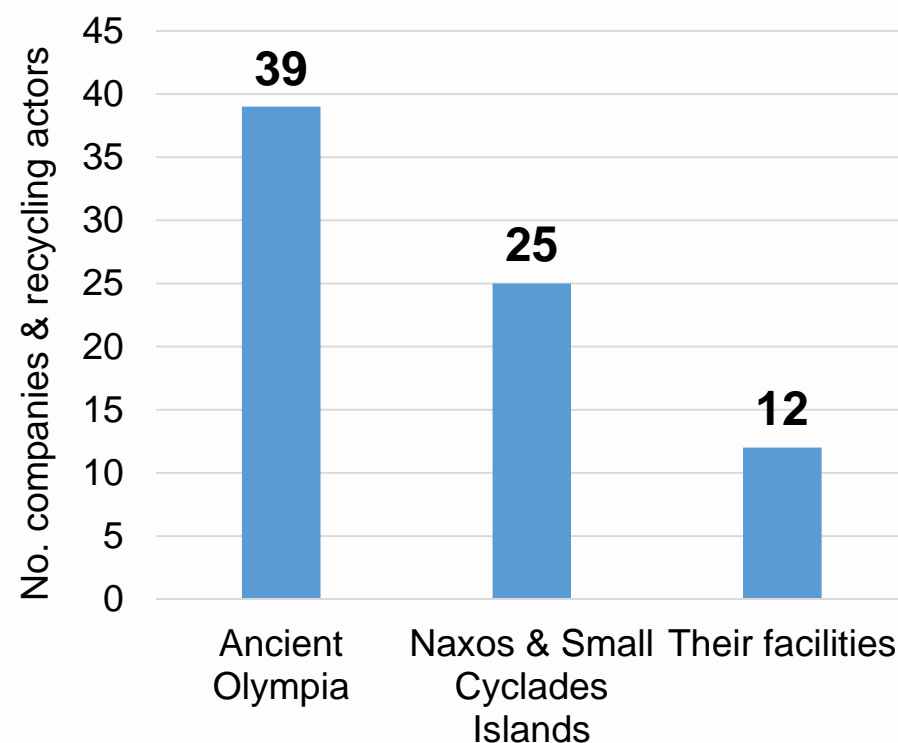
Out of the total no. companies with positive response (64 companies)

## 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**.

Interest - geographical distribution



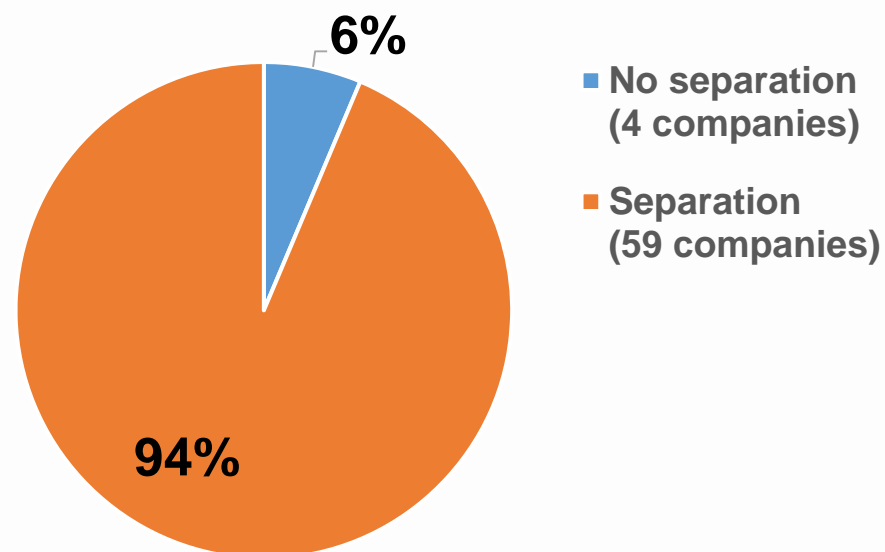
Out of the total no. companies with positive response (64 companies)

## ACTION A1: STAKEHOLDERS' CONSULTATION results

### 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)



## ACTION A1: STAKEHOLDERS' CONSULTATION results

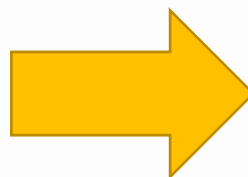
### STEP 3.2: Recyclable materials' processing industries

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

Waste group		SELLING Price range (€/tonne)
Paper	News & PAMs	<b>101 - 113</b>
	Mixed papers: domestic	63 - 67
	Mixed papers: export	69 - 75
Plastic	Clear PET	<b>238 - 288</b>
	Coloured PET	38 - 50
	Mixed Bottles	63 - 151
	Natural HDPE	<b>428 - 440</b>
	Mixed HDPE	<b>126 - 145</b>
Other Plastic	LDPE 98/2	<b>377 - 403</b>
Ferrous metals	Grade 10	91 - 189
Non-ferrous metals	Copper dry bright wire	<b>4349 - 4591</b>
	Aluminium pure cuttings	<b>818 - 931</b>
	Lead batteries	<b>503 - 579</b>
Glass	Clear	31 - 44
	Amber	33 - 44
	Green	19 - 31
	Mixed	25 - 31

## 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**

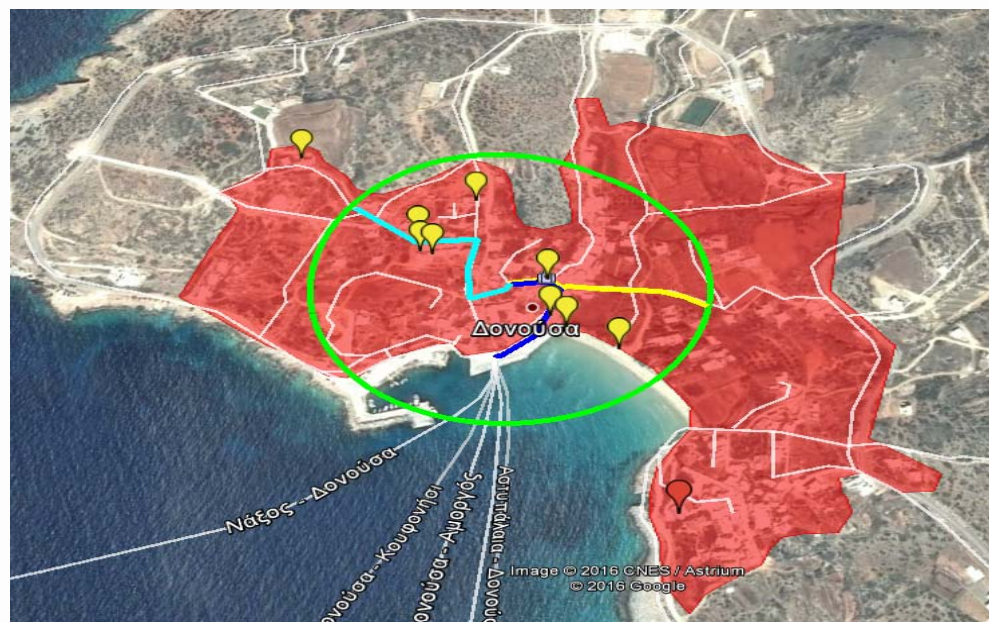
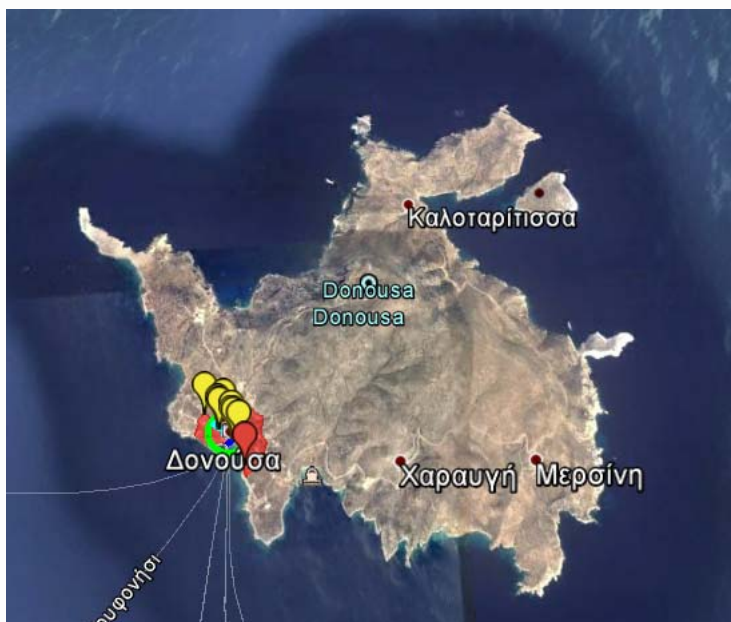
## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

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

Population (inhabitants)	<b>150</b>
MSW production (tn/year) by 2020:	<b>213</b>

- Population concentrated in the island capital
- Large waste producers

Indicative installation site





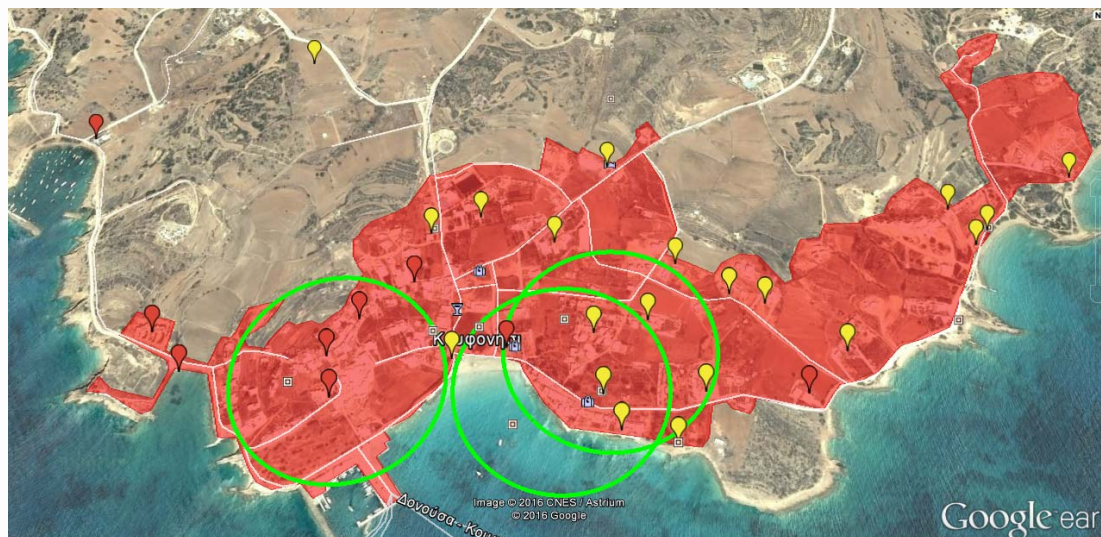
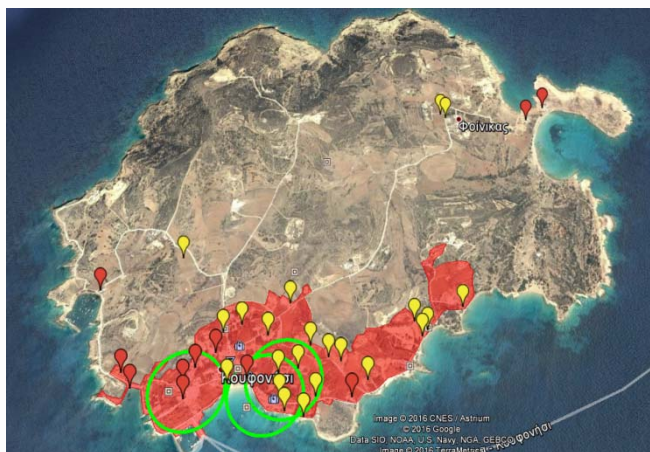
## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

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

Population (inhabitants)	<b>398</b>
MSW production (tn/year) by 2020:	<b>725</b>

- Population concentrated in the island capital
- Large waste producers

### Indicative installation sites



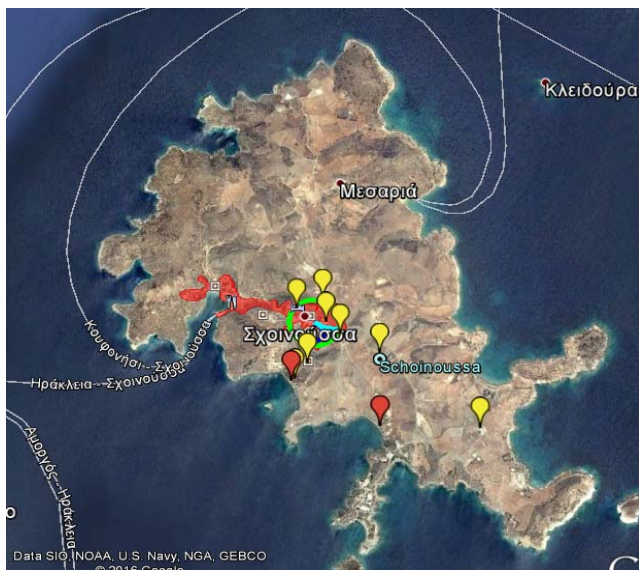
## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

### Municipality of Naxos & Small Cyclades: **Schinoussa**

Population (inhabitants)	<b>210</b>
MSW production (tn/year) by 2020:	<b>233</b>

- Population concentrated in the island capital
- Large waste producers

### Indicative installation site





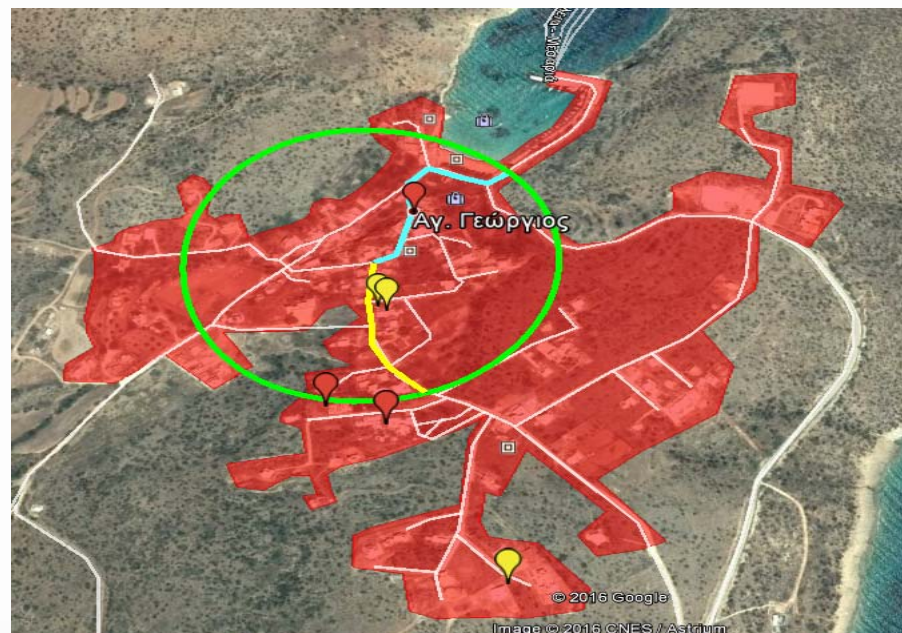
## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

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

Population (inhabitants)	<b>117</b>
MSW production (tn/year) by 2020:	<b>156</b>

- Population concentrated in the island capital
- Large waste producers

Indicative installation site



## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

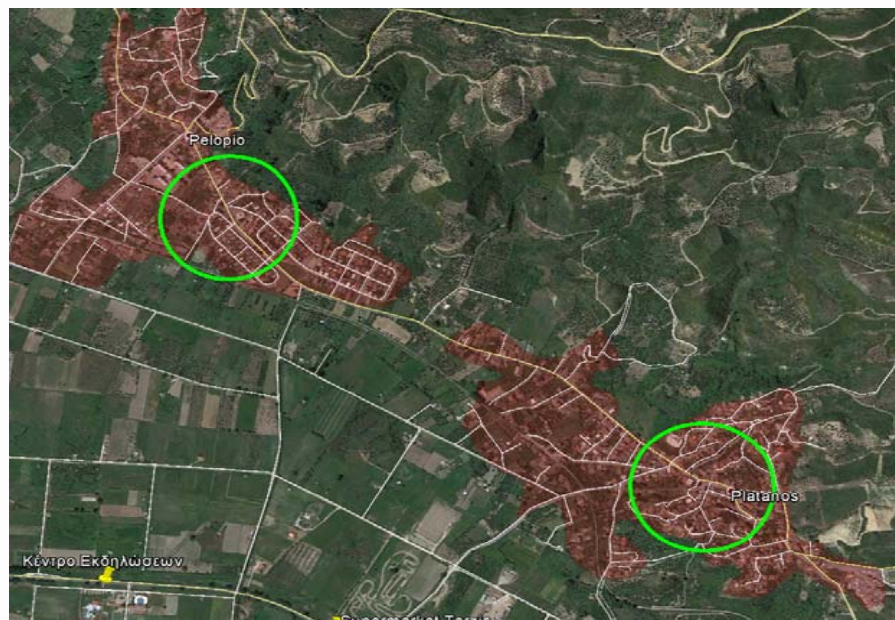
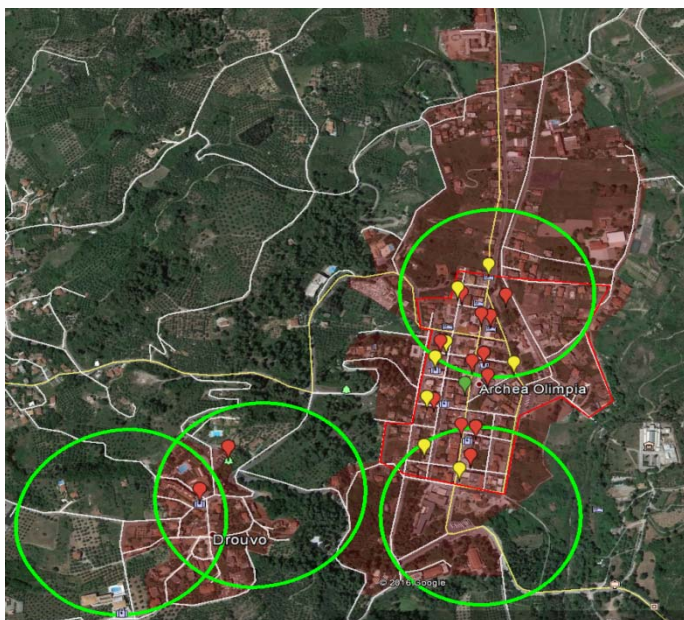
Municipality of Ancient Olympia: **Municipal Department of Ancient Olympia**  
Local Communities: Ancient Olympia, Drouva, Pelopio, Platanos

Population (inhabitants) **3108**

MSW production (tn/year) by 2020: **1697**

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

### Indicative installation sites



## 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*

- ✓ 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

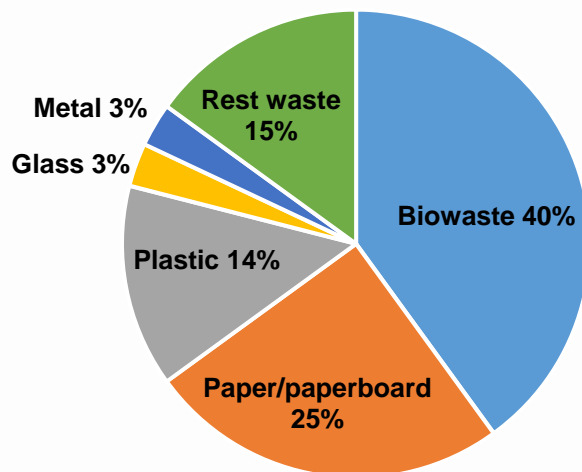


## ACTION A2: Organization of the Integrated Solid Waste Management Strategy in the target remote areas

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

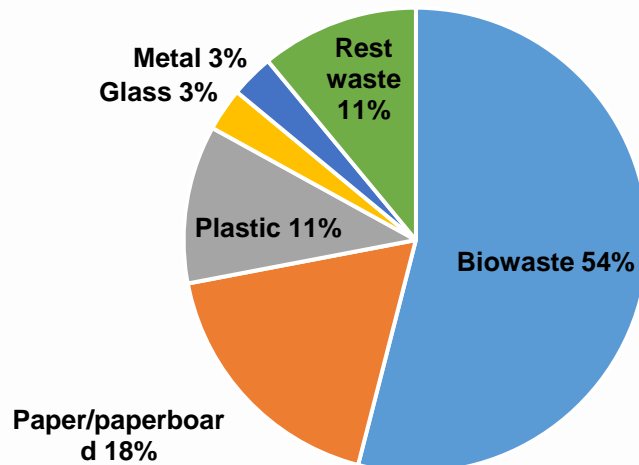
MSW composition analysis of examined remote areas

#### Municipality of Naxos & Small Cyclades Islands



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

#### Municipality of Ancient Olympia

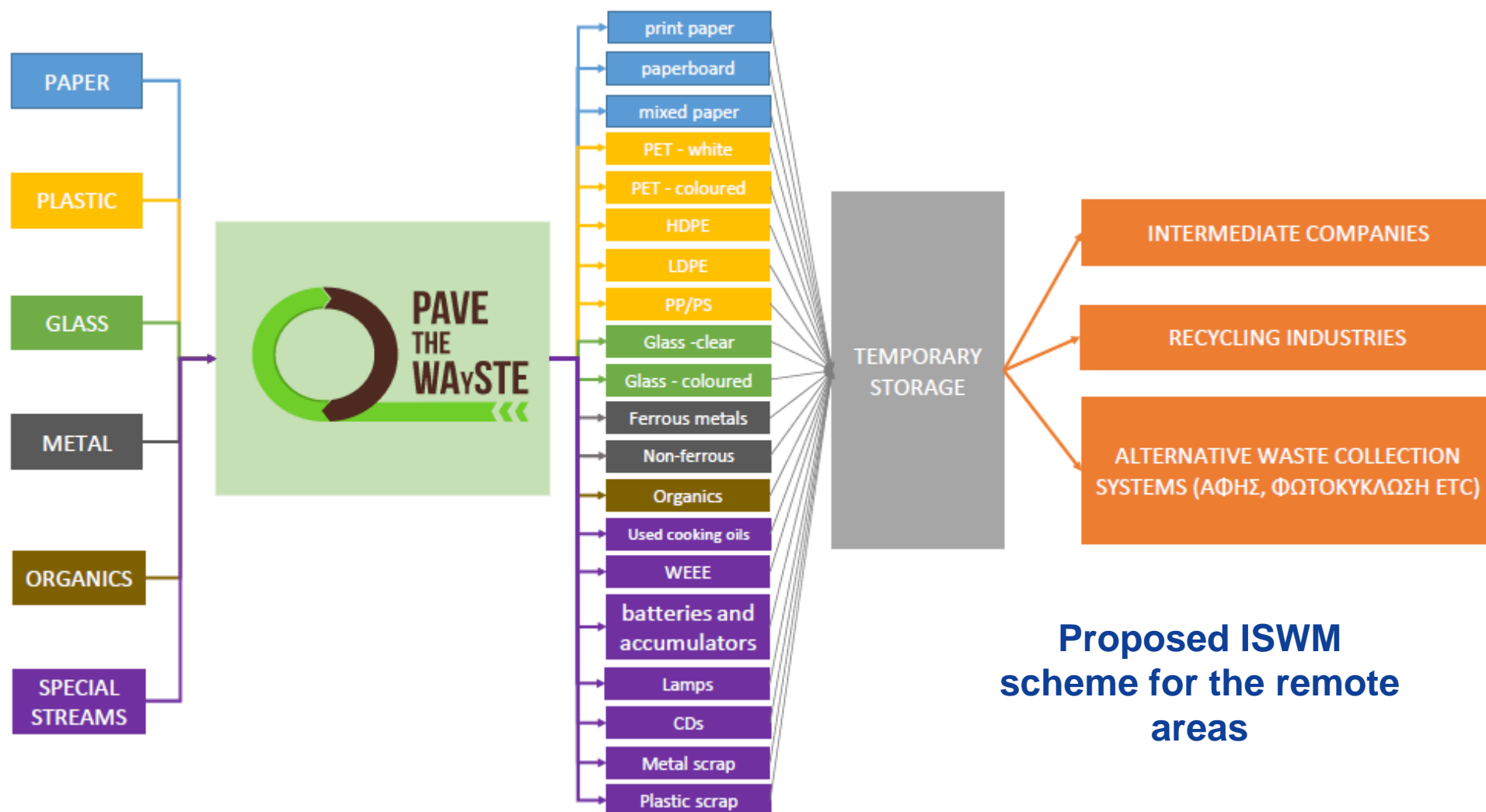


Biowaste & Recyclables  
85% of MSW = 1438 tn/yr

## 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 MSW source separation and treatment scheme



# 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](http://www.pavethewayste.eu)

### Project notice board



### E-newsletters

### Project LOGO



### 1st leaflet



### Networking workshops

efficiency through innovative, integrated waste recycling schemes for remote areas



## 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

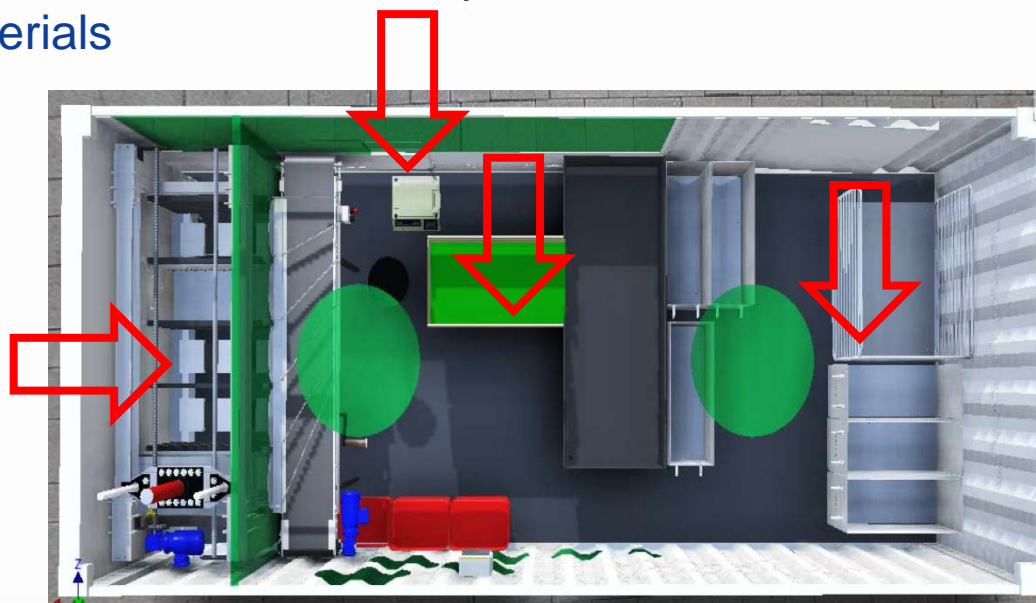
### Operational Specifications

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 20m<sup>3</sup> container,

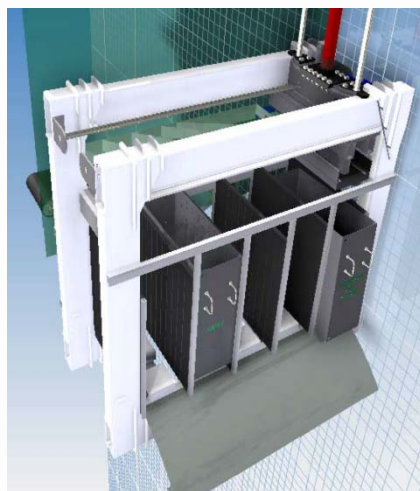
(6.058m x 2.591m x 2.438m)



## 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.



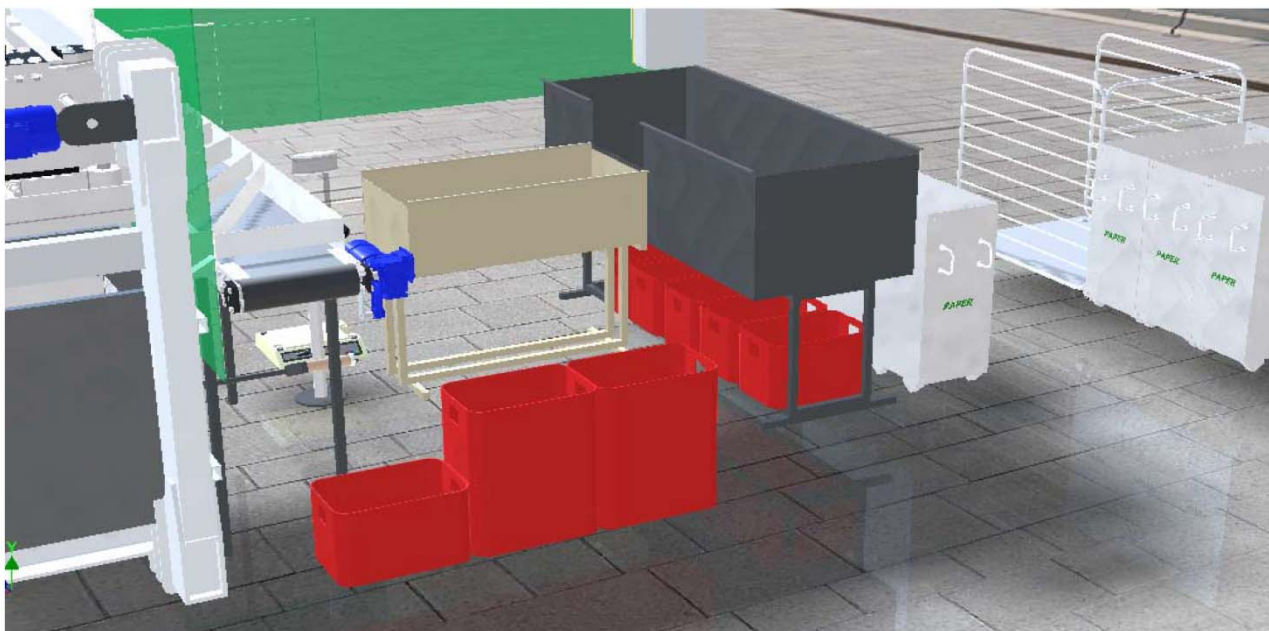
- A **study on compression tests** was carried out with different pre-sorted materials so as to determine:
  - compressibility of the material,
  - strength of the piston,
  - bending loads etc.

## 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



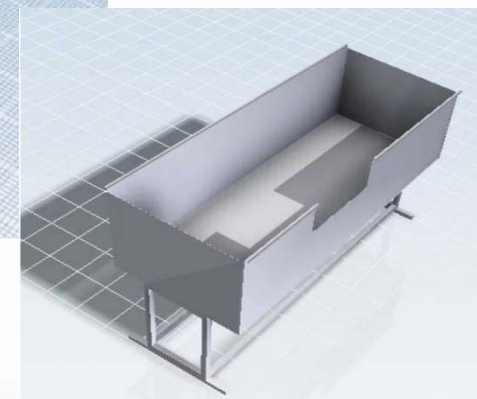
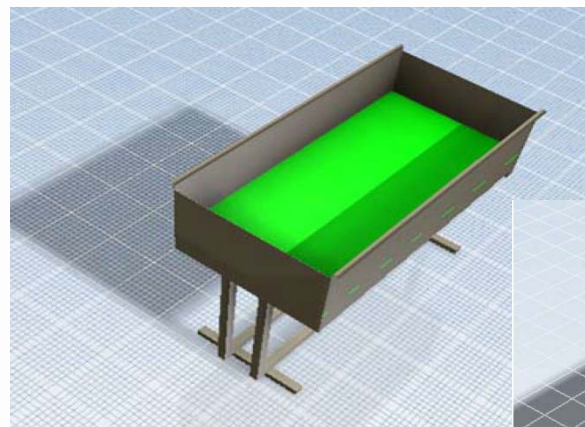
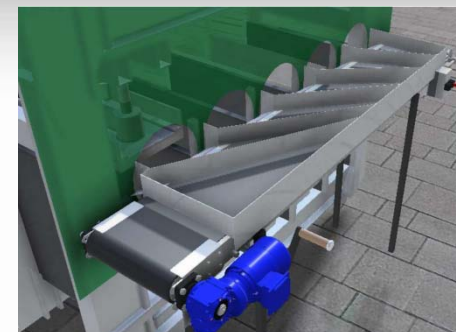
Storage of secondary materials and additional bins



## 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



## 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)

**Forthcoming**

**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)



**Forthcoming**

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



**Forthcoming**

**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)



## CONCLUSIONS

- 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.



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# Thank you for your attention!

For more information,  
visit the project website:  
[www.pavethewayste.eu](http://www.pavethewayste.eu)