

Optimizing Household Biodegradable Waste Management within European Islands

C. Falzon¹, T. Pretz² and H. Wenzel³

¹Ex-PhD Student at RWTH Aachen University, Germany, currently Waste Management Strategy Department, Wasteserv Malta Limited, EkoCentre, Latmija Road, Marsaskala, MSK4613, Malta

²Department of Processing and Recycling, RWTH Aachen University, Wüllnerstraße 2, 52056 Aachen, Germany

³Institute of Chemical Engineering, Biotechnology and Environmental Technology Centre for Life Cycle Engineering, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark

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Presenting author email: falzonclyde@gmail.com

Waste management on islands can be described as a special case and cannot be treated with a *'one size fits all'* approach. The lack of economies of scale, the generally small land area, high population density, limited resources and population fluctuations (mainly due to tourism), all contribute to make this case a special one (Street, 2013, Zevgolis, 2011). Although the relatively small nature and geographical location of islands makes them fragile, they still have to comply with the stringent legislative requirements on waste. Moreover, the inhabitants of these islands should have access to sustainable waste management that contributes to preserve the pristine nature of these unique pieces of isolated lands.

This work is focused on the islands of Gotland and Malta; however the research outcomes can be extended to other islands. Furthermore, this work is based on household biodegradable waste while other associated waste streams such as household combustible waste and mixed municipal waste are also considered. In order to implement a holistic approach, the research takes into account other sectors influenced by waste management, such as agriculture, tourism and energy amongst others.

This work is conducted using a life cycle assessment methodology applied to the islands' necessities. Whenever possible, this work was based on the consequential LCA methodology, from "bin-to-grave" i.e. from the moment waste is disposed in the collection bin or bag, through collection, sorting, and the final management of the waste. All this is mainly focused on the climate change impact category.

This work is accompanied by an economic analysis and technical/practical analysis of the proposed solutions. In fact, the work starts with twenty waste management options, shortlisted to twelve scenarios for a more detailed analysis, until the final recommendation is obtained. Furthermore, the research is divided into multiple sub-systems, each representing a group of processes such as transportation, mechanical processes, anaerobic digestion and composting and incineration.

The waste management solutions proposed by this research reflect the respective island's current practices. When current practices are achieving their purpose, this is not ignored, and only suggestions for optimization are made. In fact, this work provides an extensive implementation and improvements plan, which takes into account the public participation factor for each island case study. Furthermore, this research suggests that waste management decisions should be based on a consideration of the environmental, economic, legislative and social perspectives as presented in Figure 1.



Figure 1 Waste Management Decisions Diagram

This research outlines that households should sort their waste into recyclables/packaging waste, biodegradable waste and combustible/residual waste. Furthermore, for both island case studies, the best biodegradable waste management solution results to be treatment by anaerobic digestion and composting. In general, it results that whenever possible waste treatment should be performed locally, thereby reducing the dependency on waste export. However this research also acknowledges that some islands, due to their small nature have to rely on export in order to manage their waste.

This research also highlights the background and foreground characteristics highly relative to island waste management. This is accompanied by an analytic methodology for island waste management analysis. In general, it is recommended for integration between the waste sector and other sectors. It may be noted that complying with the applicable legislation is very important, but considering the island's specific requirements with custom-developed solutions is a key for success in island waste management.

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