Optimizing Household Biodegradable Waste Management within European Islands

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Source: http://www.escapehere.com/destination/10-best-islands-to-visit-in-europe/
Motivation

* Pieces of land surrounded by water
* Located at the geographical extremities of a continent
* Strategic, political, economic, social and cultural values
* In Europe
  * > 320 inhabited islands
  * Total population nearly 20 million inhabitants.
  * Nearly 3% of the European population
* Attract tourism
  * Population fluctuations
* Islands have unique environment
  * No ‘one size fits all’ approach
* Islands require custom made solutions
* Challenging working scenario
  * Large research gaps encountered

Source: https://steemit.com/life/@guden/motivation
Background Characteristics

Geography

a. Geographical Isolation
   i. Complex transportation
   ii. Resource limitations
   iii. Human resources
   iv. Financial means
   v. Land area
   vi. Natural resources

b. Ecological fragility

c. Climate
Background Characteristics

Tourism

- Population fluctuations
- Seasonality – waste fluctuations
- Challenge of integrating tourists into the local separation system

Background Characteristics

Infrastructure and local markets

- Energy markets and grids
  - Electricity grids
  - Heat market and infrastructure
- Industry
  - Industry’s ability to take waste derived fuel products
  - Reuse industry
  - Recycling industry
  - Materials production

Legislation

- Compliance to the various legislations and targets

Foreground Characteristics

- Household waste composition
- Location of the facilities (limited area)
- Economies of scale (small waste volume)
- Current waste infrastructure
  - Collection methods
  - Separation systems
  - Local facilities

Source: http://www.visitsweden.com/gotland
Waste Streams

Biodegradable waste

Combustible waste

Mixed Municipal Solid waste

Source: http://www.kotoweb.si/en-biodegradable_waste
Islands

Gotland

Malta

Source: Google Maps
## Islands

<table>
<thead>
<tr>
<th>Island</th>
<th>Gotland</th>
<th>Malta</th>
</tr>
</thead>
<tbody>
<tr>
<td>Country</td>
<td>Sweden</td>
<td>Independent</td>
</tr>
<tr>
<td>Capital City</td>
<td>Visby</td>
<td>Valletta</td>
</tr>
<tr>
<td>Location</td>
<td>Baltic Sea</td>
<td>Mediterranean Sea</td>
</tr>
<tr>
<td>Close mainland</td>
<td>Sweden – 90 Km</td>
<td>Sicily – 93 Km</td>
</tr>
<tr>
<td></td>
<td>Latvia – 150 Km</td>
<td>Libya – 290 Km</td>
</tr>
<tr>
<td></td>
<td>Poland – 220 Km</td>
<td></td>
</tr>
<tr>
<td>Major land use</td>
<td>Agriculture and</td>
<td>Agriculture</td>
</tr>
<tr>
<td></td>
<td>Forestry</td>
<td></td>
</tr>
<tr>
<td>Area</td>
<td>3,140 km²</td>
<td>316 km²</td>
</tr>
<tr>
<td>Coastal length</td>
<td>800 km</td>
<td>271 km</td>
</tr>
<tr>
<td>Resident population</td>
<td>57,241</td>
<td>425,384</td>
</tr>
<tr>
<td>Population trend</td>
<td>Stable</td>
<td>Increasing</td>
</tr>
<tr>
<td>Country population</td>
<td>9,644,864</td>
<td>425,384</td>
</tr>
<tr>
<td>Population density</td>
<td>18.3/km²</td>
<td>1,346.2/km²</td>
</tr>
<tr>
<td>Climate</td>
<td>Typical coastal climate, with mild Winters and warm Summers</td>
<td>Relatively cool Winters and hot, dry Summers</td>
</tr>
<tr>
<td>Type</td>
<td>S1</td>
<td>S2</td>
</tr>
<tr>
<td>-----------------------------</td>
<td>----</td>
<td>----</td>
</tr>
<tr>
<td><strong>Env. Impact (kg CO₂-Eq/T)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cost (€/T)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Env. Impact (kg CO₂-Eq/T)</strong></td>
<td>518</td>
<td>92</td>
</tr>
<tr>
<td><strong>Cost (€/T)</strong></td>
<td>620</td>
<td>620</td>
</tr>
</tbody>
</table>
Under what circumstances is waste treatment on mainland preferable to treatment on the island?

- Waste export should be pursued only when local treatment can harm the natural environment or it is not financially feasible.
- **AD and composting** requires at least **8,000 tonnes** of waste per annum.
- **Incineration** is viable with at least **80,000 tonnes** of waste per annum.
- Waste export shall also be considered when
  - There are no local facilities or interest for managing this waste. This lack of interest generally originates due to a lack of revenue from the management of waste itself.
- Waste export requires the regular dependency on other regions
- Against the circular economy principle
Environmental
- Least environmental burdens
- Process selection
- Process adaptation
- Renewable products

Economic
- Financial / market constraints
  - Capital investments
  - Direct versus indirect fees
  - Financial incentives

Legislative
- National legislations
  - EU Directives
  - Legal Enforcement

Social
- Resistance to change
  - Educational campaigns
  - Promotional activities
Island waste Management Methodology

1. Analysis of local sector
   a. Typical characteristics/trends
   b. Current waste management practices
   c. Short/long term waste management plans
   d. Local specific requirements
2. Review of legislation and the applicable waste management targets
3. List of applicable waste treatment options
4. Integration of waste management with the island characteristics and other sectors such as industry, energy, agriculture and waste water sectors
5. Consideration of the main analytic assumptions
6. Analysis of treatment practicability (technicalities)
7. Analysis of economies of scale
8. Determination of the management costs
9. Environmental analysis
10. Selection of the most suitable waste management option through a holistic perspective
11. Strategy implementation and improvements plan
12. Seek how to encourage citizens to comply with the selected strategy
13. Educational/promotional campaign

Source: http://agilepm.com/ending-the-methodology-wars
Thank You!

Grazzi!

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