The Experience of the NTUA Unit of Environmental Science & Technology in LIFE Projects

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Naxos Island, 14th June 2018

National Technical University of Athens (NTUA)

NTUA (www.ntua.gr) was founded in 1836 and is the oldest and most prestigious educational institution of Greece in the field of technology.

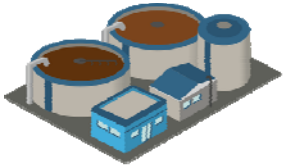
NTUA in numbers:

- 9 Faculties, 1350 personnel
- 700 academic staff
- 140 scientific assistants
- 260 administrative & technical staff
- 8500 Undergraduate students
-1500 graduate students

Unit of Environmental Science & Technology (UEST)

Areas of Expertise

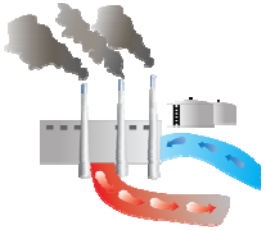
Waste management



Wastewater Treatment

Eco design

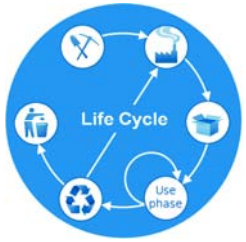
Desalination & Brine treatment



Pollution & Environment Control

Climate Change

Tools



Life Cycle Analysis

Environmental Impact Assessment

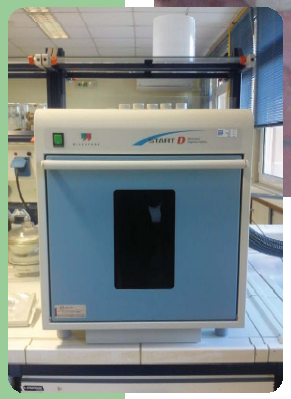
Integrated Product Policy

Decision Support Systems

UEST Laboratory – ISO 9001:2000 & 17025:2005 certified

100

industries per year



UEST Activities

- ✓ Open culture
- ✓ Innovation
- ✓ Collaborative research
- ✓ Market oriented projects
- ✓ Center of excellence - among the best in Europe

30 years: we implemented over 150 projects

32
ENV, CLIMA

Industry 82

OTHER EU 30
(H2020, FP7, EUROPEAID, INTERREG,TWINNING)

SOL-BRINE Project

- **Area of implementation:** Tinos Island, Greece
- **Project Budget:** 1,209,689.00 €
- **EC Funding (LIFE+):** 604.844,00 € (50% of Total Budget)
- **Duration:** 39 months
- **Start date:** 01/10/2010
- **End date:** 31/12/2013

SOL-BRINE: Partners

Municipality of Tinos Island (Project Coordinator)

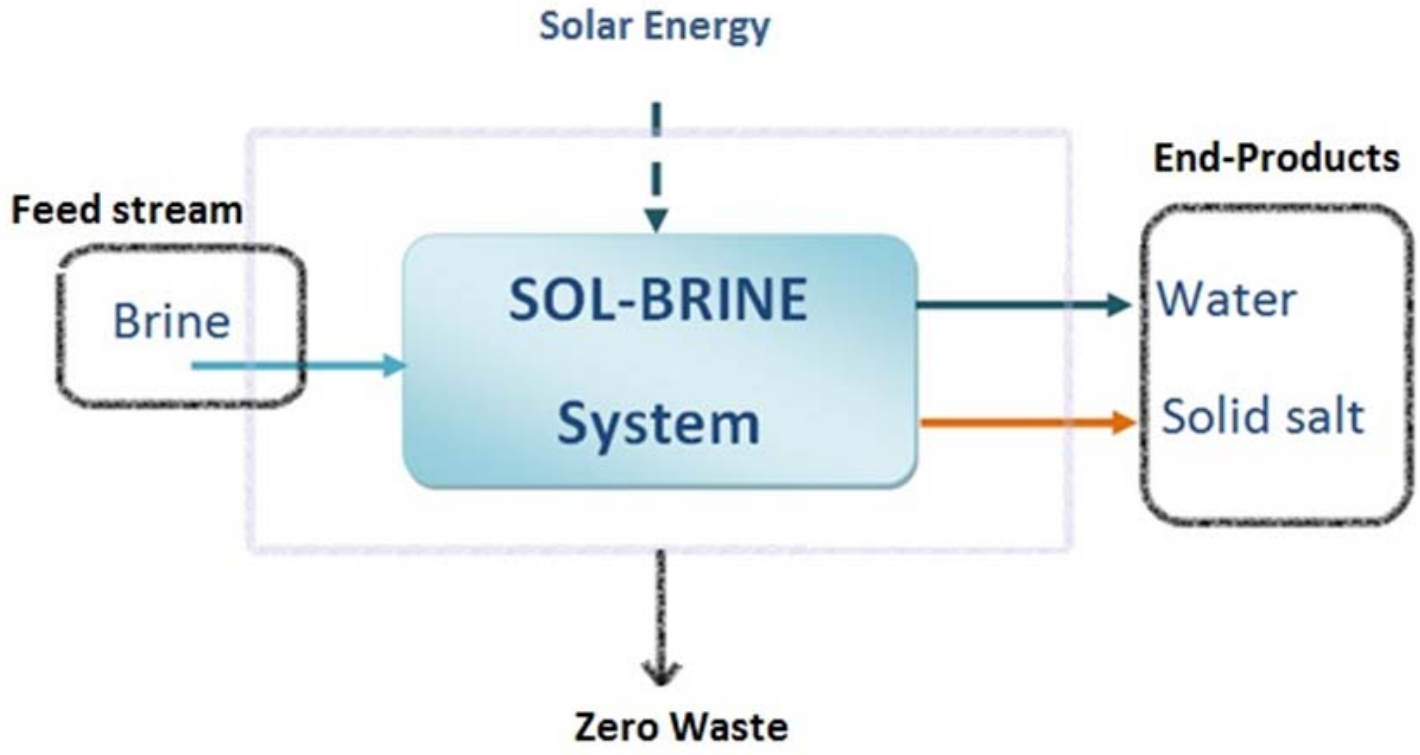
National Technical University of Athens (NTUA)
School of Chemical Engineering
Unit of Environmental Science and Technology (*UEST*)

Culligan Hellas S.A.

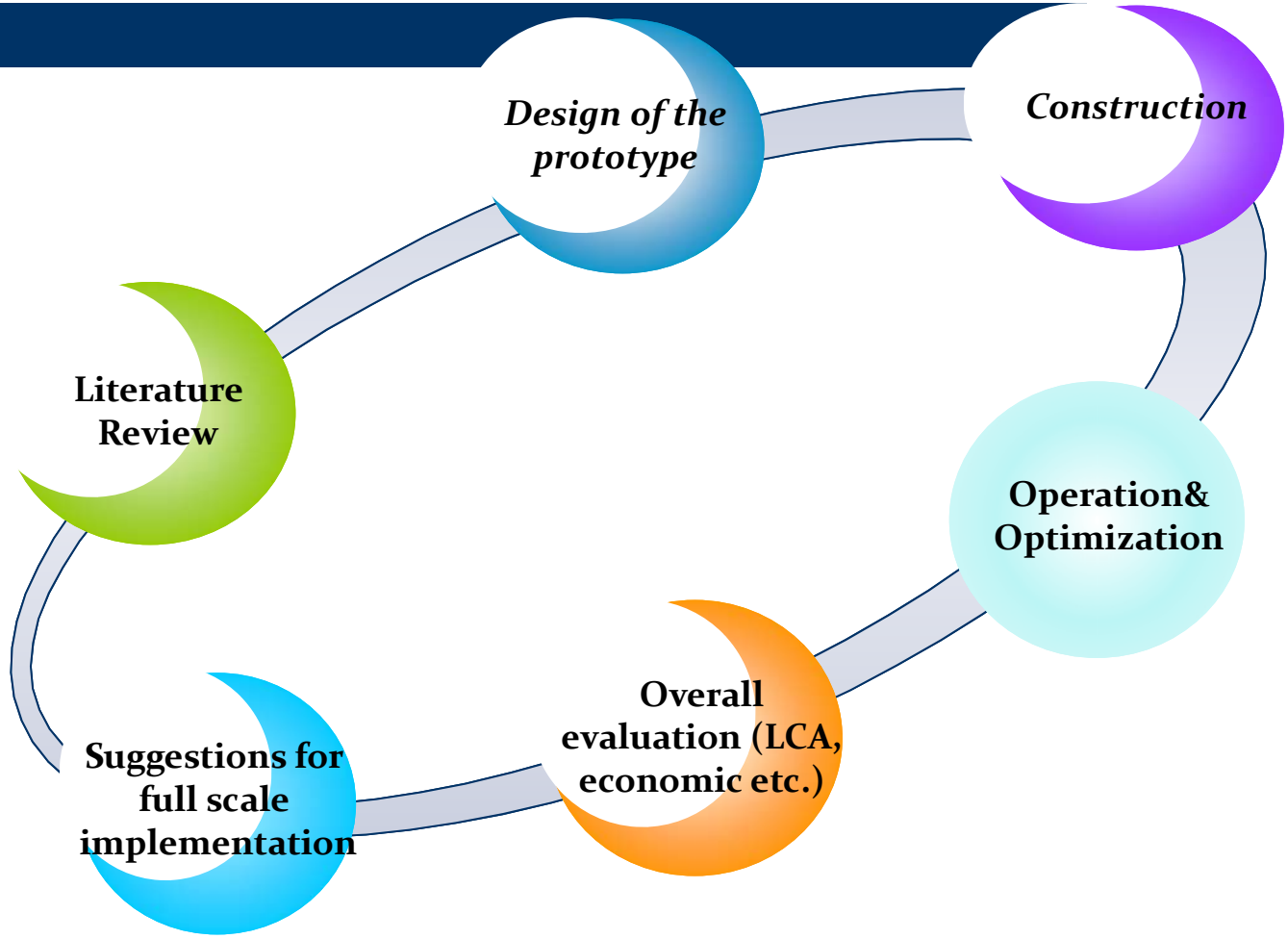
SOL-BRINE: Main aim

"The main objective of this project was the development of an innovative, energy autonomous system for the treatment of brine from seawater desalination plants "

SOL-BRINE: Concept



Methodology



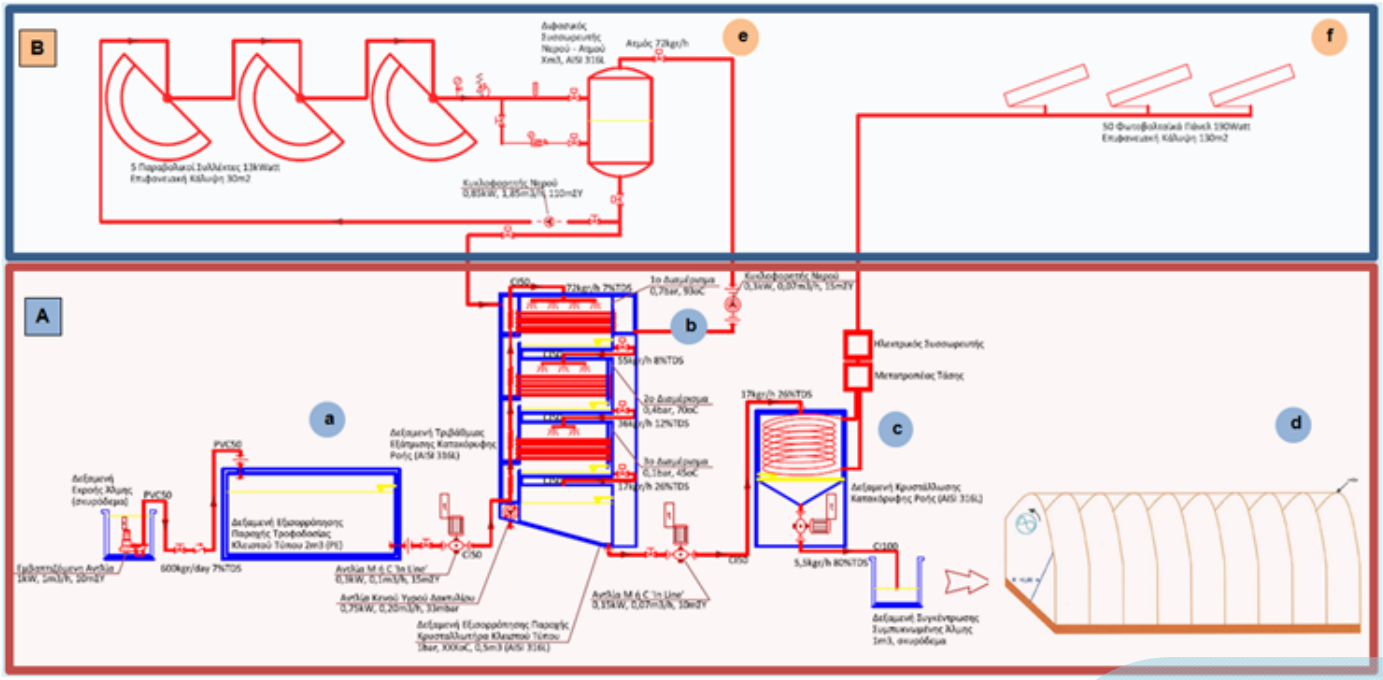
Innovative aspects of the project

- **Total brine elimination.** The system has been designed in line with the Zero Liquid Discharge principle
- **Water Recovery** (>90%)
- **Production of useful end-products.** Through the operation of the prototype system the following two products are produced: (a) distilled water of high quality and (b) dry salt. These products have potential market opportunities.

Innovative aspects of the project

- **Energy autonomous operation**. Solar thermal collectors are used for delivering hot water (10 KW_{th} at approximately 70^{o}C) and a photovoltaic generator (10 kW_{el}) for electricity. All energy requirements are covered exclusively through the use of solar energy

- **Use of state-of the art technology**: the evaporation of water is realized through custom designed vacuum evaporation technology (evaporator and crystallizer) and solar dryer

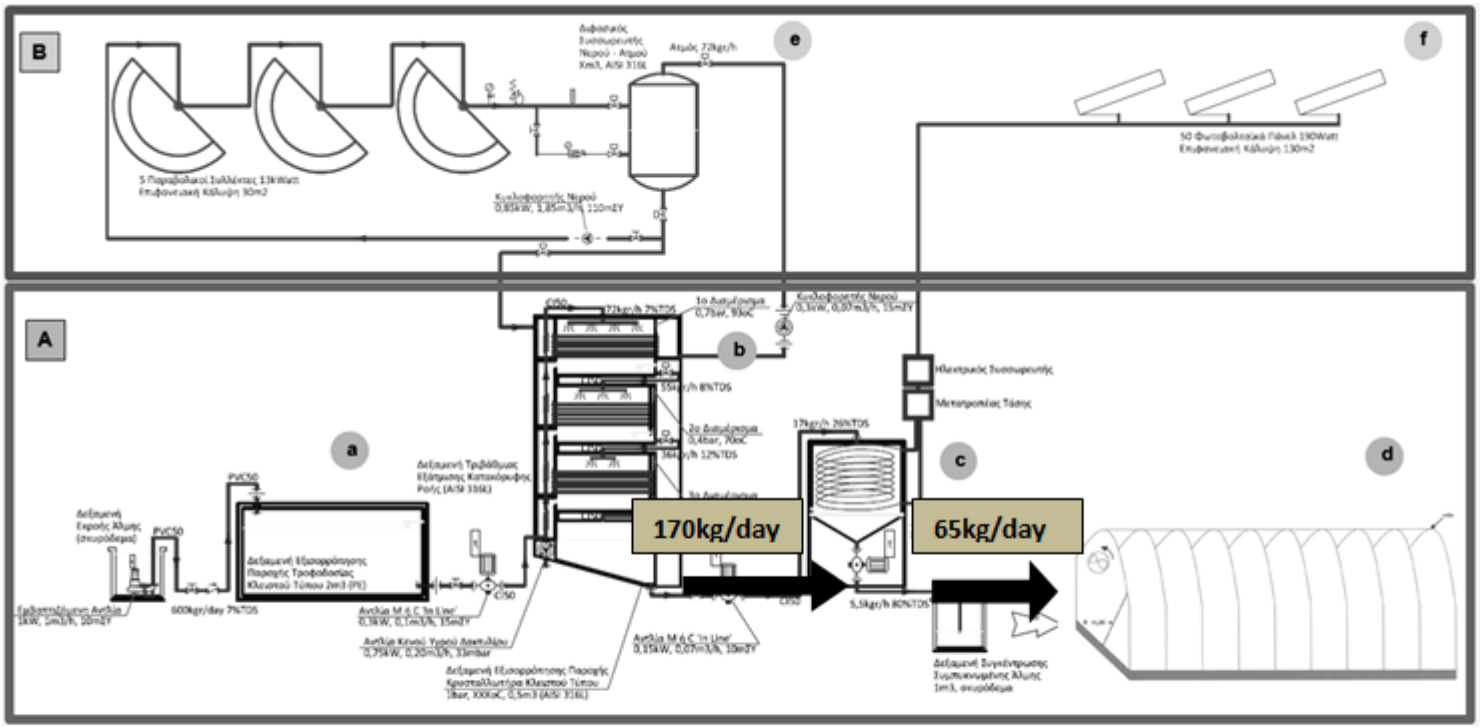


Legend

A	Brine Treatment System	B	Energy supply system
a	Feed water tank	e	Solar thermal collectors
b	MED Evaporator	f	Photovoltaic generator
c	Crystallizer		
d	Dryer		

Single line diagram

Mass Balance



500kg/day

(465kg H_2O/day)

(35kg Salt/day)

330kg H_2O/day

105kg H_2O/day

35kg Salt/day

30kg H_2O/day

Brine treatment system

The pilot brine treatment system is consisted of the following units:

(a) Evaporator

(b) Crystallizer

(c) Solar Dryer

Evaporator unit

Figure: View of the interior (1st Effect)

Figure: Transportation of the evaporator unit from the manufacturer's facilities

Evaporator unit

Figure: View of the evaporator (installed on site)

Crystallizer

Its purpose is to crystallize the brine effluent, producing a slurry (magma) with humidity levels of approximately 50%. The whole process is characterized by energy efficiency through the combined use of vacuum technology and heat pump.

Crystallizer unit

Figure: View of the crystallizer (installed on site)

Dryer unit

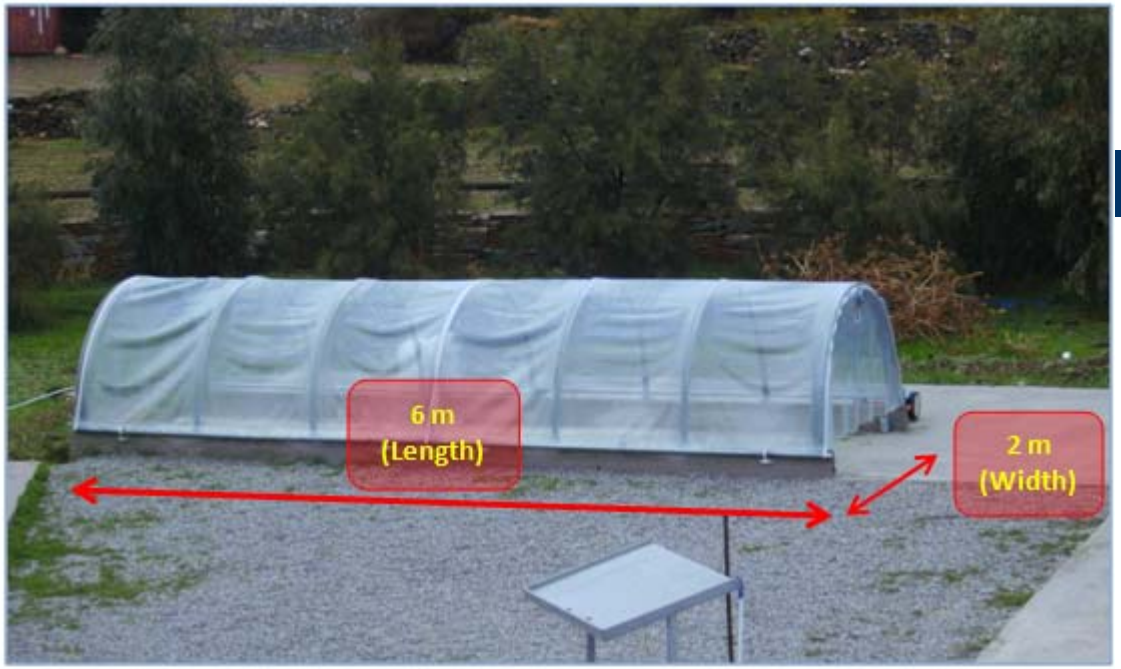


Figure: View of the dryer (installed on site)

Photo from the constructed prototype brine treatment system!

SITE VISIT

Sol - Brine

Life

Project awards

BEST LIFE ENV 2015

1st Blue Growth Award

BEST 25 YEAR-LIFE ENVIRONMENT PROJECT (1992-2017)

SYNERGIES


2010
SOL-BRINE project (€1.2M)
2012
Demonstration of concept at pilot scale
2015 (May)
Green Desalination project (€71K)
2015 (July)
Seed Funding – 1st (Private) Investor (€15K)
2016 (May)
SOL-BRINE is awarded BEST LIFE 2015 project
2017 (February)
BRINE-MINING project (€82K)
2017 (May)
ZERO BRINE project (€10M)
Life
HORIZON 2020
HORIZON 2020
HORIZON 2020
TRL=5
TRL>7

We are highly involved in Circular Economy

ZERO BRINE:

Horizon 2017 project
Brines → Materials (metals, minerals)

HORIZON 2020

€10M
Budget

Circular Economy - priorities

1. Plastics
2. Food waste
3. Critical raw materials
4. Construction and demolition
5. Biomass and bio-based products

Waste & natural resources

- Each year in the European Union:
  - 7.3 billion tonnes of resources are consumed
  - 2.7 billion tonnes of waste are generated,
  - 40% is being re-used or recycled, the rest ends up at landfill or is partly incinerated.

Waste & natural resources

- If this quantity of waste was recycled then:
  - the equivalent of 148 million tonnes of CO_2 emissions could be avoided annually;
  - Around 5.25 billion euro would be saved from the recovery of recyclables such as paper, glass, plastics, aluminum and steel per year.
  - 500,000 new jobs at least would be created.

We create value

PLASTICS

FOOD WASTE & BIO-MASS FEEDSTOCKS

ATHENS-BIOWASTE LIFE+ project

- **Project title and acronym:** «Integrated management of bio-waste in Greece – The case study of Athens**, ATHENS-BIOWASTE**»
- **PROJECT LOCATION:** Athens, Greece
- **BUDGET INFO:** 1,339,930.00 € (50% EC Co-funding)
- **DURATION: Start:** 01/09/11**- End:** 31/08/2014
- **PROJECT'S IMPLEMENTORS:**
  - **Coordinating Beneficiary:** National Technical University of Athens
  - **Associated Beneficiaries:**
    - Association of Communities and Municipalities in the Attica Region
    - EPTA – Environmental Engineers – Consultants
    - Municipality of Athens
    - Municipality of Kifissia

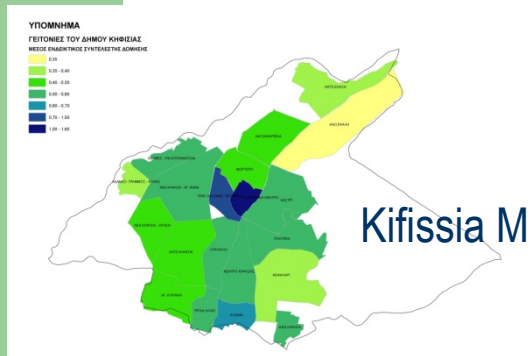
ATHENS-BIOWASTE BACKGROUND and AIMS

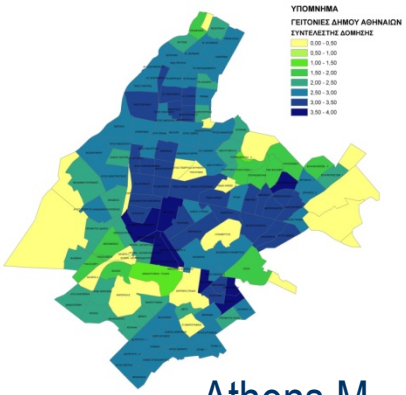
- ATHENS-BIOWASTE aims to establish and promote sustainable biowaste management in Greece using the municipalities of Athens and Kifissia as case study areas.
  - Separate collection systems in the Municipalities of Athens and Kifissia
  - Collection and composting of biowaste at the MBT facility of EDSNA
  - Developing appropriate bio-waste management software tool
  - Drafting recommendations for the amendment of the current technical specifications included in Greek legislation
  - Raising environmental awareness and knowledge in citizens and other stakeholders regarding management of bio-waste

Selection and planning of separate collection methods for the case study areas

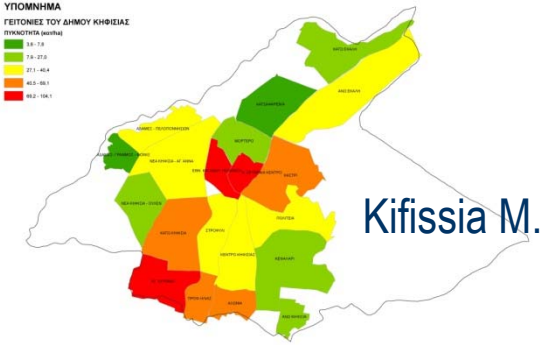
Criteria considered for the selection of the pilot areas in Athens & Kifissia municipalities

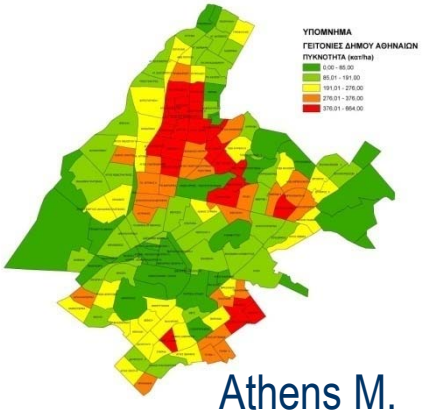
Urban planning conditions



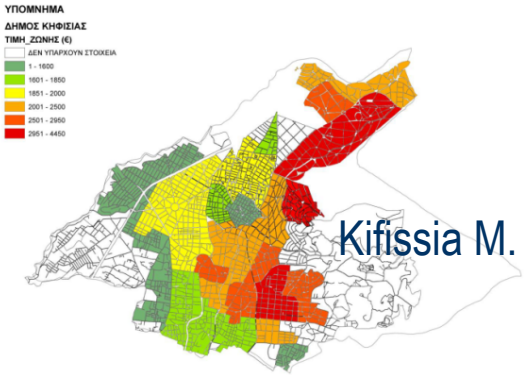


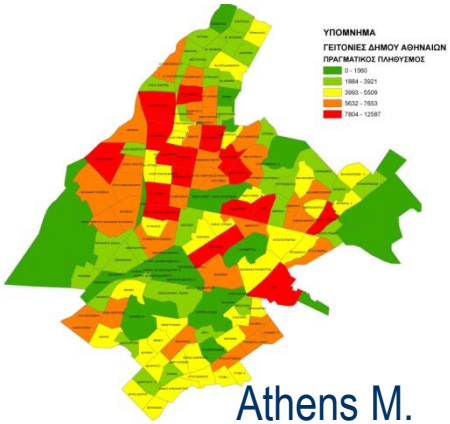
Population Density





Economic criteria





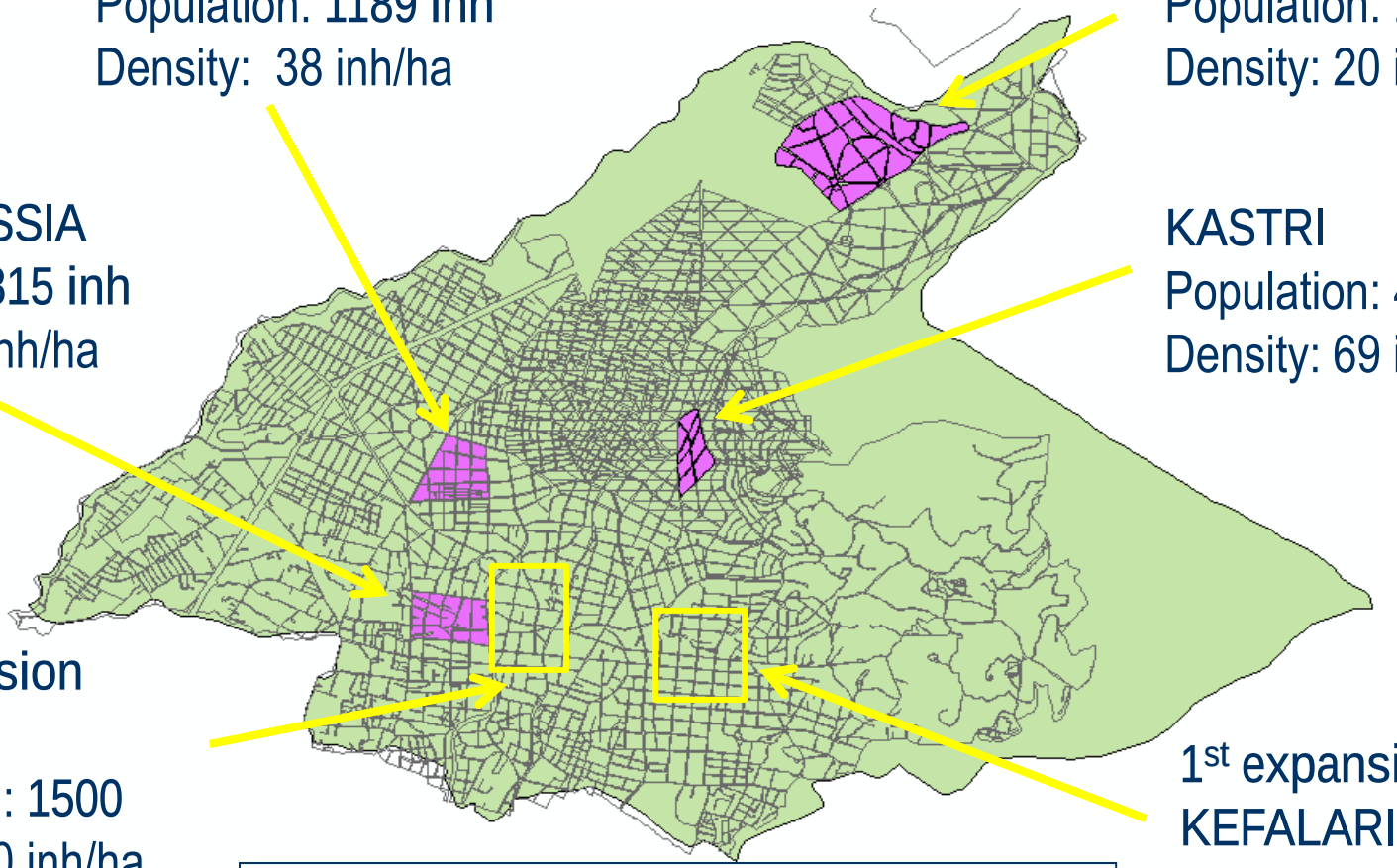
Pilot areas selected in Kifissia Municipality

NEA KIFISSIA
Population: 1189 inh
Density: 38 inh/ha

EKALI
Population: 1108 inh
Density: 20 inh/ha

KATO KHFISSIA
Population: 815 inh
Density: 48 inh/ha

KASTRI
Population: 409
Density: 69 inh/ha



2nd expansion
STROFILI
Population: 1500
Density: 30 inh/ha

1st expansion
KEFALARI
Population: 705
Density: 41 inh/ha

Targeting about 1700 households

Kifissia Municipality Biowaste

120-360L bin for apartment blocks

Bin collection at common building area

10L bin per household (including biobags)

Bin collection outside the resident

35-50L for single-family detached residents

Pilot areas selected in Athens Municipality

1st area KYPRIADOU

Population: 2.707

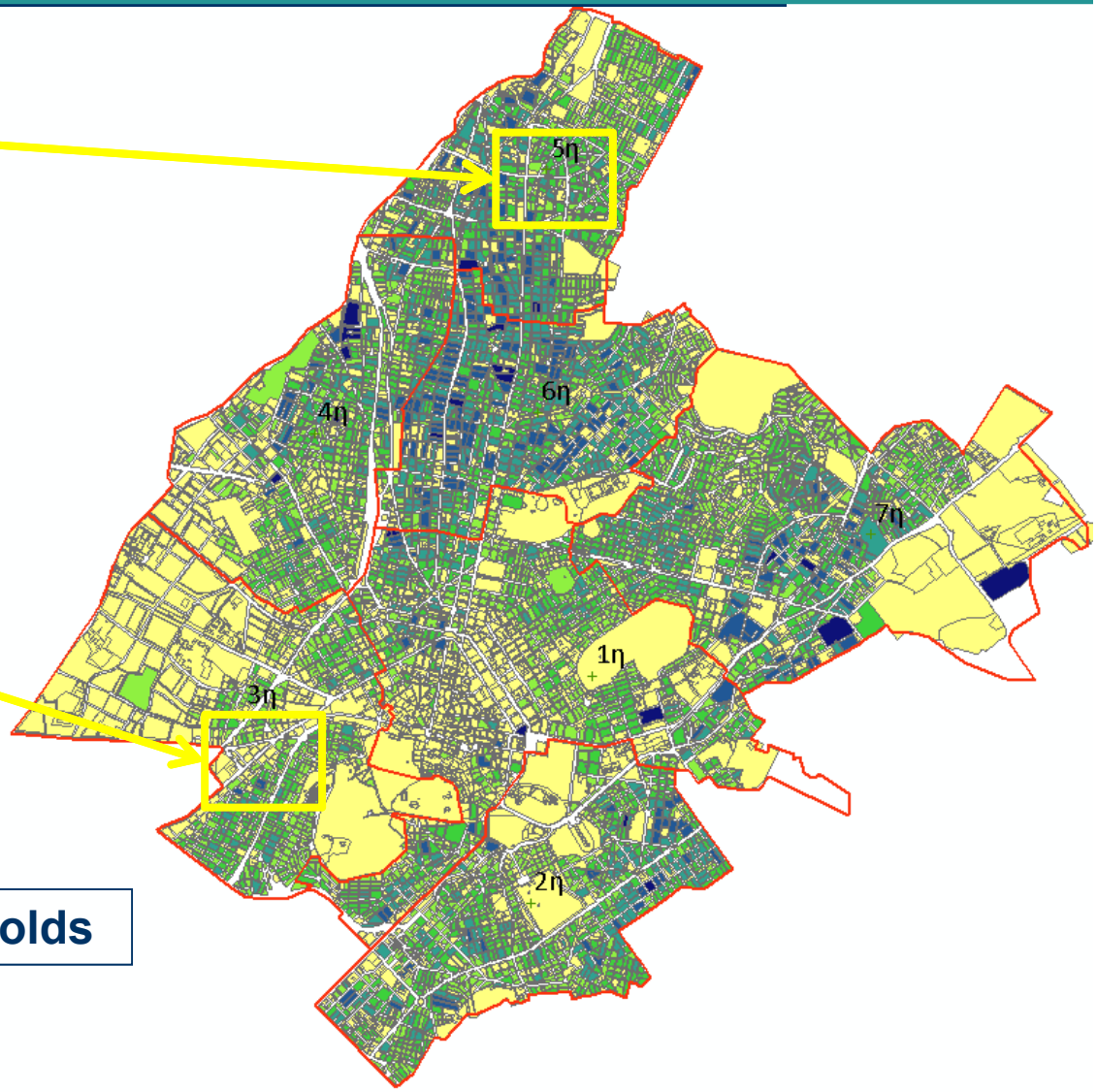
Density: 208 inh/ha

2nd area GAZI

Population: 1.447

Density : 54 inh/ha

≈ 80 restaurant, bars etc



Targeting about 2000 households

Further biowaste collection points in Athens Municipality

Armed Forces Officers Club
(Restaurant - Food waste)

Agricultural University of Athens
(Restaurant – Food waste)

Agricultural Floricultural Nurseries Cooperative of Attica
(Green waste)

Athens Municipality
Biowaste kerbside collection

System

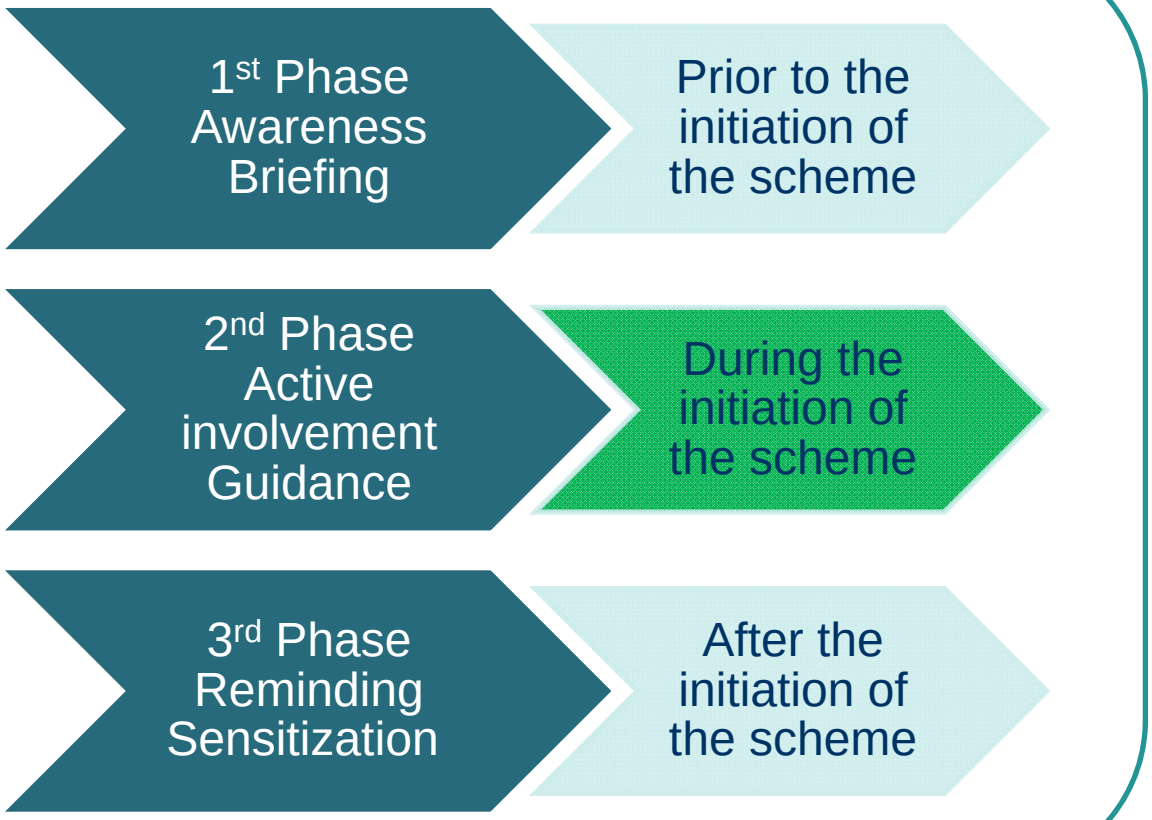
10L bin per household
(including biobags)

30-50L bin per bar
restaurant etc.
(including biobags)

Planning of the awareness campaign

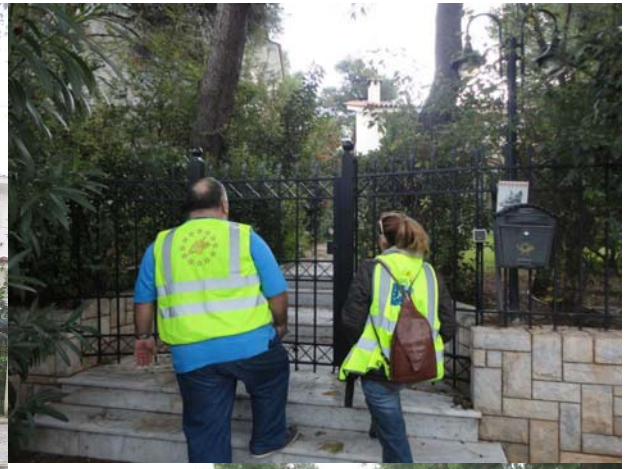
Horizontal Actions

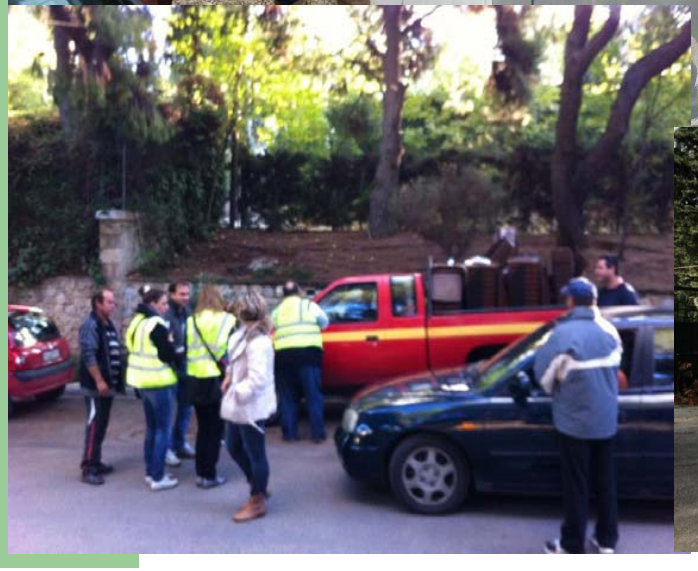
- Website
- Facebook profile
- Project Logo & banner
- Hotline

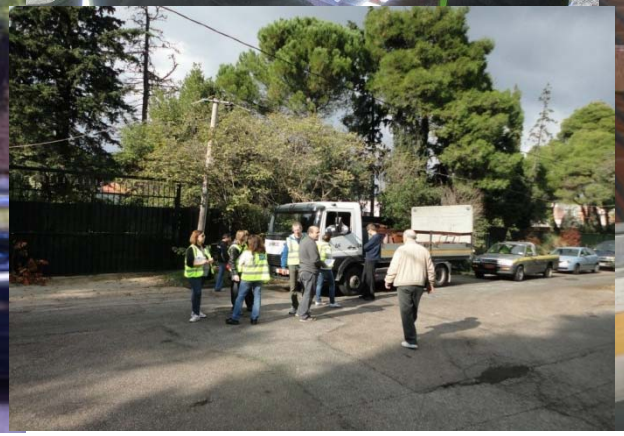


Implementation of the separate collection program in the selected areas

Distribution of bins and biodegradable bags to households

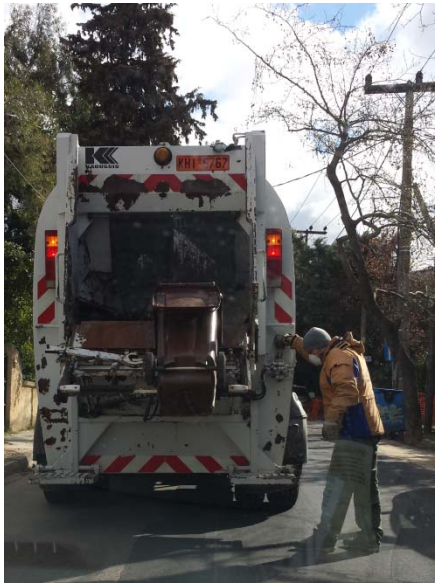






Implementation of the separate collection program in the selected areas

Collection and Transportation of source separated biowaste



Composting of the collected material and analysis of the final product

Mechanical and Biological (Composting) Treatment plant in Attica Region

Composting process at the MBT

Biowaste weighting

Biowaste unloading

Biowaste mixing
(Food & Green waste)

Biowaste feeding

Biowaste composting

‘Good practice’ examples of implementing CIRCULAR ECONOMY on waste management in islands

The 'ISWM TINOS' LIFE+ project

LIFE 10 ENV/GR/000610

SCOPE: 'ISWM-TINOS' project aimed to promote and demonstrate an **I**ntegrated **S**olid **W**aste **M**anagement (**ISWM**) system to a selected remote area of the Municipality of Tinos for the sustainable management of MSW in line with the Waste Framework Directive 2008/98/EC

Tinos Island
Target population: 400 inhabitants

- **LIFE+ 'ISWM TINOS' pilot project** in remote communities of Tinos Municipality:

- Separate collection of dry recyclables & biowaste in **5 different streams** and composting **at community level**

Website: www.iswm-tinos.uest.gr

ISWM scheme for Packaging Waste

Indoor

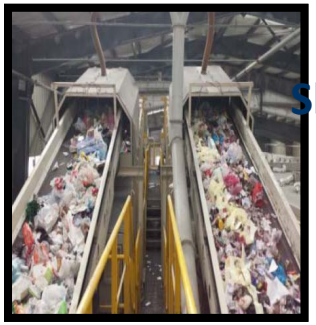
Outdoor

Packaging Waste
Paper/paper board
Glass
Plastic & Metal

Reusable bags

Wheelie bins 240l

MRF



Shipment

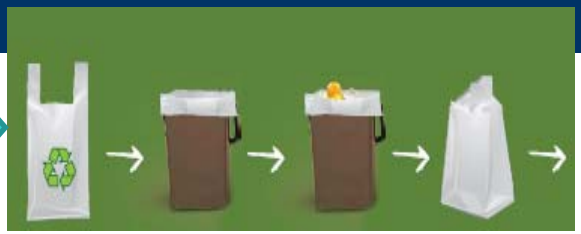
Temporary storage (3 containers)

Collection & Transportation

ISWM scheme for BioWaste

BIOWASTE

Indoor



- Biodegradable bag
- Small bin (10 or 40 L)

Outdoor

Wheelie bin 120L

Collection & Transportation

Community Composting (prototype unit)

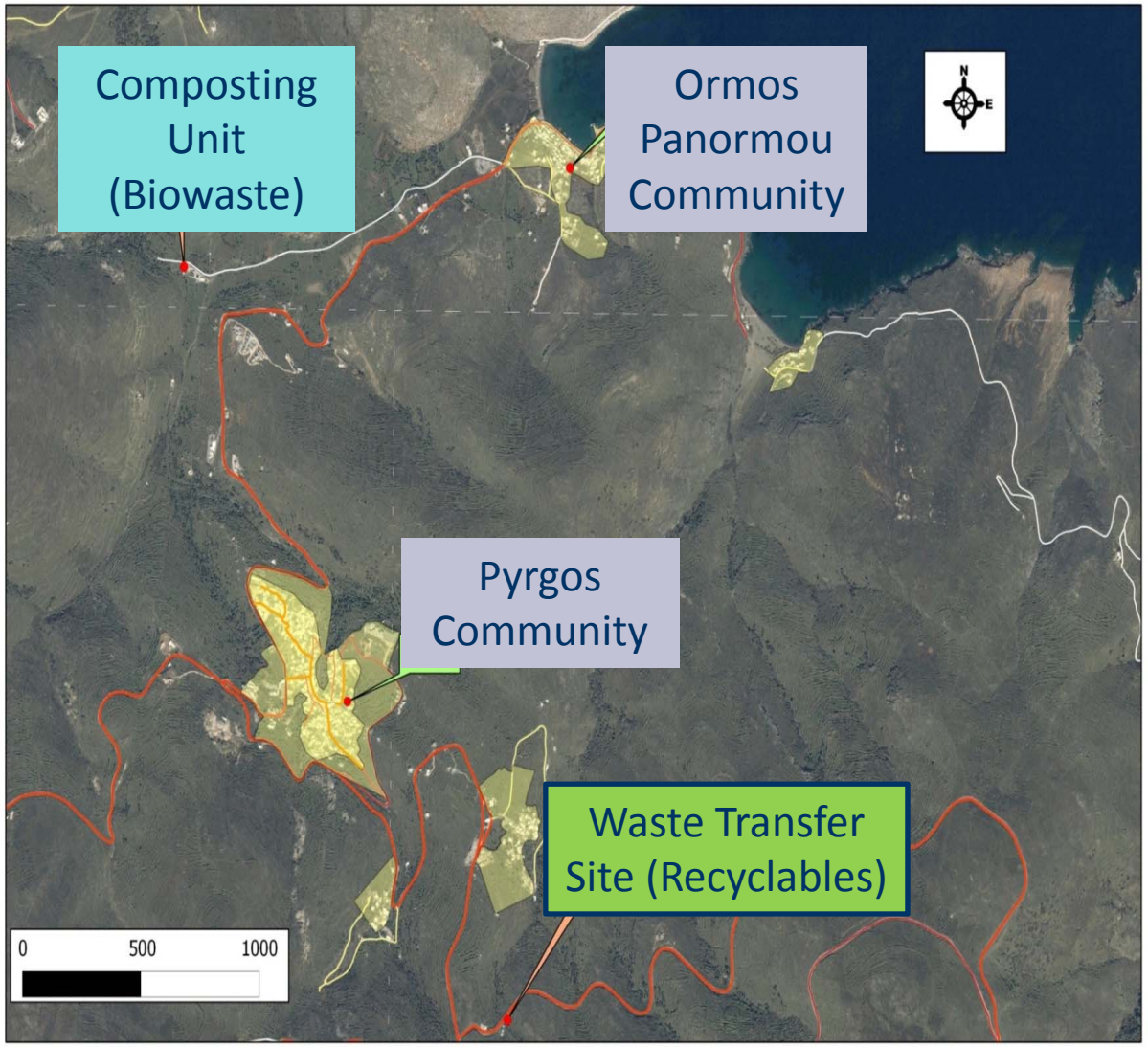
Compost

Decentralised composting of BioWaste

Compact prototype biowaste composting unit

- ✓ The capacity ranges between 70 to 200 tn yr^{-1} (residence time 15 to 60d)
- ✓ Automated hydration, aeration and deodorization systems
- ✓ Biofilter for the treatment of emitted gases
- ✓ Collection and recirculation of leachates
- ✓ No mechanical agitation is needed

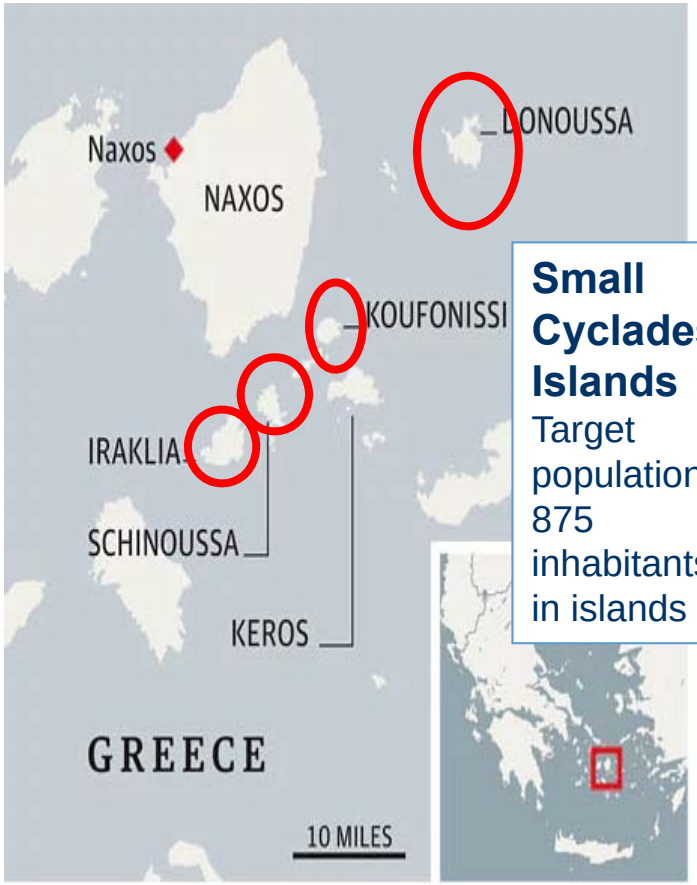
Overview of the ISWM scheme



The 'PAVEtheWAySTE' LIFE project

Demonstrating resource efficiency through innovative, integrated waste recycling schemes for remote areas

LIFE 14 ENV/GR/000722



Small Cyclades Islands
Target population: 875 inhabitants in islands

Website: www.pavethewayste.eu

- **LIFE 'PAVEtheWAySTE' project** in Small Cyclades Islands of Naxos Municipality (& Ancient Olympia):
  - Donousa
  - Schinoussa
  - Irakleia
  - Koufonissi
  - (& Ancient Olympia)

- Fine source separation in **15 different streams** and pre-treatment (compression, crushing etc.) of recyclables **at neighbourhood level**

The ‘PAVEtheWAySTE’ LIFE project

OVERALL SCOPE:

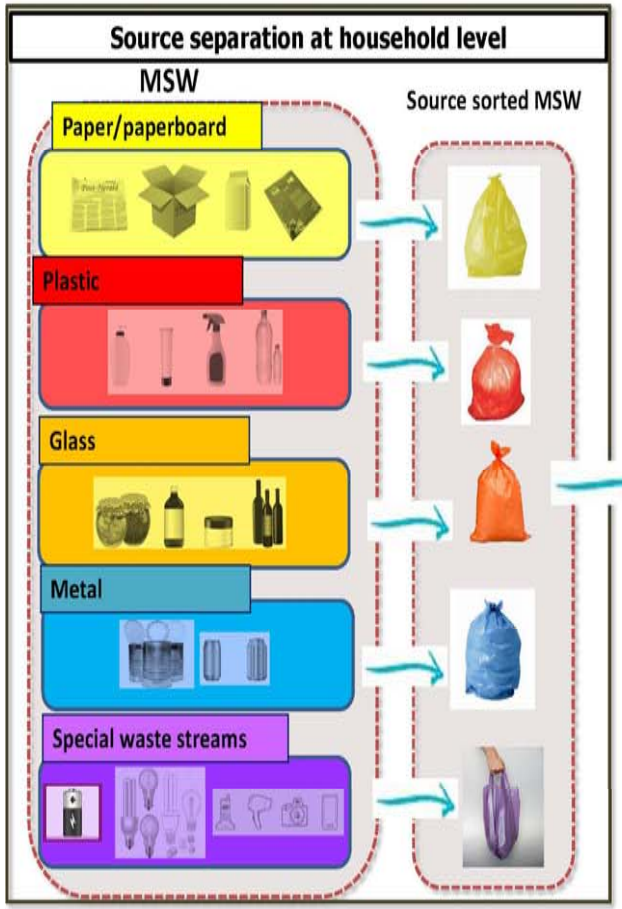
This project aims to facilitate the implementation of the Waste Framework Directive in remote areas, by enabling local and regional authorities to improve their municipal waste recycling performance and thus pave the way to high resource efficiency.

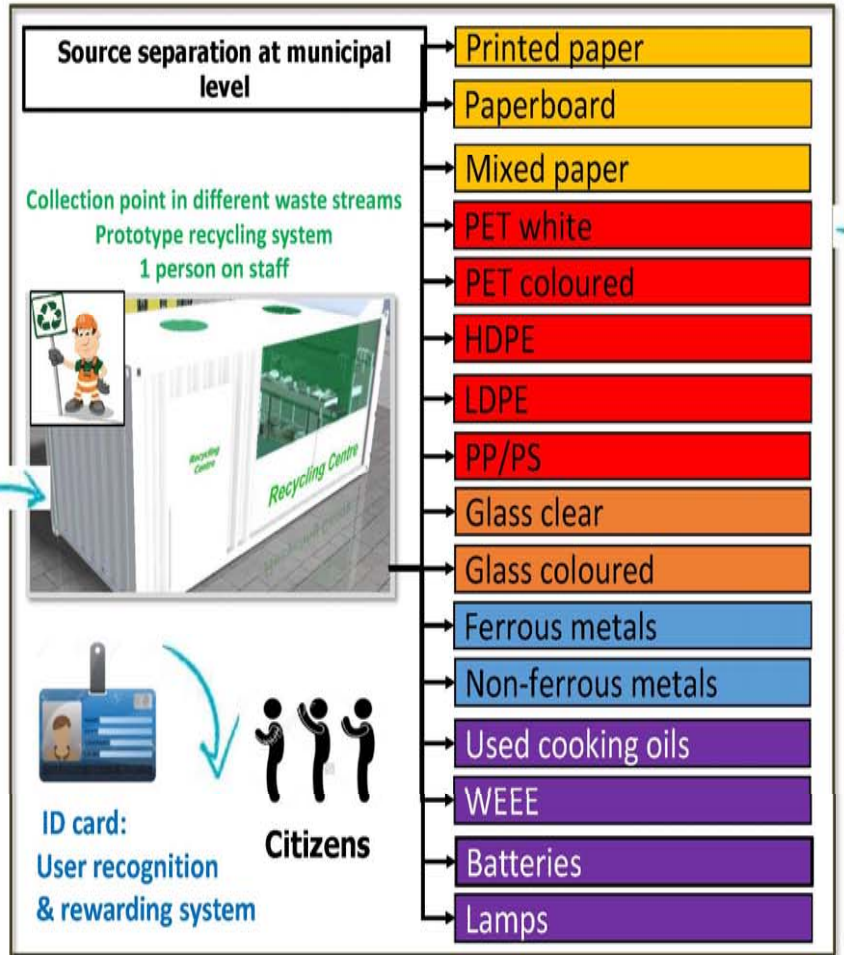
The proposed ‘PAVEtheWAySTE’ scheme

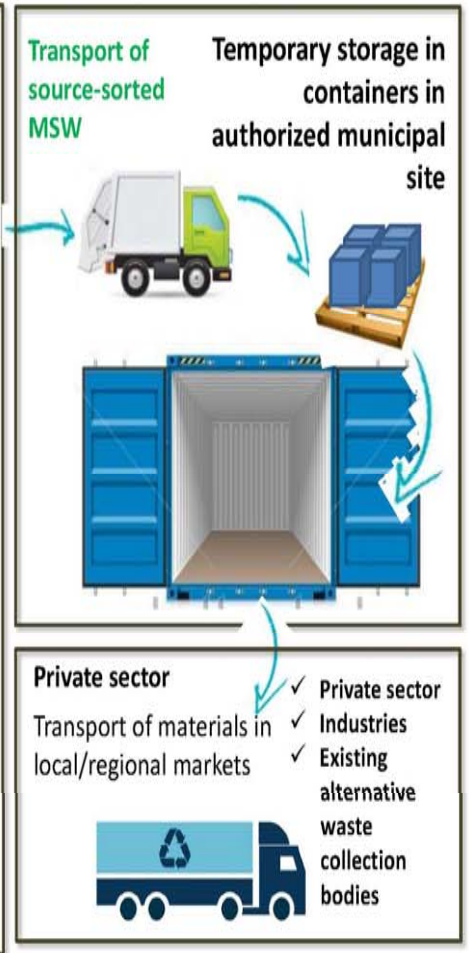
1 Household level/
Separation at source in 5 streams

2 Municipal level
Fine separation of waste materials in multiple streams

3 Municipal level
Temporary storage







4 National level
Transport of sorted materials in the secondary raw materials markets

The innovative 'PAVEtheWAySTE' recycling system

Objective:

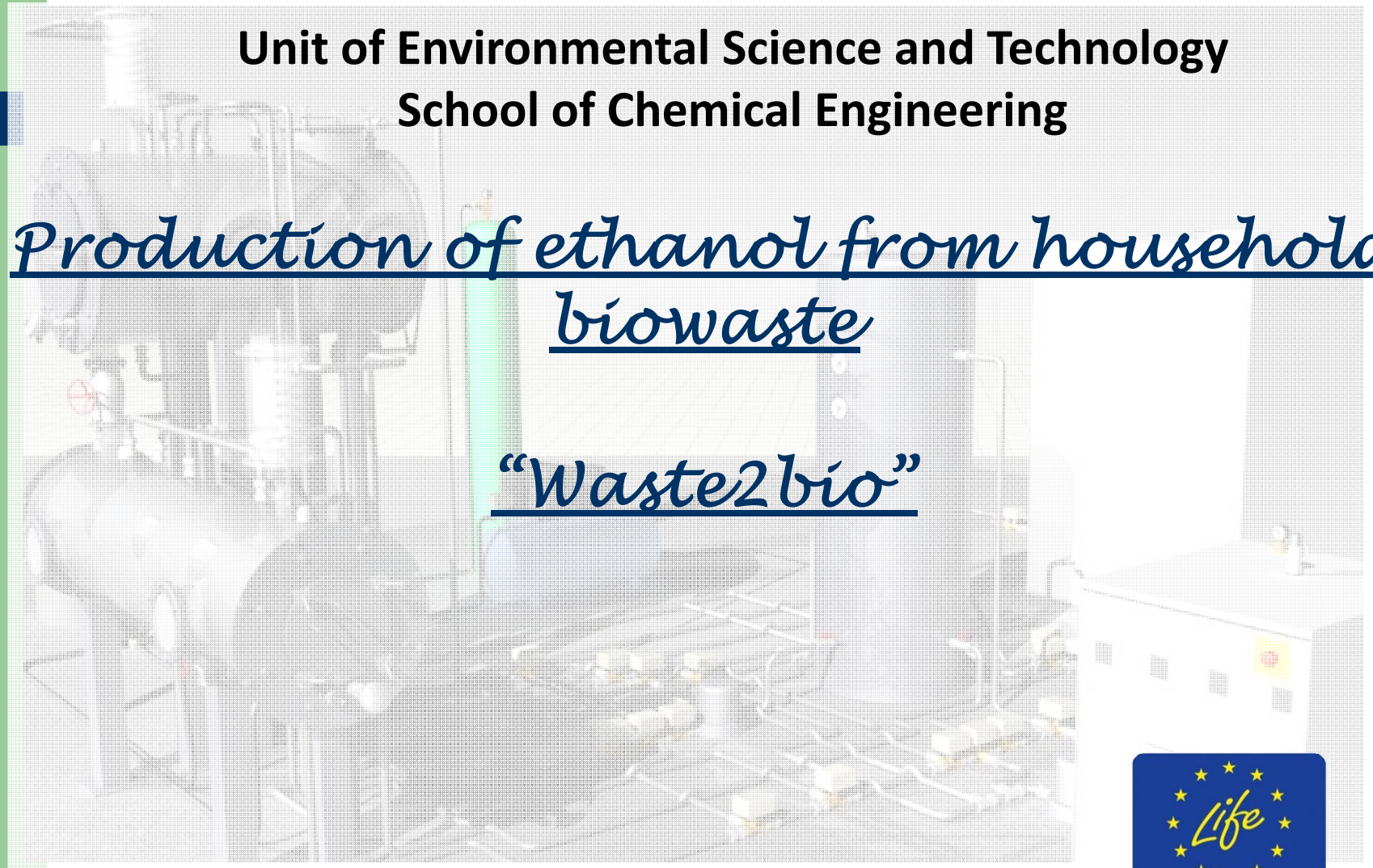
The design of a prototype system which is able to facilitate the recovery of materials of high quality and purity from MSW at community level

National Technical University of Athens

Unit of Environmental Science and Technology
School of Chemical Engineering

Production of ethanol from household biowaste

"Waste2bio"



WASTE2BIO

Life

200L Bioconversion facility

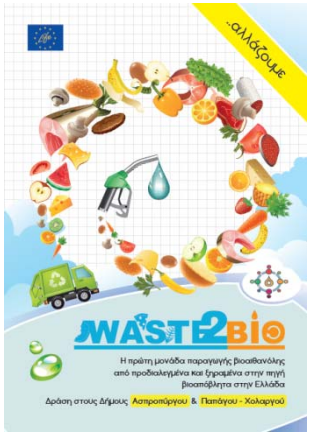
The innovative Waste2bio bioconversion facility is comprised of:

- 100L pre-treatment unit (for the sterilisation and enzymatic pre-treatment of the lignocellulosic material/dehydrated household bio-waste);
- 200L bioreactor (for the fermentation process);
- Boiler (for the production of steam which is necessary for the reactors temperature control and the material's sterilization before the initiation of the bioconversion process);
- Control panel (providing fully automated control of the whole process).

It should be stressed that both the reactors may operate as pre-treatment or fermentation reactors. The necessary sensors have been placed inside the reactors and their conditions are controlled automatically.

Pilot plant facility

Demonstration of waste to ethanol pilot plant

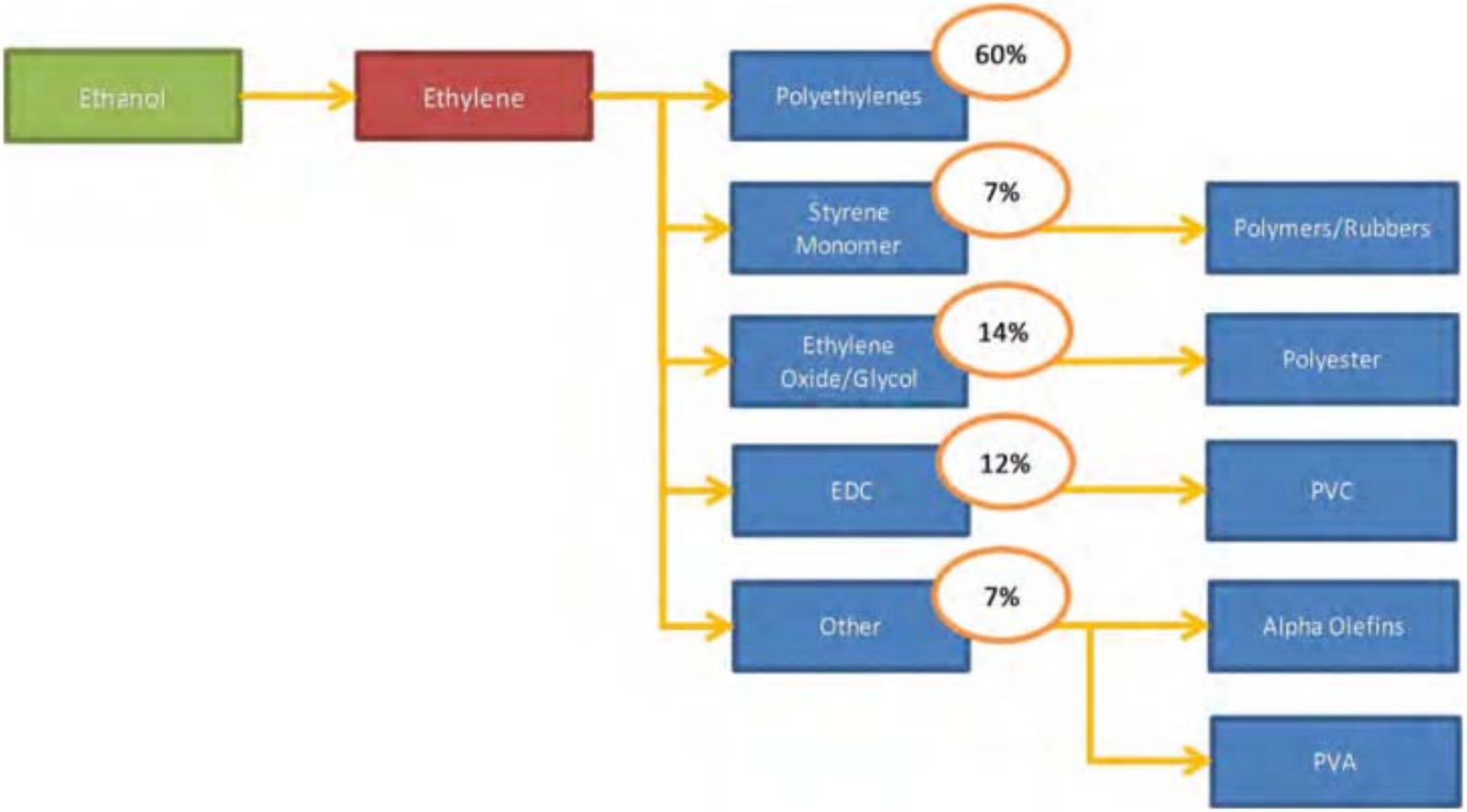


WASTE2BIO

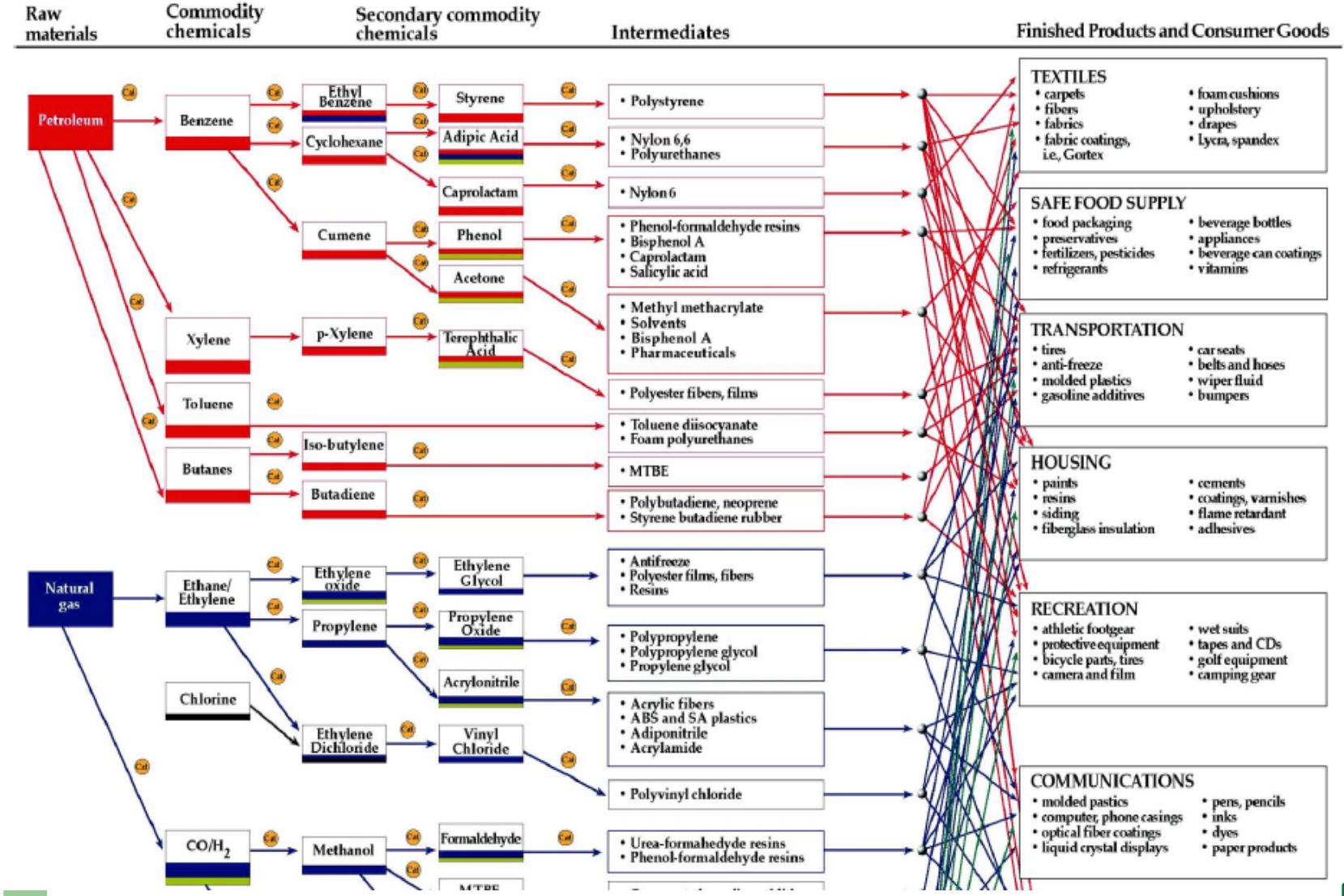
Waste Drying as Implemented in our Labs

Bio-waste to ethanol perspective

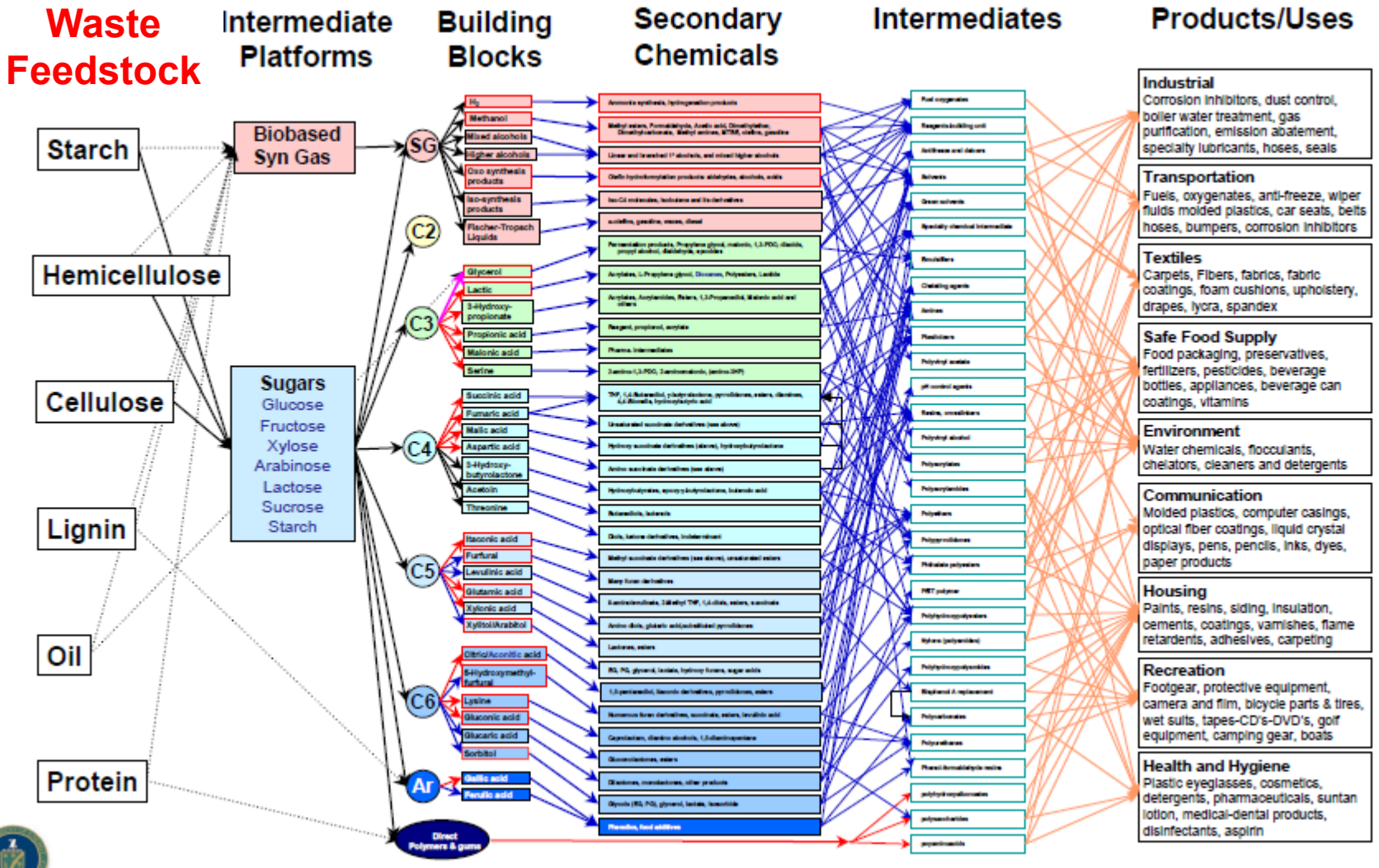
Ethanol Value Chain



An Example of a Flow-Chart for Products from Petroleum-based Feedstocks



Analogous Model of a Bio-based Product Flow-chart for Biomass Feedstocks



Development of a national strategy for adaptation to climate change adverse impacts in Cyprus

Start date: 01-09-2011

End date: 31-3-2014

Duration: 31 months

Project budget: 1.358.847 € (50% EC funding)

LIFE10 ENV/CY/000723

Project website:
http://uest.ntua.gr/cypadapt/

The main aim of the CYPADAPT project was to strengthen and increase Cyprus adaptive capacity to climate change impacts through the development of a National Adaptation Strategy.

Project partners

Coordinating beneficiary:

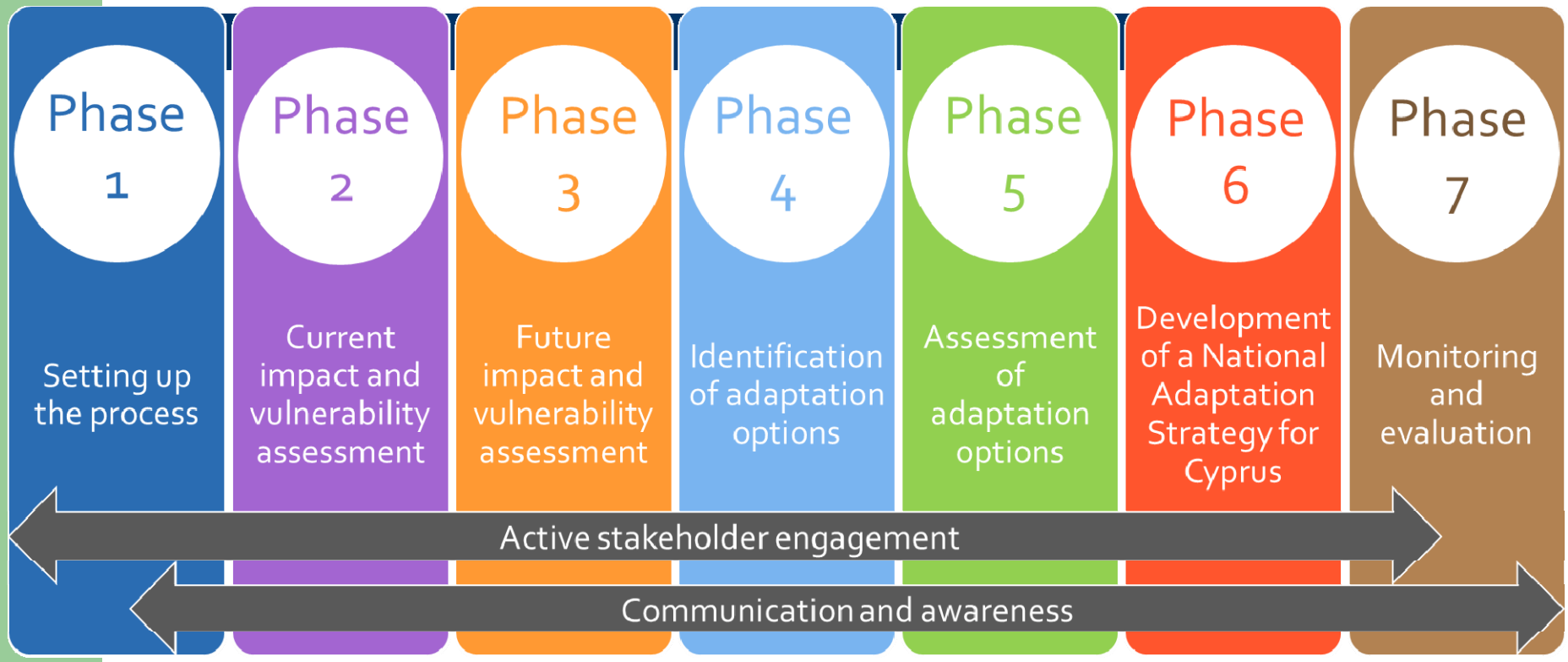
Department of Environment, Ministry of Agriculture Natural Resources and Environment of Cyprus

Associated beneficiaries:

National Technical University of Athens

National Observatory of Athens

Project methodology




Selected policy areas for adaptation
Water resources
Biodiversity
Soil resources
Forests
Coastal areas
Fisheries & aquaculture
Energy
Tourism
Public health
Infrastructure
Agriculture

National Adaptation Strategy of Cyprus

Over 200 measures for enabling adaptation to climate change impacts on the eleven policy areas of Cyprus are included in the NAS.

Indicative Tips & Suggestions

- Brainstorming for many months – deal with actual problems (emphasis on the priority topics of calls) – think of effective & feasible solutions
- Innovation
- Close to market
- Work on the comments of the reviewers
- Strong (not big) Partnership – one beneficiary from other MS
- Financial Part: Be as specific as possible, use actual rates, time
- Collaboration with a large number of reliable beneficiaries – the role of conferences –networking – info days
- The role of local authorities
- The role of mass media
- Keep your projects alive – next steps – emphasis on after-life, feasibility study

Let's join forces and create synergies!

... Thank you for your attention

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