

# A FEASIBILITY STUDY CARRIED OUT FOR THE ISLAND OF HYDRA – GREECE

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*Place* : the most cosmopolitan island of the Saronic Gulf.

Hydras Port situated in town, is protected by a framework of **laws and rules** and has been declared an archaeological site, listed as **a place of exceptional natural beauty**.



*Aim:* **Closure** and **Rehabilitation** of the Illegal Landfill (uncontrolled solid waste disposal area) of the Island of HYDRA and implementation of **Integrated** and **Sustainable** Waste Management.

*Considerations:*

- ✓ The existing **spatial planning** of the island
- ✓ Mainstream **social-economy** characteristics
- ✓ **Smooth** and **low scale** interventions
- ✓ **Social participation**
- ✓ **Changes** in international level (legal-technical)
- ✓ **Small-medium scale** facilities
- ✓ Facilities of **low disturbance**
- ✓ **Easy to handle**, by the municipality of HYDRA, facilities

This effort achieves:

- ✓ **Fine ending:** since 5th of June 2015, 80.000,00 € / 6months / operating illegal landfill is imposed by the EU charged in the municipality in charge,
- ✓ Benefit from the existing **EU financial funds** which can be absorbed for the financing of projects and actions planed.



*Data:* huge fluctuation of population → huge fluctuation of quality and quantity factors of waste.

Quantity of waste ranges from 1,500 tons / year to 1,869 tons/ year.

*Considering:* - the economic downturn → reduced production of waste  
- the population growth data having a negative trend,

the **Quantity** of waste was estimated to **1870 tn/year** fixed for 20 years future projection (a safety factor was considered),

*No qualitative data for waste produced in Hydra.*



The following table presents the waste quality (composition) as estimated in the context of the feasibility study:

	PERCENTAGE IN MSW (% ww)
Organic fraction	38
Paper- Cardboard	29
<i>Paper- Cardboard</i>	10,22
<i>Printed paper</i>	9,07
<i>Other types of paper</i>	9,70
Plastics	15
<i>Plastic for packaging</i>	8,66
<i>Other types of plastic</i>	5,91
Metals	6
<i>Metal packaging</i>	4,80
<i>Other types of metal</i>	1,20
Glass	3
<i>Glass packaging</i>	2,95
<i>Other types of glass</i>	0,05
Rest	9
<i>Leather – Wood – Rubber     (packaging)</i>	0,99
<i>L-W-R Rest</i>	0,64
<i>Fiber</i>	1,58
<i>Rest</i>	5,79
<b>TOTAL</b>	<b>100</b>

*Qualitative goals* derived from legislation:

- ✓ Reuse – Recycle – Recovery (RRR): operation of integrated RRR network of MSW till 2020,
- ✓ Impetus of *Source Separation and Recycling* for MSW,
- ✓ Reduce of *BM*s to sanitary landfilling,
- ✓ *Prevention or reduction* of MSW production: kick off of implementation 2015,
- ✓ Expansion of *on source collection/transfer* network,
- ✓ Establishment of *separate collection/transfer network* for recovery of *BM*s,
- ✓ *Energy recovery* by the non recyclable fraction of MSW,
- ✓ Final Disposal (D): Establishment of *suitable infrastructure* in country level till end of 2020,
- ✓ Completion of the program for *restoration* of illegal landfills.

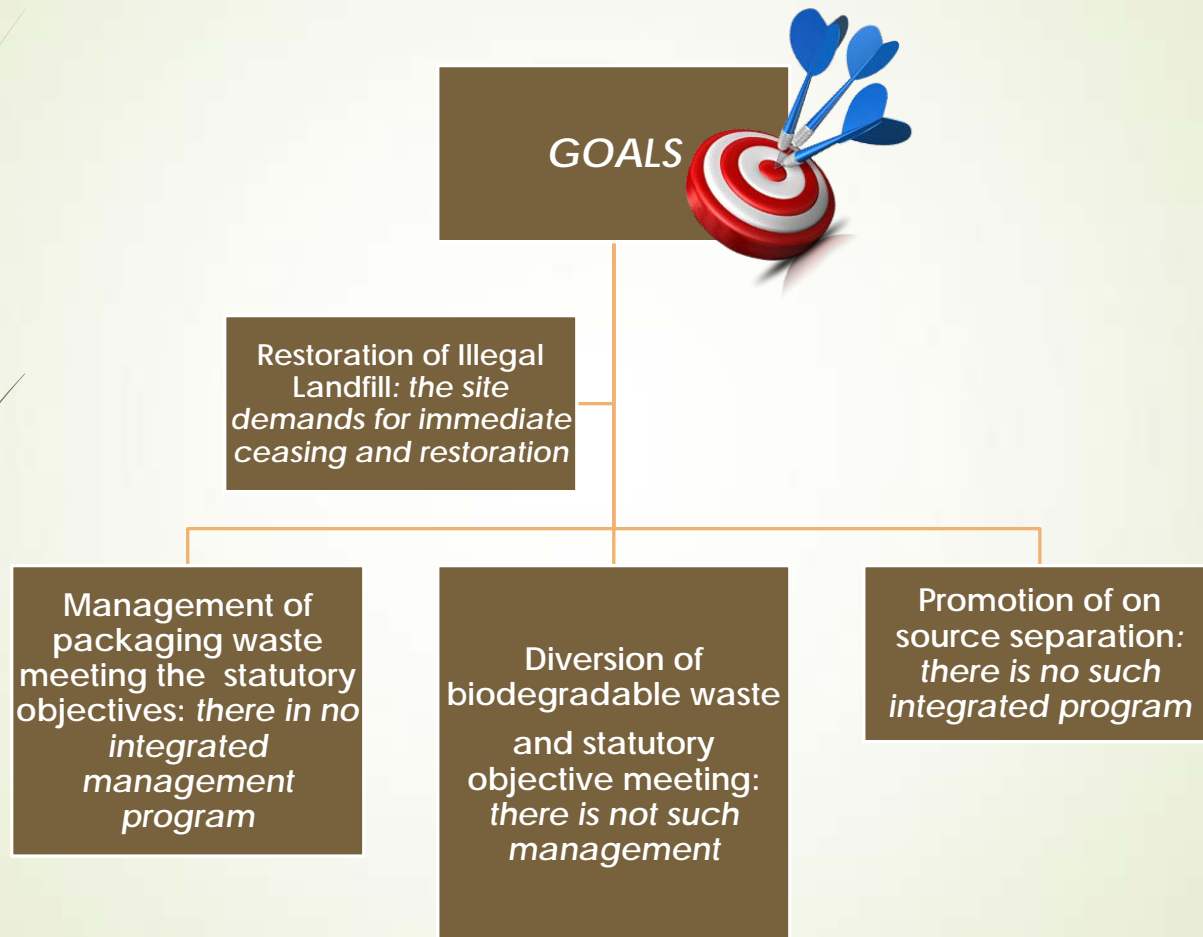
*Quantitative goals* derived from legislation :

Biodegradables (BD)		2020	Reduction of sanitary landfilled waste at the level of 35% ww (estimation based on 1995 production)	
Biowaste (BW) (N.L.N.* 4042/2012)		2015	5%	of total weight in separate collection
		2020	10%	
Municipal waste (N.L.N. 4042/2012, 2011/753/Directive)		2015	Separate collection: at least for paper, metals, plastic, glass wherever it is technoeconomically viable	
		2020	Preparation for reuse & recycle at least for paper, metals, plastic and glass at the level of 50% ww	
		Recovery	Recycle	
			min	max
Packaging waste (N.L.N. 9268/469/2007)	2005	50%	25%	45%
	2011	60%	55%	80%
<u>Minimum recycle goals:</u> 60% ww glass 60% ww paper- cardboard 50%ww metalls κβ 22,5% ww plastics 15% ww wood κβ				

\*National legislation number



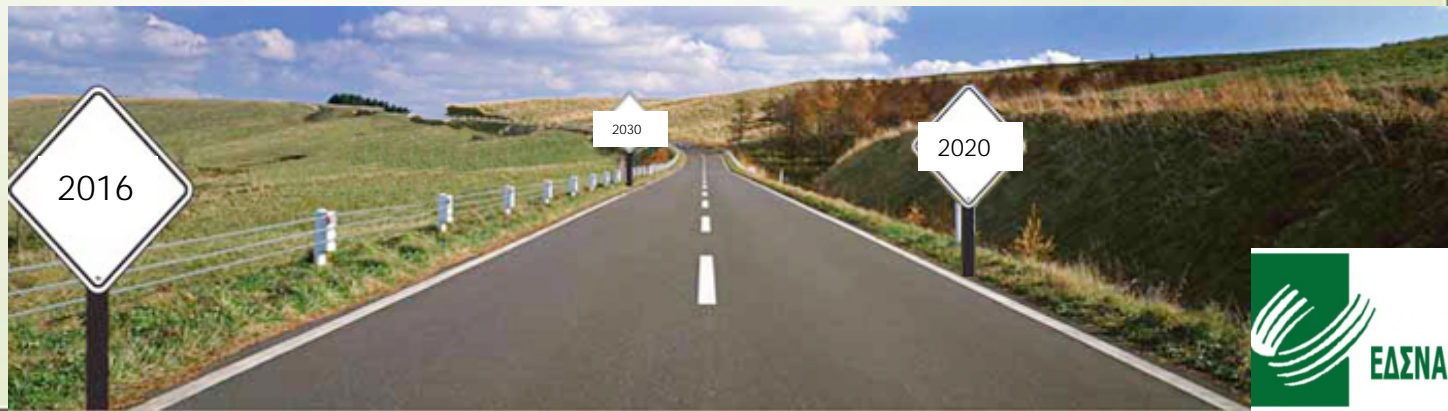
Qualitative goals derived from *analysis of current situation* as well as *objectives* of the study:



*Suitable Final Disposal for Residuals*

*Milestone years* for design purposes are:

- **2016** as the year that the **full implementation** of integrated waste management of Hydra will begin,
- **2020** as the year when the **comparable targets** are set by current legislation,
- **2030** as the year that the system is estimated to have **reached its limits**







## Targets of feasibility study :

- ✓ Diversion of BD from Landfill: target refers to environmentally proven disposal in a landfill of non treated MSW. **Diversion target was set to 438tn (of 1253 tn produced).**
- ✓ Separate collection of BW: Target is **separate collection of 71 tn BW / year (of 711 tn produced).**
- ✓ Packaging waste management: Target is to **recycle 284 tn (of 517tn produced).**

## Applicable Criteria

Multicriteria  
Tool

- The **potential for disposal** of end products,
  - **Environmental** issues,
  - Investment **financial** constraints,
  - **Operational** constraints,
  - Special **characteristics** of the interest area,
  - Special **characteristics** of **MSW** produced in the area,
  - **Parallel actions** for the utilization of MSW.

*Ab initio rejected alternatives:*

- mechanical separation, pyrolysis – vaporization and biological drying: demand for **much higher capacities** in order to be financially viable.
- incineration is a **high investment and operating cost** technology particularly in small scale with low social acceptance. Note that in each case one incinerator must be accompanied by an **appropriate landfill site** for the disposal of hazardous solid waste, which is part of a solid waste incinerator. As the above, combustion is not an available alternative to Hydra.

*Multicriteria  
Tool*

*Ab initio approved alternatives:*

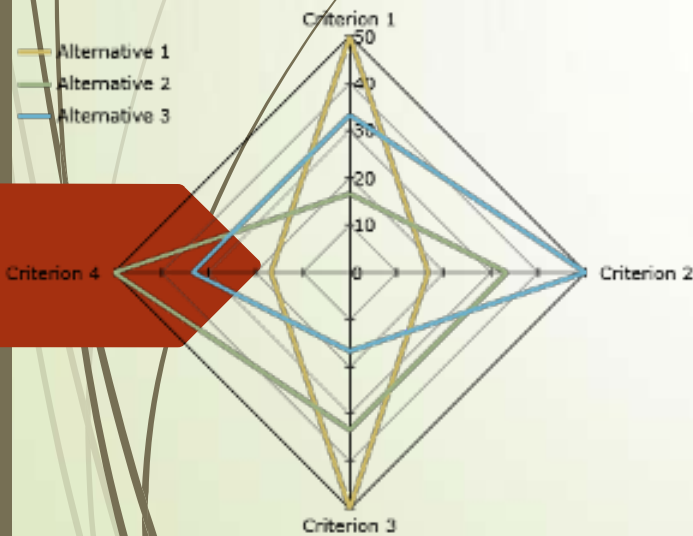
**Restoration** of Hydras' illegal landfill site and the source separation process as a vital choice .



# Multicriteria Tool

*Multi-criteria analysis* "a systematic mathematical effort to **resolve problems arising from conflicting objectives**".

A compromise between conflicting objectives is necessary.





*Multicriteria  
Tool*

CRITERIA	SIGNIFICANCE FACTOR
<b>FINANCIAL CRITERIA</b>	
Investment cost	10
Operation cost	12
<b>ENVIRONMENTAL CRITERIA</b>	
Leachate and gas emissions	6
Aesthetics	4
<b>TECHNICAL CRITERIA</b>	
Operational requirements - complexity	9
Existing experience - reliability	6
Scenario Flexibility (in future legislative trends and changes in the incoming waste quantities)	8
Land requirements	10
<b>INSTITUTIONAL CRITERIA</b>	
Social acceptance	10
Compliance with EU policy	9
New jobs opportunities	9
Management autonomy of the region	7
<b>TOTAL</b>	<b>100</b>

## *Transitional Scenario*

### *Development of on Source Separation System*

- Paper,
- Cardboard,
- Plastic,
- Glass,
- Metals.



### *Composting System launch*

*Development of project is based on compost bins distributed to households by the municipality.*

*Operation of local waste transshipment station and transfer of remaining waste to the landfill site of Fyli in Attica Region.*



- *Construction period for Sanitary Landfill Site for residuals*

## *Optimal Scenario*

### *On Source Separation System (higher yield)*

- Paper,
- Cardboard,
- Plastic,
- Glass,
- Metals.



### *Composting System operation*

Full - Operation status

### *Operation of Sanitary Landfill Site for Residuals*

Full - Operation status

### *Operation of local waste transshipment station*

On-call status (emergencies)



*On source  
separation for the  
waste fractions*

*Construction &  
Operation of  
Composting Unit*

*Construction and  
operation of  
Sanitary Landfill  
for residuals*

*Restoration of  
illegal Landfill  
and  
LWTS Operation*

*Projects and Actions as presented, will be put into effect by ACMAR through a Programmatic Agreement with the Municipality of Hydra (active since 04/2015) with the contribution of EU funding.*



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