Moving Up the EU Waste Hierarchy in Remote Area

Exploring the Case of Lesvos Island, Greece

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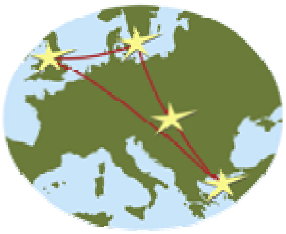

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ขอบคุณค่ะ

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Abstract

The main purpose of this research is to contribute to sustainable waste management in remote areas of the European Union (EU) by specifically employing the concept of 'waste hierarchy' as a mean to reach this goal. The last three decades see the EU waste management approach evolve from pollution control (disposal/end-of-pipe) toward more strategic approach focusing on waste prevention and recycling. This evolution has been instrumental for many Member States' waste policy transformation notwithstanding; many remote areas of the EU are still lag behind in their waste management situation. Lesvos Island of Greece is one such areas still dealing with numerous dumpsites scattering around the island, anticipating a single central landfill, and having no formal recycling system - therefore chosen as a case study. To learn how to improve this situation, relationship between the EU policy implications and factors which condition waste management in the remote/rural Island was investigated. The factors were explored through in-depth interviews with stakeholders, chosen by triangulation method, representing local government authorities, academics, and civil society.

The research has confirmed that transposition of the EU waste Directives into the Greek national policy does not imply effective implementation; its implications on the local waste policy and implementation in Lesvos are very limited. Factors influencing the current local waste policy agenda have been identified. This includes: keep to conventional perception of waste management, low pressures from citizens and from regulation obligations, lack of willingness to change, and limited resources and funding. However, the current situation of uncontrolled dumpsites, growing amount of waste, opposition to construct more landfill, and high cost of waste transport (characteristic of remote areas and islands) suggest that Lesvos needs more sustainable alternatives for waste management. The research has concluded that the Island should pursue a more holistic approach to waste management, considering socio-economic and environmental benefits that waste management can contribute to its sustainable development. Correspondingly, community source-separation, recycling, and composting are proposed as they may contribute to the Island's energy and resources independency. Moreover, some voluntary recycling initiatives/systems run by private companies and local NGO exist in Lesvos. It is therefore wise to maximize these systems in order to increase the resource-use efficiency. Furthermore, recycling of some specific waste streams (e.g. packaging waste) which have low material prices can not be economically viable for the remote Island where costs of energy and transportation are high. Since these waste streams are regulated by relevant EU Directives and having established national (collective or individual producers responsibility) systems for their alternative management; involvement (e.g. financial support) from the national systems will be instrumental in their recycling in Lesvos as well as other remote areas of the EU.

Key words: European Union, EU waste management, EU waste policy, waste policy, waste hierarchy, recycling, recovery, sustainable development, community recycling, municipal solid waste management, municipal solid waste, solid waste management, waste management in remote areas, remote areas, island waste management, Greece, Lesvos

Executive Summary

The main purpose of this research is to contribute to sustainable waste management in remote areas of the European Union (EU) by specifically employing the concept of 'waste hierarchy' as a mean to reach this goal. Waste hierarchy establishes the rule of thumb as to which waste management operations are best for the environment; consecutively suggesting waste prevention over reuse, over material recycling or composting, over energy recovery, over landfill disposal. Lesvos Island of the Northern Aegean of Greece is chosen as a case study, representing a remote/rural area of the EU. The summary of this research is presented here.

Background of the research

Waste is one of the major environmental problems that the European Community is facing. Currently having to deal with approximately 241 million tonnes of municipal solid waste each year, the amount of municipal waste generated within the Community is expected to grow by 25% in 2020 comparing to what was produced in 2005. With the shifts in its waste policy toward a more strategic approach focusing on waste prevention and recycling, the EU managed to reduce disposal of municipal waste to landfill (from 60% to 41% between 1996 and 2006). At the same time, most of its Member States managed to increase their recycling rates by 5% during 1998-2003. However, many, specifically some remote/rural areas of the Member states, still lag behind. This is also the case of Greece where recycling rate has remained at 8% (1997-2003) and has not improved in recent years. Additionally, the country's waste management has been in a state of crisis due to thousands of uncontrolled dumpsites.

Greece's main challenges for waste management are the nature of the country's territory and the spatial distribution of population. More than half of the populations live around coastal areas and islands, with a large number of small and isolated communities. More than 6,000 islands and islets are scattered in the Aegean and Ionian Seas, 227 of which are inhabited, and most of them are not connected with mainland's grid for water and energy supply. This insular character also suggests difficulties in, thus high costs of, transportation, communication, and energy production. The selected case study, Lesvos Island of the Northern Aegean Region of Greece, is one such case.

Method of inquiry

This thesis is set to find out how to improve waste management situation in Lesvos, specifically moving up the waste hierarchy. Three questions have guided the research:

1. What are the implications of the EU waste policy on the Greek national municipal waste management policy, in particular on waste prevention, recycling, and recovery?
2. What are the factors influencing policy choices of the local governments (at prefecture and municipality levels) regarding waste management in the remote Island of Lesvos, and how such influences take place? (Here, relationship between the EU policy implications and factors which condition waste management in the remote/rural Island is investigated.)
3. How did the existing practices or initiatives on separate collection, recycling, and recovery of household municipal waste take place in Lesvos Island? And what are the conditions for their existence?

Literature reviews and in-depth interviews are the main methods of inquiry for this thesis research; employing triangulation method to choose stakeholders who represent local government authorities, academics, and civil society (NGOs and entrepreneurs). Following the research questions, relationship between implications of the EU waste policy on local waste policy and factors which condition local waste management agenda will be investigated.

Understanding this relationship will lead to the understanding of how have they influenced the local waste policy agenda hence how to alter the local waste policy to improve the situation.

In Conclusions

Implications of the EU waste policy on the Greek national and local waste policies

The EU waste policy has guided the direction of the Greek national waste policy. Many of the significant EU Directives have already been transposed to the Greek legislation, e.g. the Waste Framework Directive, the Landfill Directive, and the Directives on specific waste streams such as packaging waste and waste electrical and electronic equipments. However, the research has confirmed that transposition of the EU waste Directives into the Greek national policy does not imply the same level of implementation (i.e. Greece is still lag behind in waste prevention and recycling). This is partly due to the fact that the country has had to deal with numerous uncontrolled dumpsites which, in turn, have hindered development of other waste management alternatives. Additionally, influences of the EU's waste hierarchy concept on the local waste policy are not evident albeit the concept being recognized in the Nation Solid Waste Management Plan and (some of the) Regional Plan (e.g. the Northern Aegean Region).

On the other hand, the Greek national framework for alternative management of specific waste streams has been highly influenced by the EU Packaging and Packaging Waste Directive and some other EU legislation on specific waste streams. Since 2001, the establishment of the Greek Law on Alternative Management of Packaging and Other Products has been instrumental in starting the country's separate collection systems. Among others, packaging waste, waste electrical and electronic equipments (WEEE), and waste portable batteries are the main household wastes for which respective national collective systems for their alternative management have been developed. However, geographical distribution of these systems is still limited in remote regions.

Local municipal waste management and the need to move up the waste hierarchy

Waste management is among priority environmental concerns for local governments in Lesvos due to the growing amount of waste generated and the dumpsites which they have yet to close and restore. None of the municipalities on the Island implement household source-separation, recycling, or composting. The recently constructed central landfill is expected to be soon operating, and to deal with all municipal waste generated on the Island. However, due to the remote distances between some municipalities or communities and the central landfill, higher costs of waste transportation are foreseeable. Disposal of waste in the central landfill will not be a long-term sustainable solution to waste management on the Island; not only because landfill disposal is the last preferable option in the waste hierarchy, but also because once the landfill is full, building a new landfill will highly likely faces opposition from the locals. In this regard, it is necessary for local governments in Lesvos to explore other alternatives which are more sustainable than the current waste management practices. Accordingly, the conditions seem to favour decentralized and small-scale waste management systems, for example community recycling and composting programmes, over centralized and large-scale systems. This is because large-scale waste disposals (e.g. central landfill or incineration) generally need large amount of waste input therefore require most communities (who are not hosting the facilities) to transport waste in long distance for disposal.

Facilitating Change in Local Waste Policy Agenda

In order to change local governments' waste policy agenda toward waste prevention and recycling (i.e. to move up the waste hierarchy), it is important to understand what constitutes their making. Factors influencing the current local waste policy agenda have been identified, as favoring or challenging the change, accordingly:

Drivers for change: pressures to implement recycling exist directly from the conditions of the EU grant to the central landfill; local governments recognition that recycling is inevitable and start to show their interest; some municipalities have had experience with short-term voluntary recycling program (awareness raising campaign) in corporation with local business or NGO; the establishment of the Inter-Municipal company presents an opportunity for collective action of the local governments on the Island.

Challenges for change: local governments keep to conventional perception of waste management (no recycling, source-separation, and waste prevention); low pressures from citizens and from regulation obligations; lack of (political) willingness to change (passively rely on civil society initiatives, i.e. NGO voluntary recycling programme and the operations of the local material recovery facilities); and limited resources and funding.

Learning from the past to start the change

Lesvos Island has the advantage of already having some alternatives for management of specific waste streams (waste portable batteries, glass beverage bottles, waste electrical and electronic equipments, and packaging wastes to a certain extent). These alternatives are (1) two local recycling businesses (material recovery facilities); (2) several voluntary recycling programmes initiated by a local NGO; and (3) two separate collection systems in shops or public spaces for waste portable batteries and glass beverage bottles. It will therefore be wise to maximize these systems in order to increase the resource-use efficiency. Learning from what have been contributing to their successes or failures, the following are derived:

- Local governments should explore real potentials of the existing systems, how to support and utilize their full potentials and integrate them into the local waste policy/practices.
- Public participation is a pre-requisite for the success of waste prevention/reduction which is at the top of the waste hierarchy. Factors for successful public participation includes, among others, higher awareness and adequate knowledge, collection bins visibility, convenience for the consumers (disposers), use of economic incentives.
- Recycling of some specific waste streams (e.g. packaging waste) with low material prices can not be economically viable for the remote Island where costs of energy and transportation are high. Since these waste streams h established national (collective or individual producers responsibility) systems for their alternative management; involvement (e.g. financial support) from the national systems will be instrumental in their recycling in Lesvos as well as other remote areas of the EU.

The path to pursue,

The research suggests that the Island should pursue a more holistic approach to waste management, considering socio-economic and environmental benefits that waste management can contribute to its sustainable development. Correspondingly, community source-separation, recycling, and composting are proposed as they may contribute to the Island's energy and resources independency.

More detailed recommendations for stakeholders and policy makers and recommendations for further research are given in the last section of this Thesis.

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1 Introduction

This first chapter of the thesis introduces the reader to the background of the research. The first section gives the background of how the researcher came about to choose the implementation of waste hierarchy at the local level in Europe as the main subject of this research. Lesvos Island of the Northern Aegean Region of Greece is chosen as a case study. In this regard, problem statement in the context of the case study is discussed so as to justify the relevance of the case to the subject of the study. The objectives, scope, methodology, and limitation of the research are given in the subsequent sections so as to explain how the research was conducted.

1.1 Background of the Topic

This section gives background of the research with regard to the subject of the research – the European Union (EU) approach to solid waste management. Consequently, how implementation of the waste hierarchy at the local level is relevant to the success of the EU waste policy implementation will be discussed.

1.1.1 European Approach to Solid Waste Management

As a result of economic development, waste is one of the major environmental problems that the European Community is facing. Approximately 1,300 million tonnes of solid waste[1] are generated each year within the European Union; of which, municipal waste constitutes around 241 million tonnes (European Commission (EC), n.d.). According to the latest available Eurostat statistics, the average EU-27 waste generation was 516 Kg per capita in 2006 - increased from 474 Kg per capita in 1995 (Eurostat & World Bank, 2007). It is expected that municipal waste generation in the EU will continue to grow. By 2020, the amount is expected to increase by 25% comparing to what was generated in 2005 (Skovgarrd, Villanueva, Andersen, & Larsen, 2006). It should be note that each countries' waste generation profile varies depending on different factors, such as economic growth, population density, and consumer behaviours. At the same time, the countries' waste policy can play important role in reducing waste generation. For example, waste generation per capita of Greece and Spain has grown more than 55% during the past decade while Belgium managed to reduce its waste generation per capita by 35% during the same period. (Eurostat & World Bank, 2007)

Disposal in landfills has been the common practice of waste management in the EU for a long time. Disposal in landfills poses several threats to the environment (pollution to soils and water quality) as well as causing social conflicts since no one wants waste disposal near their houses. However, changes are happening. During the last one decade (1996-2006), the EU managed to reduce disposal of municipal waste to landfill from 60% to 41% while waste being treated or managed by alternative methods has increased. Most of Member States managed to increase their recycling rates by 5% during 1998/1999 – 2002/2003. (European Environment Agency (EEA), 2007b) However, the recycling rate in Greece has not been improving; it has remained at 8% of the total among of household waste generated between 1997 and 2003) (EEA, 2006b). (See Chapter 2.1)

[1] Solid waste includes municipal waste, hazardous waste, construction waste, and waste from manufacturing sectors.

This trend of change from landfill toward recycling can be attributed to the evolution of the EU approach to waste management. During the first decade of its waste policy (1970s/1980s) the EU started to address waste problem in terms of pollution control from waste management operations; that is to say, from the Waste Framework Directive[2] to the Waste Landfill Directive[3] and the Waste Incineration Directive[4]. At the end of the 1990s, the EU started employing a strategic approach to improve the situation of waste management, namely: it reinforced the notion of waste hierarchy, re-affirmed the polluter pay principle, and developed the concept of specific waste streams. (EC, n.d.) The current EU waste policy has been based on: (1) waste prevention, (2) recycling and reuse, and (3) improving disposal and monitoring (EC, 2009). Some of the Directives which have implications of the policy and implementation of prevention, recycling, and composting of municipal waste in Member States are discussed in Chapter 2.3.

The evolution of the EU waste policy has shown that adhering to the concept of waste hierarchy will continue to be one of its main approaches toward waste management during the next decade. By adopting the Thematic Strategy on the Prevention and Recycling of Waste at the end of 2005, the EU has demonstrated that it is taking a stronger step to enhance waste prevention and recycling with the long term goal for the EU to become a *'recycling society'* that seeks to avoid waste and uses waste as a resource. (See more discussions in Chapter 2.2.2). However, the success of the Community's policy will depend on the implementation by its Member States.

1.1.2 Moving up the Waste Hierarchy in Remote or Rural Areas

The concept of ***'Waste Hierarchy'*** establishes the rule of thumb as to which waste management operations are best for the environment even when scientific analysis is not possible or proportionate. (EC, n.d.) The concept was first established in the EU waste policy in 1975 in the first Waste Framework Directive (Council Directive 75/442/EEC) and has been reinforced in the recently adopted new Waste Framework Directive (2008/98/EC).

'Waste Hierarchy' means that prevention of waste should come at the first place in any waste management strategy. When prevention is not possible, reuse of products and then recycling or composting of materials should be considered as the best options for managing waste. Subsequently, recovery of energy (i.e. by incineration) and disposal to landfills should be considered the last options. (EC, n.d.) (See Appendix I for definition of 'waste hierarchy' according to the EU Waste Framework Directive.)

Due to the (large) scale of operations and technologies, options at the bottom of the waste hierarchy (landfill disposal and incineration) generally require centralized management of waste. They usually handle a large amount of waste which in turns requires involvement of more than one municipality (i.e. inter-municipalities or higher levels of government) in their operations. Options at the upper part of the waste hierarchy (i.e. waste reduction, reuse, and recycling) usually do not entail highly centralized or large-scale technology. In this regard, programmes like community-based recycling may have an additional benefit for remote or rural areas (apart from benefits to the environment and resources) as they can facilitate self-

[2] Council Directive 75/442/EEC, amended by Council Directive 95/156/EEC, codified by Directive 2006/12/EC, and will be completely repealed by Directive 2008/98/EC

[3] Council Directive 99/31/EC

[4] Council Directive 2000/76/EC

sufficiency of the areas where distance between agglomerations is an important characteristic. This assumption has set the direction of this thesis to inquire on how to move up the EU waste hierarchy using a Greek Island as a remote/rural context.

1.2 Problem Statement in the Context of the Case Study

Lesvos Island of the Northern Aegean Region in Greece is selected as a case study in order to explore the opportunity in implementing options at the top of the waste hierarchy at the local level, more specifically, to explore how to enhance recycling and composting in Municipalities on the Island. This section of the chapter justifies the selected case study in relation to the subject of the study. Firstly, the context of waste management in Greece as a Member States of the EU will be discussed; the national context also has strong implication on the local level. Secondly, the context of Lesvos Island and its waste management will be discussed as a local unit to be explored.

1.2.1 Greece as an EU Member State

With regard to the extent of the problem of municipal waste in Greece, it has been the country with the highest waste generation per capita among the EU-27 since 2003 and the rate continues to grow. In 2006, each person in Greece produced 796 Kg of municipal waste per year (the EU-27 average is 516 Kg per capita). (EEA, 2006b) & (Eurostat & World Bank, 2007) Recycling and recovery accounted for only 8% of municipal waste generated and the figure has not changed much in recent years. (EEA, 2006b) During 1997 – 2003, around 90% of its municipal waste was disposed of in landfills – this includes the 44% which went to uncontrolled dumpsites in 2002 (Technical Chamber of Greece (TCG), 2006).

The country's waste management situation is often considered to be in a state of crisis due to the situation of its large number of uncontrolled dumpsites. (Andreou, 2004) Uncontrolled dumping has been somewhat a 'traditional' way of waste disposal until the end of 1990s when the situation started to improve. About 6,500 uncontrolled dumpsites were in used in 1997; the latest available figures show that there were still 1,453 dumpsites still in use in 2005, and 1,173 more sites that are not in use any more but need to be restore. (TCG, 2006) This situation has led to unpleasant experiences when the country was brought to the European Court of Justice several times since the 1990s for the infringement of the EU Landfill Directive because it has not been able to close down these dumpsites. The country was already fined € 5.4 million for the notorious case of illegal dumping in Kouroupitos in Crete; and because the situation has not improved much, the country may expect further penalty of € 10 million in the coming months (Kathimerini, 4 May 2009). (More discussions in Chapter 3.1.2 and Chapter 3.1.3)

On the other hand, Greece has undergone various policy changes on waste management during the past decade. Several EU Directives have been instrumental and important drivers for the Greek waste policy transformation. The country has transposed most of the EU Directives on waste management which will be discussed further in Chapter 3.2. The reform of the country's waste policy and legal framework resulted in the new National Plan for Solid Waste Management (2003) which aimed at full compliance with the EU Waste Framework Directive. Another law establishing legal framework for alternative management of specific waste streams was also established in 2001. This means that at least the country has a national legal framework to implement separate collection, reuse, recycling, and recovery.

Despite the reform, it has been criticized that the existing structures and practices of waste management in Greece still remain largely unaffected. The current focus is still on how to deal with landfills (closing existing dumps and building new sanitary ones while facing local oppositions). On the other hand, the concept of waste hierarchy has not been strongly adopted in its policies and practices; in particular, not much has been done in terms of waste prevention and material recovery. (Andreou, 2004)

The overall context seems to suggest that, as an EU Member State, Greece is still lagging behind most of its fellow Member States, especially when considering its slow progress in waste reduction, reducing landfilling, and moving toward a recycling society. This makes the country interesting as a Member State of the EU in the study of how to move up the waste hierarchy as room for improvement of the situation is still large.

1.2.2 The Case Study - Municipal Solid Waste in Lesvos Island

One of the major challenges for waste management in Greece is due to the nature of the country's territory and the spatial distribution of the population - around 40% of the population concentrated in two main cities while most of the rest are centred around coastal areas and islands with a large number of small and isolated communities and islands. Greek territory comprises 6,000 islands and islets scattered in the Aegean and Ionian Sea - 227 of which are inhabited and among them, only 78 of these islands have more than 100 inhabitants[5]. Most of the islands are not connected to any sorts of mainland's grid (water and energy supply) (Demian, 2007). These islands are classified as rural regions according to the EU Rural Development Policy (2007-2013) (Harnnarong, 2009). The remote and insular characteristics of the majority of the areas in Greece is an interesting factor for the assumption of the research since local governments in these areas may have more motivation to develop community-based waste reduction and recycling rather than relying on the centralized systems like landfill or incineration.

Lesvos Island is chosen as a case study of this research. The island is located in the Northern Aegean Sea, near the border between Greece and Turkey. It is 188 nautical miles from Piraeus (the main port in Athens) and 218 nautical miles from Thessaloniki. The island is classified, based on population density, as predominantly rural according to the EU Rural Development Policy and classified as a convergence region (least-developed with GDP per capita less than 75% of the EU-27 average) according to the EU Cohesion/Regional Policy (Harnnarong, 2009). Its insular character suggests distances that divide them from the mainland which resulted, among others, in difficulties in transportation and communication as well as energy production. In terms of administrative structure, the island is part of Lesvos Prefecture, which belongs to the Region of Northern Aegean. Mytilene is the capital of the island as well as administrative center for the Prefecture and the Region. 31% of the Island's population lives in Mytilene while the rest 69% of the population scattered around the island in other much smaller 12 municipalities.

Like most places in the country, the main way of waste management in Lesvos is disposal in landfill. Every community used to have their own dumpsites. In 1988, it was reported that the island had 50 uncontrolled dumpsites. When the EU Directive on Landfill came into effect, these dumpsites have been gradually closed and restored. The process for studying for and constructing the landfill took almost 10 years until it was build in 2008; however it has not yet begun its operation due to lack of waste transfer station. Distances between

[5] Greek National Tourism Organization (http://www.visitgreece.gr/pages.php?langID=2&pageID=254)

municipalities and the central landfill will also incur high cost of waste transportation from some remote municipalities to the central landfill. Currently, each municipality still maintains one or more semi-controlled dumpsite for their municipal waste disposal. On the other hand, the municipalities are also pressured to close their dumpsites with fear of being fined by the EU. Additionally, the increase in waste generation as well as the change in type of waste resulting from consumption pattern has been observed especially in places where tourism activities are developing. The situation seems to suggest that the Island should start looking for alternative ways of managing its waste. (See more discussion in Chapter 4.1.2)

Another reason for this selection is also due to practicality of the research. The University of the Aegean which is part of the consortium of the researcher's Masters Programme (MESPOM) is located in Mytilene, the capital of the Island, providing available data and experts on the specific field.

1.3 Objective and Research Questions

As part of the European Union, the EU Directives have set legal framework for sustainable waste management in Greece. Underlying the framework is the waste hierarchy concept as a solution toward sustainable waste management, in which waste prevention and recovery shall be put as the first priority before end-of-pipe solutions such as landfill and incineration. On the other hand, there exist various benefits for remote and rural areas to implement waste prevention and recovery programmes in order to facilitate sustainable development in communities, e.g. creating employment opportunities (see Weinberg, Pellow, & Schnaiberg, 2000 on Evanston Recycling Programmes). More importantly, such programmes may contribute to self-sufficiency of the area in terms of resources (materials) and energy which, in turn, will facilitate long-term sustainability of the areas where available land, resources, and cost of transportations are of main concerns. Yet, this has not been much explored in the Greek context. As previously demonstrated, the country has been focusing on its immediate problems from landfill management over the past decade.

The ultimate goal of this research is to contribute to ***'solution to sustainable waste management in remote areas in the EU'***; and specifically employing ***'waste hierarchy'*** in order to reach the goal. Choosing waste management on a Greek island as a case study, the research will explore the local contexts, to see what is going on and why. Building up on the findings, it shall eventually lead to the knowledge of how to improve the situation. The following are detailed research questions which shall guide the study:

4. What are the implications of the EU waste policy on the Greek national municipal waste management policy, in particular on waste prevention, recycling, and recovery?
5. What are the factors influencing policy choices of the local governments (at prefecture and municipality levels) regarding waste management in the remote Island of Lesvos, and how such influences take place? In order to find the answer to this question, the following subquestions are to be answered:
    5.1. How do the EU policy and national policy influence local waste management policy and implementation, especially on separate collection, recycling, and composting?
    5.2. What are the main problems regarding waste management from the local governments' perspective and how they address these issues?

6. How did the existing practices or initiatives on separate collection, recycling, and recovery of household municipal waste take place in Lesvos Island? And what are the conditions for their existence?

1.4 Scope

The geographical scope of the study is the Island of Lesvos which comprises 13 municipalities. Description of the Island can be found in Chapter 4.1.1.

The object of the study is limited to 'household municipal solid waste'. Although the definition of municipal solid waste in Lesvos[6] includes waste from hospitals, it is not included in the scope of this study since waste from medical operations requires specific management and treatment. Although the municipalities on the Island are responsible for disposal of other specific wastes such as waste from industrial operation, construction and demolition waste, end-of-life vehicles, and waste from ships that come to the port, these waste streams are also not included in the scope of the research due to the same reason that the nature of waste and their origins require different management and treatment operations.

In terms of waste management options at the top of the waste hierarchy, this research focuses on separate collection and recycling/material recovery as an alternative management as oppose to landfill disposal. There are several reasons. First, preliminary literature review and discussions with some local experts revealed that the case study area has some initiatives on separate collection and recycling. The interest of this research is therefore to see if these initiatives can be promoted into formal practices. Second, from discussions and some interviews with local authorities, local actors are not familiar with the terms waste prevention and waste reduction (and that they do not have any plan or policy on these two practices). Hence, it would not make much sense to discuss them.

On the other hand, waste prevention, in terms of hazardousness and amount of waste generated from products, is also best dealt with in product policy which its implementation is based on national policy rather than local policy therefore not included in the scope of this research.

1.5 Methodology

The approach to this study is based on qualitative research methods. In order to understand the implication of the higher level of policy on the lower level of policy (i.e. the EU policy on the Greek National policy, the Greek national policy on the Regional policy), literature review of available academic papers and relevant EU and Greek policies and legislations has been the main sources of inquiry. Information on the Greek situation and policy has been complimented by some in-depth interviews with experts in the area. Because of the limited availability of updated publications on waste management in Lesvos Island, semi-structured and in-depth interviews with key informants were the main sources of data in order to find out answers to the last two research questions which have been supplemented by relevant policy and legal documents. Selection of interviewees were based on triangulation method where three groups of informants are identified: (1) government authorities (local level: prefecture and municipalities), (2) academic/experts, (3) civil society (local NGOs,

[6] Article 3 of Decision 418/2004 of Municipal Council of Mytilene concerning the Approval of Cleaning Regulation. 22 July 2004. Municipality of Mytilene.

community initiatives, and local entrepreneurs). Snowballing technique is also utilized in order to identify further key informants. List of the interviews can be found in Appendix III.

Figure 1-1 presents a framework which has been developed during the course of the thesis study in order to facilitate the analysis.

(1) Firstly, the link between the EU waste policy and the Greek national waste policy and subsequently the Greek implementation of the waste hierarchy at the national level will be explored to answer the first research question. Inquiry for this part is done through literature reviews and some interviews. The results are presented in Chapter 2 and Chapter 3 of the thesis.

(2) Secondly, to answer the second research question, the link between the Greek national waste policy and local waste policy and planning will be explored including factors for policy decisions of the local governments. Inquiry for this part is done through interviews and supplemented by some literature review. The results are presented in Chapter 3 and Chapter 4.

(3) Thirdly, to answer the last research question, the existing practices on waste separate collection, recycling, and recovery will be explored; in particular, the conditions of their existence. Inquiry for this part is done mostly through interviews. The results are presented in Chapter 4.

(4) Lastly, the main research question of how to move the local waste management up the waste hierarchy will be answered by exploring the possibilities to enhance the existing practices into a formal local policy agenda. The analysis is presented in Chapter 5.

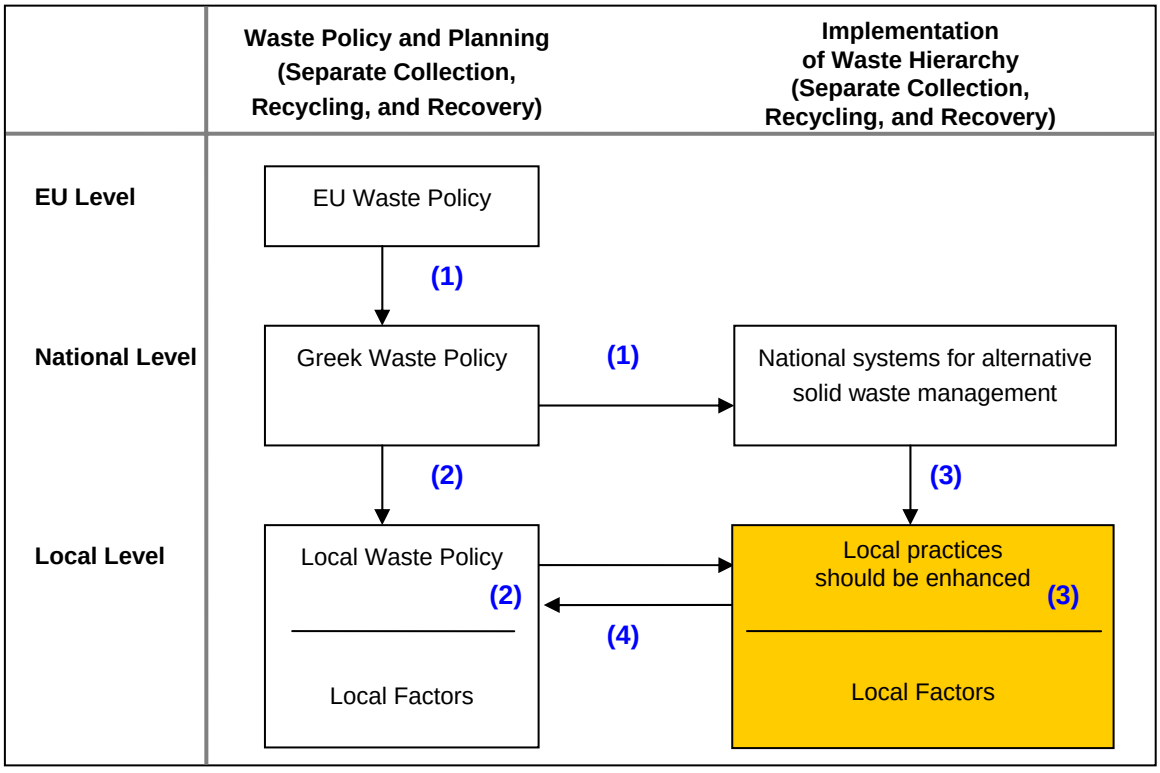


Figure 1-1 Analytical Framework

1.6 Limitations

Local language (Greek) is the main limitation for the researcher. This has limited, to a certain extent, the accessibility of information and interpretation of data. Few published documents in English can be found with regard to the topic of the research (in particular, local or community based waste prevention, recycling, and recovery policy in the Greek and Lesvos context). Most of the published documents (in English) on Greece waste management are related to waste management technologies and the country's problematic landfills/dumpsites situation in relation to not-in-my-backyard syndrome. Therefore, support from the Department of Environment at the University of the Aegean, i.e. guidance from waste management experts and PhD students working on relevant topics has been instrumental in order to identify and acquire relevant documents and key informants. However, there are still some pertaining limitations

Greek legislation rarely has English translation; only one used in this research has the official English translation available (Presidential Decree 117/2004 - the Greek transposition of the EU WEEE Directive). Translation of the Greek legislation and relevant documents are done with the assistance from a Master student and a PhD student at the Department of Environment, University of the Aegean. Although the students are studying/working in the field of environmental management and environmental policy, different terminologies used between the English and the Greek texts have posed some obstacles in interpretation of some documents.

Google translate[7], an internet-based translation tool, has also been instrumental for the researcher to acquire certain information from websites of some relevant Greek organizations. However, when certain information was to be used for reference in the research, the information was sent to the Greek student assistants for translation to ensure correct interpretation.

Language is also an issue in some of the interviews. Of all the 16 interviews conducted, fortunately only four needed to be conducted in Greek. These interviews are mainly with local actors namely: the representative of the Prefecture of Lesvos, representatives of two municipalities, and one local business. When interviews are not possible in English, the Master student assistants had assisted the researcher and acted as interpreter to translate questions and answers back and forth. In some cases where the interviewees seemed not very confident in his/her capacity regarding English conversation, the researcher was usually assisted by one of the student assistants. Each interview was noted and recorded, and some parts of relevant information that were not possible for the researcher to note down during the interviews were sent to the assistant to transcribe.

It was not possible to interview all the local stakeholders, in particular all 13 municipalities on the island, one reason being the limitation of the time of the research and the limited transportation to the remote municipalities during the season when this research was conducted. Another reason is the availability of the interpreter. In this regard, key informants have been first chosen according to suggestions and recommendation from researchers and faculty members from the University of the Aegean who have experiences and in contact with the local stakeholders. Accordingly, six interviews were conducted with local authorities in order to gain their perspectives; more details are discussed in Chapter 4.2.3.

[7] http://translate.google.com/

1.7 Outline of the Thesis

This report is structured as follow: Chapter 1 introduces the readers to the research, Chapter 2, 3, and 4 present findings from the literature reviews and interviews; Chapter 5 analyses the data in order to answer the research questions; and lastly, Chapter 6 presents conclusions and recommendations for further research.

Chapter 1 – Introduction to the research

Chapter 2 – The European Waste Management discusses the EU approach to waste management and its legal framework which influence the Greek waste policy.

Chapter 3 – The Greek Waste Management discusses the current situation of the country and its waste policy and legal framework which has been influenced by the EU waste policy, and in turns influencing the local policy and implementation in the country.

Chapter 4 – Waste Management in Lesvos Island discusses the case study. This chapter present the main findings that the researcher gathered during the course of the research. It explores the problem of waste management on the islands as well as local waste policy and planning with regard to local authorities. In the end, it explores the three existing alternative waste management systems that exist on the island.

Chapter 5 – Analysis discusses the findings of this research in order to answer the research questions.

Chapter 6 - Conclusions and Recommendations for stakeholders and policy makers.

2 The European Municipal Solid Waste Management

This chapter discusses the European Union approach and its legal framework on municipal solid waste management as the EU waste policy has been the strongest influence on Greek's national waste policy. The chapter is divided into three parts. The first part presents waste generation and situation of municipal waste management in the EU to provide background perspective for the next section. In the next section, historical development of the EU waste policy and its recent evolution into strategy on waste prevention and recycling is discussed. The last section presents legal framework of the EU waste policy, as can be categorized as (1) framework legislation, (2) legislation on waste treatment operations, and (3) legislation on specific waste streams. Particular attention is given to legislation which involve obligations on separate collection, reuse, recycling, and recovery so as to use them as a background for further analysing their implication on the Greek waste policy and legislation.

2.1 European Municipal Waste in Perspective

The European Community recognizes that waste has become one of its main environmental problems as its society has grown wealthier. This section provides some facts and figures on the amount of waste generation and its projection as well as how these wastes are managed so as to give the perspective of the problem.

2.1.1 EU Waste Generation and Projection

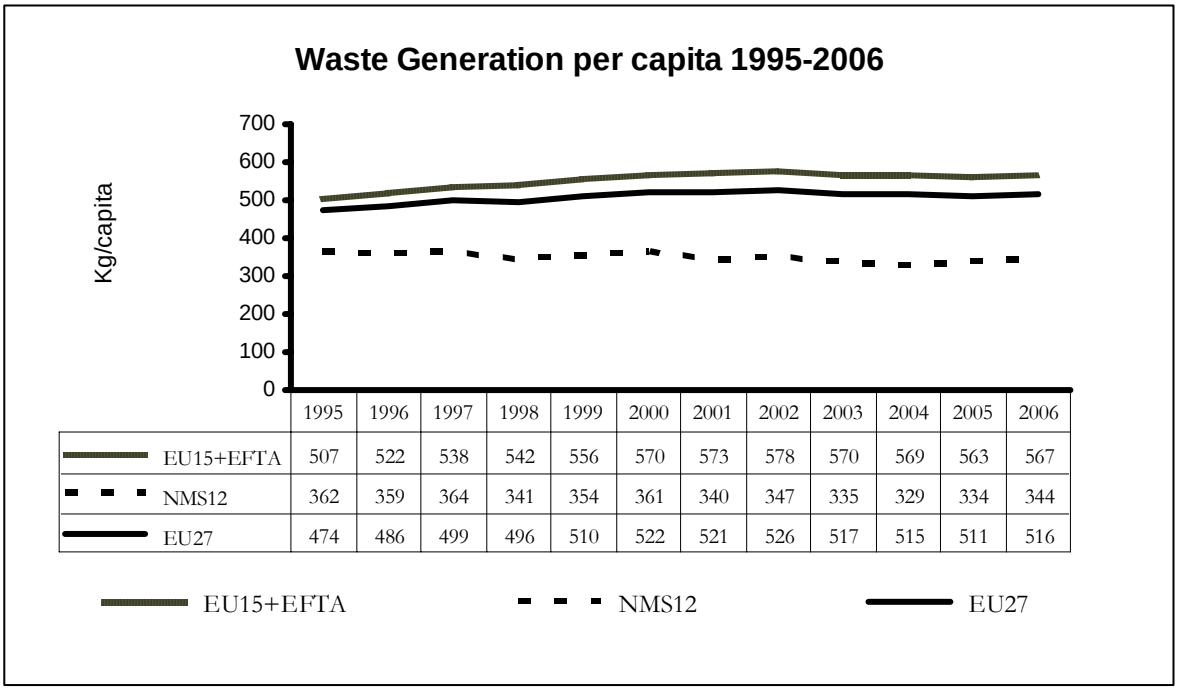
Waste refers to materials for which the generator has no further use for their own purpose of production or consumption therefore is discarded. Around 1,300 million tonnes of waste is generated each year in the EU, about 40 million tonnes of which is hazardous waste. The largest amount of waste is from construction sector (510 million) while manufacturing sector generates 427 million tonnes and waste from household or municipal waste constitute around 241 million tonnes. (EC, n.d.) Municipal waste consists of waste collected by or on behalf of municipal authorities and disposed of through the waste management system. According to the latest available Eurostat statistics (Eurostat & World Bank, 2007), municipal waste generation per capita for EU-27 has increased around 8.8% during 1995 - 2006. In 2006, EU-27 generated 516 kg of municipal waste per person. However, the difference between the old and the new Member States is worth noticing. For the EU-15, the figure has increased around 14% while 5% decrease can be observed for the 12 new Member States. Furthermore, each country's waste generation profile varies depending on different factors such as economic growth, population density, and consumer behaviour. For example, among the EU-15, waste generation per capita in Greece and Spain has grown more than 55% while several countries managed to reduce their figures over the same time period (most notably 35% reduction for Belgium). Figure 2-1 demonstrates waste generation per capita during 1995 - 2006 for EU-27 in comparison to the 12 New Member States (NMS12) and EU-15 plus EFTA countries[8]. (Eurostat & World Bank, 2007)

Projecting into the future, the European Environmental Agency has calculated that generation of municipal waste in the EU-25[9] will continue to grow (Skovgarrd, et al., 2006).

[8] EFTA: European Free Trade Association - currently comprises Iceland, Norway, Switzerland, and Liechtenstein. Liechtenstein is however not included in this set of data.

[9] Projection for EU-27 is not available at the current time of research.

By the year 2020, it will increase by 25% comparing to 2005. Variation between the old and the new member states will still be observed. The projected increase for EU-15 is 22% (all countries increase except the Netherland and Luxemburg). On the contrary, it is expected to grow faster in the new Member States (EU-10), by 50% during the same period. The variation between countries is however significant; Poland expected 5% of waste generation growth while Hungary, Czech Republic, and Malta expected more than 50% increase in their waste generation. It is also important to note that total amount of waste generated by the EU-10 is, however, less than 10% of those generated by the EU-25 and the trend has been decreasing since 1995. Decoupling of waste generation from both GDP and final private consumption expenditure may be expected for the EU-15 and EU-10 as a whole since GDP is expected to grow by 35% and 75% respectively. However, the degree of decoupling may vary depending on variation in the projected national waste generation and economic development. (Skovgarrd, et al., 2006)



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006
EU15+EFTA	507	522	538	542	556	570	573	578	570	569	563	567
NMS12	362	359	364	341	354	361	340	347	335	329	334	344
EU27	474	486	499	496	510	522	521	526	517	515	511	516

Figure 2-1 The EU Waste Generation per capita

Source: graph derived from Eurostat & World Bank, 2007

2.1.2 EU Municipal Waste Management

A significant trend in the EU waste management is the change from landfill, which has been a common practice, toward other kinds of waste treatment and management options. In 1996, 60% of municipal waste in the EU-27 was landfilled. By 2006, waste going to landfills has dropped to 41% while waste being treated or managed by other alternatives has increased. Incineration increase from 14% to 19% while recycling and composting has more than doubled during the same period. Recycling and composting accounted for 18% and 10% respectively in year 2002/2003[10]. The latest available five years data (1998/1999 - 2002/2003) shows that most countries have managed to increase recycling rates by at least 5

[10] The latest data available from Eurostat is for EU-25 (except Cyprus, Luxembourg, Lithuania, Malta, and Finland for composting).

percent while some even exceeded this rate (Germany, Latvia, and Ireland from 8% - 17%). At the same time, the rate of composting increased slightly and was stable in many countries. Incineration with energy recovery during 2000 - 2005 has also expanded in some countries like Sweden and Austria (increased by 12%, now incineration accounts for 50% and 23% respectively). (Eurostat, 2008)

The European Environmental Agency suggested that theses trends are a result of various EU waste policy instruments. For example, the Landfill Directive clearly pressures Member States to divert biodegradable municipal waste (BMW) from landfill; some of which had been diverted to incineration. On the other hand, the targets of landfilling BMW and national policies to meet these targets had not yet had an effect (in 2002/2003, the observed years) therefore had not affect the composting rate. At the same time, the implementation of the Packaging Waste Directive may result in the increasing recycling rate. (EEA, 2007b)

Furthermore, significant difference between each countries' waste treatment options can be observed. Figure 2-2 represents waste treatment options by each country of the EU-25 from 2004 data. Although landfill was accounted for 45% of treated waste in the EU-25, most of the countries are still depending on landfill for more than 50% of their treated wastes. This includes Poland, Greece, Lithuania, Malta, and Cyprus where more than 90% of their waste goes to landfill. On the other hand, the Netherlands, Denmark, Sweden, and Belgium have already arrived at very low landfill rates with a high level of material recovery and a substantial level of incineration. In terms of BMW going to landfills, Figure 2-3 represents the numbers in 2003 compared to BMW generation in 1995. Of all the countries presented here, Greece was not only unable to reduce but also had put more BMW into its landfills in 2003 than the level at which it generated in 1995 - and increase by 140%. (EEA, 2007b)

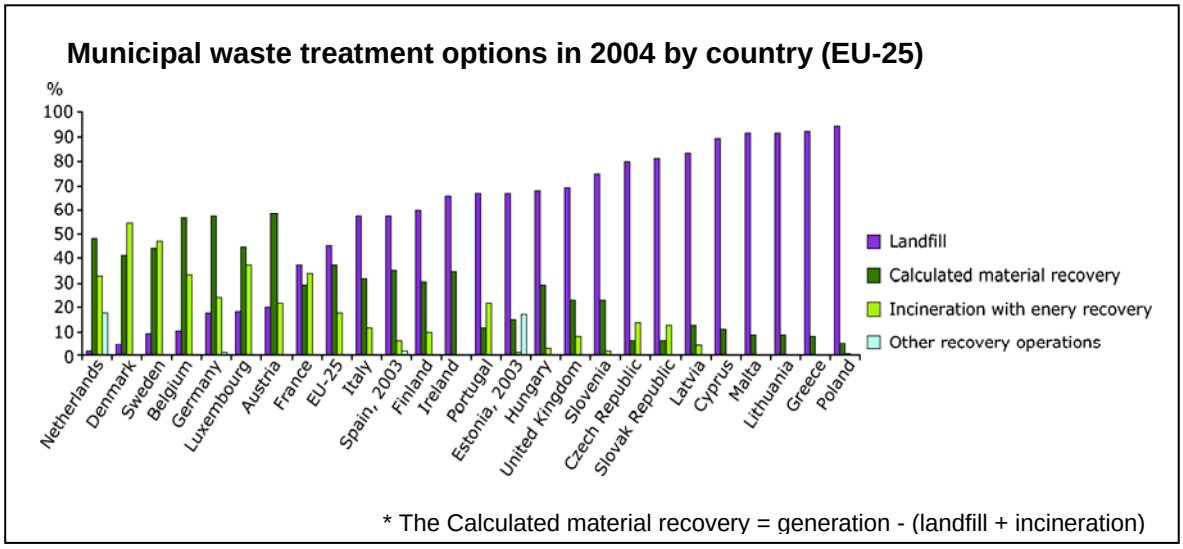


Figure 2-2 Municipal waste treatment options in 2004 by country (EU-25)

Source: EEA, 2007b

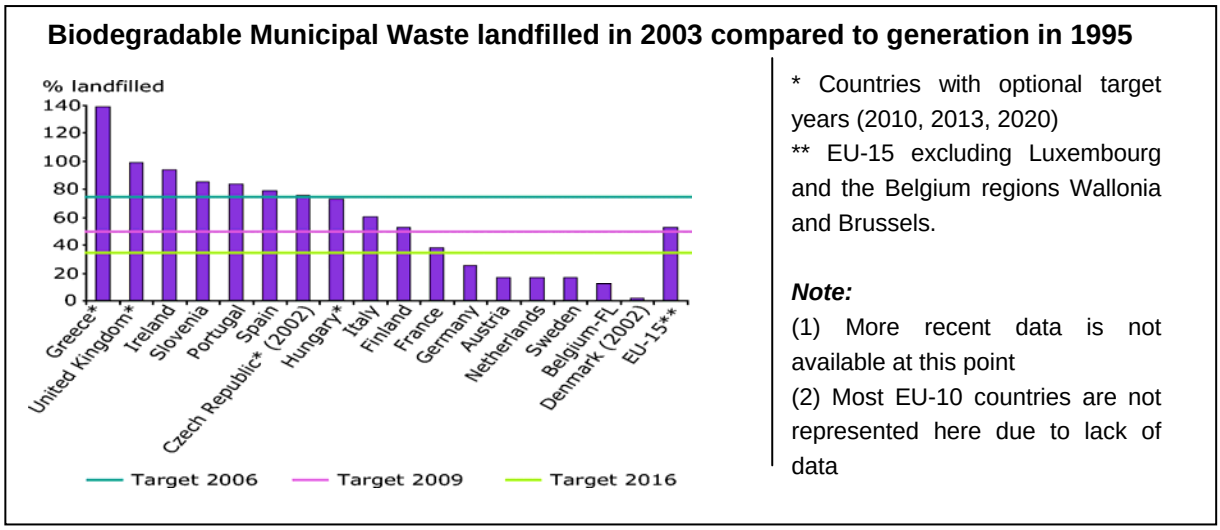


Figure 2-3 Biodegradable Municipal Waste landfilled in 2003 compared to 1995 generation

Source: EEA, 2007b

For shifting from landfill toward recycling, the European Environmental Agency (EEA, 2007b) has identified two main strategies that Member States choose to divert municipal waste from landfill: (1) to aim for high material recovery, at the same time promoting high incineration; (2) to aim for high material recovery (recycling, composting, mechanical biological treatment) but not high incineration. Figure 2-4 in the next page shows grouping of countries according to their diversion strategies.

The same study by EEA explores implications of various policy instruments, mainly introduced as a result of the Landfill Directive and the Packaging and Packaging Waste Directive. For the four countries with high levels of material recovery (Austria, Germany, Denmark, and Sweden), package of policy instruments have been introduced. The common ones which seem to be producing results are landfill ban, separate collection systems for packaging waste, and landfill tax. For landfill tax, if relatively high can be effective in diverting waste from landfill and improve recovery of heavier materials although less effective on waste prevention. (EEA, 2007b)

However, the growing acceptance of incineration with energy recovery (see also Chapter 2.3.1 on reclassification of some municipal waste incinerators as recovery) seems to drive Member States to incline toward introducing incinerators as part of the solution to divert biodegradable municipal waste from landfills rather than choosing options like composting or prevention - even though they are at the higher level of the waste hierarchy. (Tojo, Neubauer, & Brauer, 2008) European environmental NGOs also commented that although the Landfill Directive has immediate effect in improving landfill management and activities, it has not yet played a strategic role to encourage the change toward upstream waste management options (Cioci & Shinn, 2005).

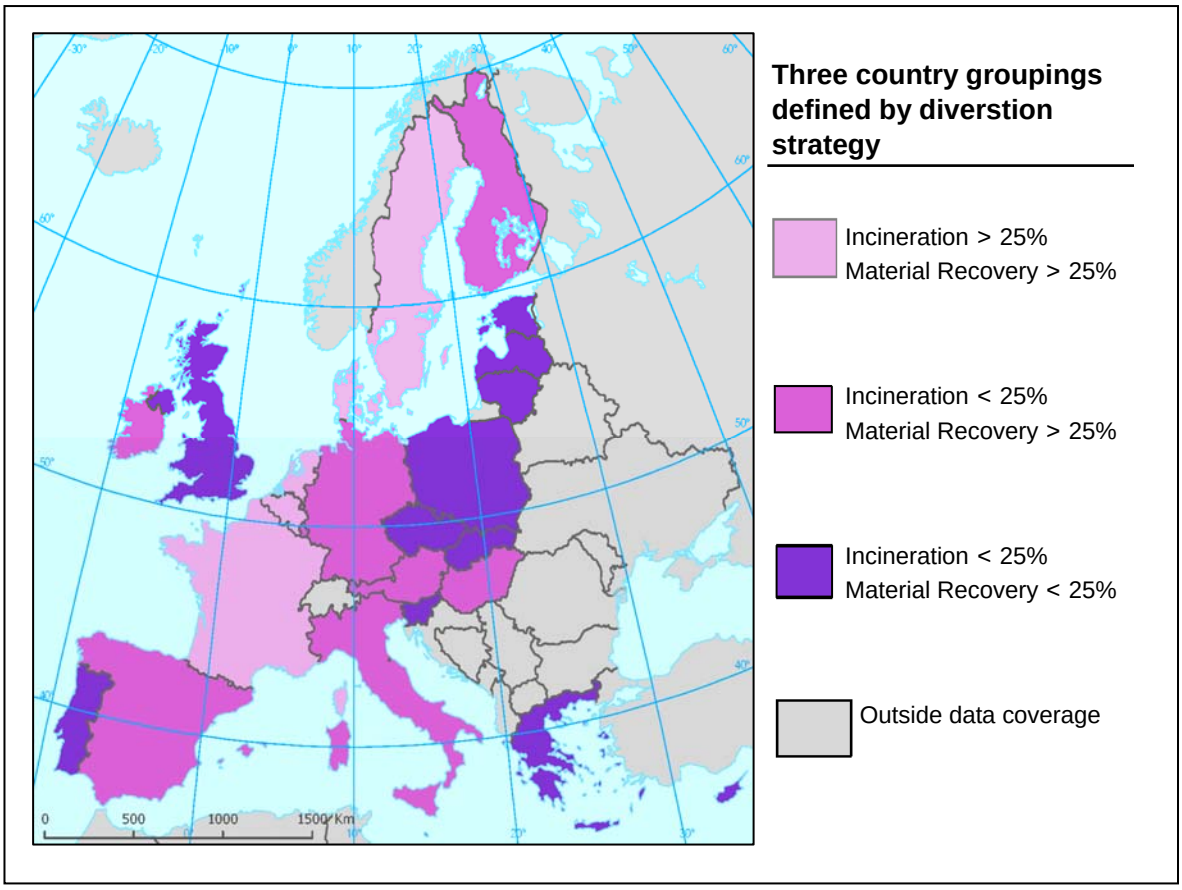


Figure 2-4 Country groupings by diversion (of waste from landfill) strategy

Source: EEA, 2007b

2.2 The EU Approach to Waste Management

This part of the chapter gives account of historical development of the European Union's waste policy as well as its evolution into the current strategic approach.

2.2.1 Historical Development of the EU Waste Policy

It is said that the history of waste policy in the EU begins with waste policy, evolving around situation and problems occurring over the particular period of time. Starting around 1970s and 1980s, several problems and scandals related to (mis)handling of waste[11] attracted the public and policy-makers' attention; the situation had led to three legislations which have formed basis for the regulatory structure on waste. The first Waste Framework Directive and the Hazardous Waste Directive were adopted in 1975, and later the Waste Shipment Regulation in 1993. The issue of toxic (waste) trades or dumping to developing countries and Eastern Europe became apparent in the late 1980s as a result of tightening environmental controls in industrialized countries. The situation had also led to the adoption of the international Basel Convention in 1989. The next set of EU legislation is pollution-control in nature when problems involving pollution from waste management options (landfill,

[11] One of the well-known scandals being the Seveso case in which some 41 barrels of dioxin waste from a big accident of a chemical plant in Seveso, Italy, in 1976 was found abandoned in northern France in 1983. The scandal had escalated the European public concerns on hazardous waste dumping and waste management issue.

incineration, and certain recycling plants in particular) started to emerge. The Landfill Directive[12] and the Incineration Directive[13] set standards for these two waste disposal operations which were the most common waste disposal options by that time. The Integrated Pollution Prevention and Control (IPPC) Directive[14] in 1996 also partly involves standards for a number of waste related activities in terms of pollution from industrial facilities. (EC, n.d. & 2009)

The next step was to improve the management of waste, in particular to promote recycling, reuse, and recovery over waste disposal. In 1996, the Waste Strategy Communication from the European Commission has: (1) reinforced the notion of ***waste hierarchy*** [15] - a rule of thumb as to which management operations are best for the environment even though scientific analysis is not possible or proportionate; (2) re-affirmed ***the Polluter Pay Principle*** - where those who produce waste should have to pay the cost of treatment; and (3) developed ***the concept of priority waste streams*** - specific waste streams where current practices had a high environmental impact or that it had proved particularly difficult to organize funding for recycling despite the clear environmental and social benefits[16]. (EC, n.d.)

The current EU's approach to waste management has been based on three approaches: ***(1) waste prevention*** (reduction of the amount and the hazardousness of waste); ***(2) recycling and reuse***; and ***(3) improving disposal and monitoring***. (EC, 2009) Furthermore, the following principles are the main guiding principles of the EU waste management policy and legislation: the principle of prevention, the precautionary principle, the polluter pays principle, the extended producer responsibility principle (EPR), and the proximity principle (waste should be disposed of or managed as close as possible to where it is generated). Subsidiarity principle is also applied with regards to jurisdiction, suggesting that only those tasks that can not be addressed at the lower levels of governments are dealt with by the higher level of governments. (Tojo, Neubauer, & Brauer, 2008)

During the current decade, although benefits from these Directives can not yet be fully evaluated since they are still in transitional periods, it is expected that the landfill directive will continue to be a major driver for the development of waste management policy at national level, in particular promoting the diversion of waste towards material recycling and biological treatment. At the same time, progression toward prevention and recycling of waste from specific waste/product streams is also anticipated through several policy instruments and measures which have been developed over the past decades. This includes: restriction of the use of certain hazardous substances in certain products; setting targets for collection, recycling and recovery of some key complex waste flows (discussed above); and applying the principle of extended producer responsibility (EPR) aiming at the design change of products (to generate less amount of waste and toxicity at the products' end of life) and offsetting the cost disadvantage of recycling against disposal. (EC, n.d.)

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[12] Council Directive 99/31/EC

[13] Council Directive 2000/76/EC

[14] Council Directive 96/61/EC amended 4 times and codified by Directive 2008/1/EC

[15] Waste Hierarchy: prevention of waste should come at the first place in any waste management stragtegy; and while prevention is not possible, reuse the product, and recycling or composting of material should be consider as the best option for managing waste; then recovery of energy (by incineration) and environmentally soud disposal in landfills should be consider the last options.

[16] For example, batteries and accumulators, waste oils, mining wastes, packaging wastes, waste electrical and electronic equipments (WEEE), end-of-life vehicles (ELVs), etc.

2.2.2 Recent Evolution into Strategy on Prevention and Recycling

In December 2005, the EU has taken a further step on its waste policy, not entirely new but seen as a shifting in direction of the matured policy area. The European Commission proposed a new strategy to deal with waste: the Thematic Strategy on the prevention and recycling of waste[17]. It is one of the seven thematic strategies specified by the 6th Environmental Action Plan (EAP) and adopted by the Council and the Parliament[18]. The 6th EAP also set out a vision to ***integrate resource, product, and waste policies*** since waste prevention can not be achieved in isolation from product and resource policies. In this regard, this new direction of the EU waste policy with its *'Thematic Strategy on Prevention and Recycling of Waste'* is closely linked to the Thematic Strategy on sustainable use of resources[19] and the other two EU policies - the Integrated Product Policy (IPP)[20] adopted in 2003 and the latest Sustainable Consumption and Production Policy[21] adopted in 2008. (EC, 2008b)

According to the Environment Directorate-General of the European Commission, the main objective of the EU waste policy is to prevent waste and promote re-use, recycling, and recovery so as to increase the resource efficiency therefore reducing negative environmental impacts of resource use. The long term goal is for the EU to become a ***recycling society*** that seeks to avoid waste and uses waste as a resource[22]. The Thematic Strategy on the prevention and recycling of waste is based on two approaches: an approach to focus on the environmental impact of resource uses, and the life-cycle approach. In order to achieve its objective, several measures for action was proposed in order to: modernize the existing legal framework (streamline and simplify the existing legislation and emphasis on its full implementation), introduce life-cycle thinking into waste policy, promote more ambitious waste prevention policies, better knowledge and information, develop common reference standards for recycling, and last but not least, further elaboration of the EU's recycling policy. (EC, n.d., 2009, & 2008b)

2.3 The EU Legal Framework

According to its approach on waste management, the existing EU legislation on waste can be categorized as follow: (EC, 2009)

(1) ***Framework legislation:*** Waste Framework Directive[23], Hazardous Waste Directive[24], and Waste Shipment Regulation[25]

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[17] Commission Proposal COM(2005)666 final

[18] Four main priorities of the 6th EAP are: climate change, nature and biodiversity, health and quality of life, and natural resources and waste. The other thematic strategies are: the sustainable use of resource, air quality, the marine environment, pesticides, soil quality, and the urban environment.

[19] http://ec.europa.eu/environment/natres/index.htm

[20] http://ec.europa.eu/environment/ipp/home.htm

[21] http://ec.europa.eu/environment/eussd/escp_en.htm

[22] Commission Proposal COM(2005)666 final

[23] Council Directive 75/442/EEC, amended by Council Directive 91/156/EEC, codified by Directive 2006/12/EC, revised and will be completely repealed by Council Directive 2008/98/EC. (See Chapter 2.3.1)

[24] The Hazardous Waste Directive (91/689/EEC) will be streamlined into the Waste Framework Directive and will be completely repealed from 12 December 2010.

[25] Council Regulation (EEC) No 259/93 of 1 February 1993 on the supervision and control of shipments of waste within, into and out of the European Community

(2) ***Legislation on waste treatment operations***[26]: Waste Incineration Directive[27] and the Landfill Directive[28]

(3) ***Legislation on specific waste streams***[29]: waste oils[30], titanium dioxide[31], sewage sludge[32] (from urban waste water treatment), PCBs and PCTs[33], batteries and accumulators[34], packaging wastes[35], end-of-life vehicles[36], waste electronic and electrical equipments (WEEE)[37], Restriction of Hazardous Substances (RoHS)[38], and mining wastes[39].

Because household municipal solid waste is the subject of this study, the following pieces of legislation are chosen for discussions in the following sub-sections of this Chapter: the Waste Framework Directive, the Landfill Directive[40], the Packaging and Packaging Waste Directive, the Waste Electrical and Electronic Equipment Directive, and the Directive on Batteries and Accumulators and Waste Batteries and Accumulators. Another reason for this selection is because of their implications on waste policy and implementation of the waste hierarchy on the Island of Lesvos. Thus, discussions on each piece of legislation will give a brief account of the legislation then focus on requirements relating to planning and targets which influence the local implementation of separate collection, reuse, recycling, and recovery.

2.3.1 The Waste Framework Directive (WFD)

The first Waste Framework Directive or WFD was originally established in 1975 by the Council Directive 75/442/EEC, amended by Council Directive 91/156/EEC, codified by Directive 2006/12/EC. It has been revised and will be completely repealed by Directive 2008/98/EC (the new WFD) from 12 December 2010. It intends to harmonize waste management and disposal policies throughout Europe while guaranteeing environmental and

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[26] There is also a proposal for a sperate legislation on standards for recucling activities (Commission Proposal COM(2005)666 final) & (EC, n.d.)

[27] Council Directive 2000/76/EC

[28] Council Directive 99/31/EC

[29] Additionally, there are other waste streams under monitoring (waste from ship dismantling, and PVC) and potential for legislative proposal (biodegradable waste).

[30] Directives 75/439/EEC on the disposal of waste oils will also be streamlined into the Waste Framework Directive and will be completely repealed from 12 December 2010.

[31] Regarding waste from Titanium Dioxide industry, three different Directives introduce rules on (i) disposal (Council Directive 78/176/EEC), (ii) monitoring and surveillance (Council Directive 82/883/EEC) and (iii) programmes for the reduction of pollution (Council Directive 92/112/EEC).

[32] Council Directive 86/278/EEC

[33] Council Directive 96/59/EC

[34] Directive 2006/66/EC - repealing Directive 91/157/EEC

[35] Council Directive 94/62/EC amended by Directive 2004/12/EC

[36] Council Directive 2000/53/EC

[37] Council Directive 2002/96/EC

[38] Council Directive 2002/95/EC

[39] Council Directive 2006/21/EC

[40] The Waste Incineration Directive is not chosen because (1) the technical nature of the Directive makes it less relevant to influence moving up the waste hierarchy, and (2) Greece, as the case study country, does not have any incineration although the Directive was transposed into a national law (see Chapter 3.2.1).

health protection. The WFD has established a framework for authorization and licensing of waste management and disposal operations (Chapter IV, Article 23 - 27, Permits and Registrations). The concept of waste hierarchy has been reinforced in the new Directive[41], as Article 4 explicitly states that:

> *'The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:*
>
> *a) prevention;*
>
> *(b) preparing for reuse;*
>
> *(c) recycling;*
>
> *(d) other recovery, e.g. energy recovery; and*
>
> *(e) disposal.'*

Article 3 of the new WFD clarifies some relevant definitions, in particular the distinction between recovery and disposal operations, which has been a subject of dispute during the former WFD - energy recovery and re-processing into backfilling materials have been excluded from recycling. Appendix I gives the non-exhaustive list of definitions most relevant to this research. However, it is still being criticized by environmental NGOs that the new Directive undermines the waste hierarchy and the efforts on prevention and recycling because it re-classified some types of municipal solid waste incineration facilities as recovery rather than disposal operation. (Cliquot, 2008) & (FOEE & EEB, 2008)

With regard to waste management plan, Article 28 of the Directive requires Member States to establish one or more waste management plan(s) which shall cover its entire geographical territory. It further requires that the plan(s) shall conform to the waste planning requirements of the Packaging and Packaging Waste Directive[42] and the strategy on reduction of biodegradable waste going to landfills as stipulated in the Landfill Directive[43]. Further elaboration of what should be included in the plan is also given in the same Article.

For waste management operations, it requires Member States to set up of separate-collection by 2015. Moreover, the new Directives established the first ever general targets for reuse and recycling. Article 4(2) requires that by 2020, the preparing for reuse and the recycling of household waste materials (such as at least paper, metal, plastic, and glass) shall be increased to a minimum of overall 50% by weight; and for non-hazardous construction and demolition waste to a minimum of 70% by weight. Member States are also required to set up 'waste prevention programmes' by 12 December 2013 (Article 29). However, the new Directive fails to establish common targets for waste prevention and the discussion was postponed to 2014 when the next revision of measures and targets will take place (Cliquot, 2008).

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[41] Council Directive 2008/98/EC

[42] Council Directive 94/62/EC

[43] Council Directive 99/31/EC

2.3.2 The Landfill Directive

The EU Landfill Directive or Council Directive 99/31/EC supplements the Waste Framework Directive with regards to disposal of waste in landfills. By introducing stringent operational and technical requirements on the waste and landfills, it intends to provide measures, procedures, and guidance to prevent or reduce the adverse effects on the environment from landfilling of waste through the whole life-cycle of the landfill (Article 1). Furthermore, it defines different categories of waste (municipal, hazardous, non-hazardous, and inert waste); classifies landfills into three categories (landfills for hazardous waste; landfills for non-hazardous waste; and landfills for inert waste); and describes which types of waste should (or should not) be accepted to each category of landfills. Landfills that do not meet these requirements may not continue to operate. The deadline for implementation of the legislation for Member States was 16 July 2001. (EC, 2008a)

Another approach of the Directive is to divert biodegradable municipal waste (BMW) away from landfills by setting targets for reduction of BMW going to landfill based on the amount generated in 1995. Gradually progressive targets are set for three deadline years: 2006, 2009, and 2016. Table 2-1 presents these targets. Countries which put more than 80% of their collected municipal waste to landfill in 1995 may choose to postpone the attainment of the targets by maximum four years. Greece, the United Kingdom[44] and the EU-10 have postponed the attainment of the targets by four years. This means that, for example, by the year 2010, Greece has to reduce the amount of BMW going to their landfilled to 75% of the total amount of BMW it produced in 1995.

Table 2-1Targets for reduction of biodegradable municipal waste going to landfills by the Landfill Directive

Targets for biodegradable municipal waste allowed to be landfilled (% by weight of the total generation in 1995)	**Deadline years**	
	Normal	**Optional***
75%	2006	2010
50%	2009	2013
35%	2016	2020

* Optional targets for countries who landfilled more than 80% of their collected municipal waste in 1995.

Source: Article 5(2) of the Council Directive 99/31/EC

By this approach, the Directive is said to be a major driver during the current decade for the development of waste management policies at national level. In order to achieve the diversion targets, Member States have chosen different strategies and measures. Within the EU-15, measures introduced include source separation, incineration, landfill restriction (ban or diversion targets), landfill tax, home composting, and other fiscal measures addressing households or waste industry. (Tojo, Neubauer, & Brauer, 2008) Figure 2-3 demonstrates that, in 2003, six countries (Austria, the Netherlands, Belgium, Sweden, Denmark, and Germany) already met the reduction target for 2016, France reached its target for 2009, and Italy and Finland reached their target for 2006. However, it is estimated that if the amount of municipal waste (including its biodegradable components) generated by the EU will continue to grow, meeting the targets will be a big challenge since it might not be achievable based on the current policies. (EEA, 2007b)

[44] Commission Proposal COM(2005)105 final

2.3.3 Directives on Specific Waste Streams

For EU Directives for specific waste streams, those which are most relevant to household municipal solid waste management are discussed here. A brief account on each Directive will be given. Furthermore, information are given on targets for separate collection, reuse, recycling, and recovery in order to facilitate further analysis of their implications on the Greek waste policy.

2.3.3.1 Packaging and Packaging Wastes Directive

The first EU comprehensive legislation on packaging is the EU Directive on Packaging and Packaging Waste was established in 1994 (Directive 94/62/EC) and amended by Directive 2004/12/EC in 2004. It aims for environmental protection and market harmonization (avoid the creation of trade barriers within the internal market). It has established, among others, criteria clarifying the definition of the term 'packaging' and giving clear examples in Annex I of the Directive. The Directive adheres to the concept of waste hierarchy and aimed at reducing the final disposal of packaging waste. (EC, 2007a) & (Tojo, Neubauer, & Brauer, 2008)

The Directive demands Member States to set up appropriate systems for separate collection, reuse and recycling of packaging waste. Specific provision on the management of packaging waste should be included in the 'national waste management plan' which is required by the Waste Framework Directive. In all EU-15 countries, economic operators within the packaging chain are responsible for all or part of waste management of packaging. In practice, the collection and sorting of municipal packaging waste is predominantly done by the pubic sector (e.g. municipality). (Tojo, Neubauer, & Brauer, 2008)

Quantitative targets for recycling and recovery of packaging waste are also set. The original Directive set targets to be achieved by 2001, and the amended Directive set targets to be achieved by 2008. These targets are presented in Table 2-2. It should be noted that although the overall objective of the Directive is to reduce waste generation, targets are set for recovery and recycling; thus, full compliance of the Directive does not mean achievement of the policy's wider objective of reducing waste volumes. (EEA, 2005)

Measures at national level are primarily aimed at increasing recovery and recycling with prevention measures being limited to awareness-raising campaigns, some deposit-refund systems, and some taxes. Prevention is difficult to deal with because of constantly changing consumer demand, distribution systems, and packaging materials. (EEA, 2005)

Table 2-2 Recovery and recycling targets set by the Packaging and Packaging Waste Directive

Targets / Treatment Options	First phase targets (% by weight) Deadline: 30 June 2001 Optional: 31 December 2005	Second phase targets (% by weight) Deadline: 31 December 2008 Optional: 31 December 2011
Overall Recovery or incineration with energy recovery targets	Minimum 50% Maximum 65%	Minimum 60%
Overall recycling targets	Minimum 25% Maximum 45%	Minimum 55% Maximum 80 %
Material-specific recycling targets:		
glass	Minimum 15%	Minimum 60%
paper + board	Minimum 15%	Minimum 60%
metals	Minimum 15%	Minimum 50%
plastics (exclusively material that is recycled back into plastics)	Minimum 15%	Minimum 22.5%
wood	Minimum 15%	Minimum 15%

Notes on derogations from Directive 2004/12/EC and Directive 2005/20/EC

1. Greece, Ireland, and Portugal postpone attainment of the first phase targets until no later than 31 December 2005, but shall at least attain 25% recovery (including incineration with energy recovery) by 30 June 2001; for the second phase targets until no later than 31 December 2011.

2. Ten new Member States attain different derogations for the targets: 2012 for Cyprus, the Czech Republic, Estonia, Hungary, Lithuania, Slovakia and Slovenia; 2013 for Malta; 2014 for Poland, and 2015 for Latvia.

Source: Directive 2004/12/EC and Directive 2005/20/EC

2.3.3.2 Directive on Batteries and Accumulators and their Wastes

Directive 2006/66/EC repeals and replaces Directive 91/157/EEC as from 26 September 2008. The aim of the Directive on Batteries and Accumulators is to cut the amount of hazardous substances (in particular, mercury, cadmium and lead) dumped in the environment; this should be done by reducing the use of these substances in batteries and accumulators and by treating and re-using the amounts that are used. The Directive applies to all types of batteries and accumulators, therefore covers a wider range of products than Directive 91/157/EEC, which applied only to batteries containing mercury, lead or cadmium, and excluded button cells. The Directive also prohibits batteries and accumulators containing certain amount of mercury, lead, and cadmium. (EC, 2008c)

To ensure that a high proportion of waste batteries and accumulators are recycled, Member States must take measures to promote and maximise separate collections. Arrangements enabling end-users to discard their spent batteries and accumulators at collection points in their vicinity free-of-charge have to be established. The producers have to bear the cost of collecting, treating and recycling industrial, automotive and portable batteries and accumulators, as well as the costs of campaigns to inform the public of these arrangements.

The Directive[45] has set collection targets for Member States have to achieve separate collection of spent batteries and accumulators at least 25% by 26 September 2012 and 45% and 26 September 2016 (Article 10). Additionally, it also set recycling efficiencies of the collected waste (Annex III of the Directive).

2.3.3.3 Directive on Waste Electrical and Electronic Equipment

Directive 2002/96/EC on Waste Electrical and Electronic Equipment (WEEE) was first established in 2002, amended by Directive 2003/108/EC and Directive 2008/34/EC. The scope of electrical and electronic equipments covered by the Directive include the following categories: large and small household appliances; IT and telecommunications equipment; consumer equipment; lighting equipment; electrical and electronic tools (with the exception of large-scale stationary industrial tools); toys, leisure and sports equipment; medical devices (with the exception of implanted and infected products); monitoring and control instruments; automatic dispensers. The Directive provides different requirements for WEEE from private household and WEEE from business users. Some requirements and quantitative targets are set for the separate collection and recovery, reuse, recycling of WEEE from private households. (EC, 2008d)

In terms of separate collection, Member States are to take necessary steps to ensure that, as from August 2005, systems are set up for final holders and distributors to return WEEE free of charge or on a one-to-one basis (for the same type of equipment). Furthermore, a minimum rate of separate collection is set for 31 December 2006, at 4 Kg per inhabitant per year. The Directive does not specify which actor should be responsible for collecting WEEE from private households.

After WEEE is collected, it will be the responsibilities of producers to set up systems to recover the waste. A producer can organize system by her/himself (individual) or organize system together with other producers (collective). Targets for recovery and reuse & recycling of collected WEEE are set depending on categories of WEEE to be achieved by 31 December 2006. Member States shall ensure that producers meet the said targets. (Article 7(2))

[45] Directive 2006/66/EC

3 The Greek Solid Waste Management

This Chapter aims at giving readers an overview of solid waste management in Greece. The contents based on literature review which includes reports from European Union organizations, Greek legislation, as well as relevant academic papers and news reports.

The chapter begins with the current situation/problem in perspective. Some figures on waste generation are discussed so as to give the extent of the problem. The current practices are further explored, especially disposal in landfills and the country's situation with uncontrolled dumpsites. In this regard, the situation has been perceived as a state of crisis which has consequently deemed to affect the country's waste policy and implementation. Additionally, some figures regarding recycling in the country are provided.

Secondly, the country's waste policy and legal framework are discussed. This is to facilitate further analysis on the influence of the national policy on implementation at local levels. A brief account of the development of the Greek waste policy is given, with a focus on municipal solid waste management. Subsequently, the national legislative framework and the national solid waste management plan are explored in order to understand. Particular attention is given to the contents which are to influence alternative waste management practices at local levels. Then, the national framework for alternative management of specific waste streams is described. This is to be further explored in the subsequent chapter when discuss the existing national systems of alternative management of specific waste streams.

3.1 Current Situation in Perspective

3.1.1 Municipal Solid Waste Generation

As other countries in the EU, Greece generates more and more waste each year. According to the latest statistics, over 4.7 million tonnes of municipal waste (household, commerce and service activities) was generated in 2003, representing the increase of 47% comparing to what was generated in 1995 (see Figure 3-1) (EEA, 2006b). It is estimated to reach 5.2 million tonnes in year 2016 (Skovgarrd, et al., 2006). The figure in terms of waste generation per capita has also been increasing over the past decade. Among the EU-27, it has been the country with the highest municipal waste generation per capita since 2003. Figure 3-2 shows the latest available data of year 2006 from the EU-27; each person in Greece produced 794 kg of municipal waste. (Eurostat & World Bank, 2007) The cause of this increasing trend has been identified as: development of big urban centers, the rising tourist flow, and particularly improving living standards resulting in changes in consumer behaviour. In terms of *waste composition*, biodegradable waste (BMW) constitutes approximately 40% of all municipal waste - this is relatively high comparing to other EU countries. In 2006, the country generates 1.8 million tonnes of biodegradable waste. On the other hand, packaging waste constitutes around 20% of total municipal waste stream. (TCG, 2006)

One of the major challenges for waste management in Greece is the nature of its territory and the spatial distribution of its population. Around 40% of the population concentrated in its two main cities (30% in Athens and 10 % in Thessaloniki). Most of the rest are centered around coastal areas and islands with a large number of small and isolated communities/islands. (Andreou, 2004) Around half of the country's MSW is generated by its two largest cities - Attica region generates 39% and the city of Thessaloniki alone contributes 9% while the rest of the 11 Regions contribute between 3-7% each. (TCG, 2006)

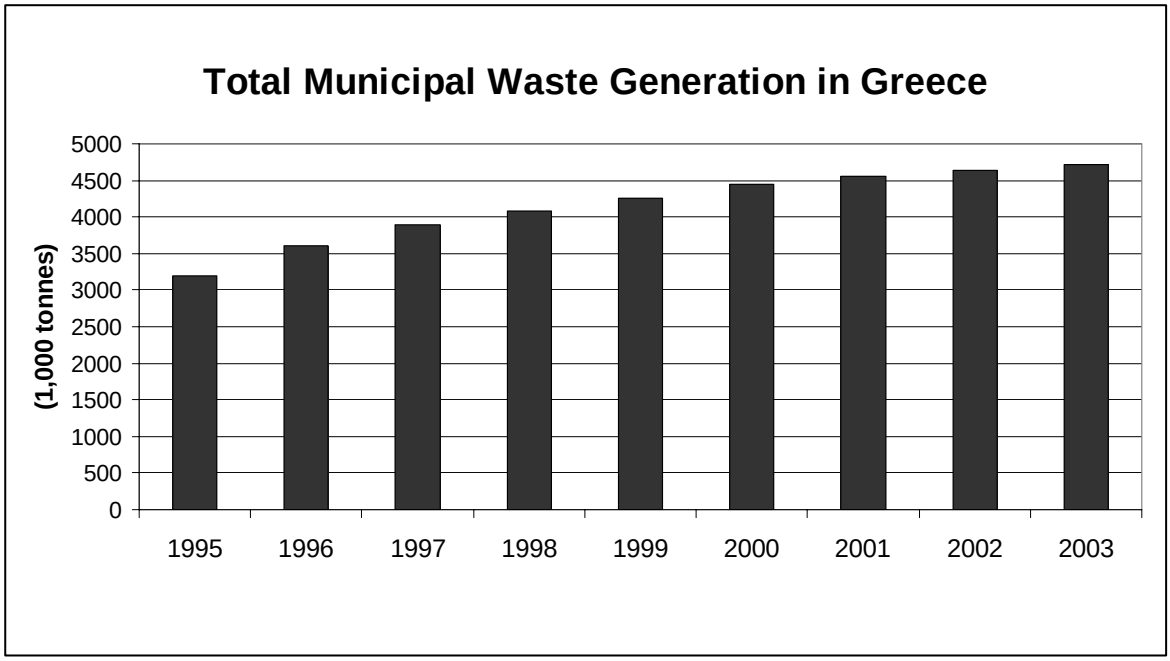

Figure 3-1 Total Municipal Waste Generation in Greece (1995-2003)

Source: modified from EEA, 2006b

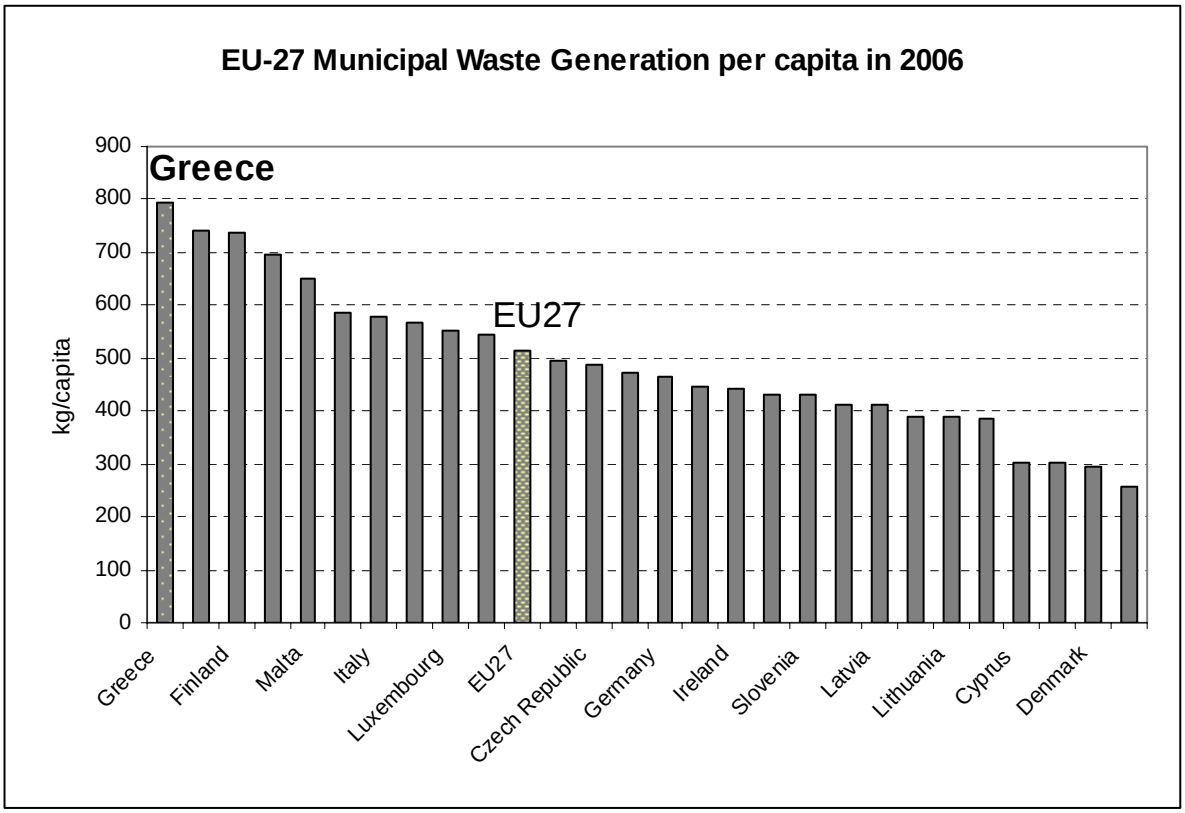

Figure 3-2 EU-27 Municipal Waste Generation per Capita in 2006

Source: modified from Eurostat & World Bank, 2007

3.1.2 Disposal in Landfill – the Most Common Practice

Until the end of 1990's, the only waste management practice in Greece was the burying of municipal solid waste in uncontrolled disposal sites. The system was reportedly improved during 1994 - 1997 when more effective waste collection and transport systems were developed, serving 85% of the MSW generated; at the same time some of the first modern waste management systems were built and started to operate. Currently, systematic collection and transportation is available for almost the whole country, with exceptions in some rural, sparsely populated, and mountainous areas. However, the uncontrolled dumping has still been the common disposal method. It had been common for each community to have one or more places within the communities where they put their garbage[46]. About 6,500 uncontrolled dumpsites were in use in 1997, the number reduced to 2,128 in 2001 and to 1,458 in 2002 - still serving 47% of the population (Andreou, 2004). In the most recent available data from June 2005, the Ministry of Environment, Physical Planning and Public Work (YPEHODE) had reported 1,173 inactive dumpsites and 1,453 dumpsites still in use - a total of 2,626 dumpsites recorded in the country. The closing down and restoration of these sites will require about € 400 million. (TCG, 2006)

In 2002, 48% of all solid waste produced in the country went to sanitary landfill without pre-treatment; another 44% went to uncontrolled dumpsites. During 1997 - 2003, around 90% of municipal solid waste in Greece are being disposed of in landfills (including the uncontrolled ones); and the number has been slightly increasing. There is no incineration in the country so far. (EEA, 2007a) From the latest available data in 2006[47], 45 sanitary landfills serving 318 local communities are in operation. Three material recycling facilities and six waste transfer stations are also in operations. 56 more sanitary landfills and 48 more transfer stations serving 670 more communities were under construction and were targeted to begin their operations in 2008. (TCG, 2006) Nonetheless, the real situation may be different. For example, the construction of the central sanitary landfill of Lesvos Island finished in 2008 but due to the lack of waste transfer station to facilitate waste transportation from various parts of the island, it has not yet begun to operate (see more in Chapter 4.1.2).

For biodegradable fraction of municipal waste, only 1.5% of what is produced is being composted, and the rest of 98.5% goes to landfills. According to Figure 2-3 in Chapter 2, Greece has been the only country among the EU-15 where the amount of BMW going to landfills increased after the enforcement of the EU Landfill Directive[48]. By 2003 it had increased by 140% comparing to the base year of 1995 - the situation in contrast with one of the aims of the Directive. (EEA, 2007b)

3.1.3 EU Fines on Greek Dumpsites – the pressure for Changes

The country's effort to close down uncontrolled dumpsites is due largely to the pressure to comply with the EU Directives. During the 1990s and the beginning of the 2000s, Greece has experienced several cases that were referred to the European Court of Justice (ECJ) for infringements of the EU waste legislation. The most notorious case was the case of illegal dumping close to the mount of Kouroupitos River in the region of Chania on Crete Island

[46] Up until the rearrangement of the national administrative map which came into effect in October 1998, there used to be 5,600 communities and 360 municipalities in the country. They were merged to approximately 1,000 local administrative authorities after the rearrangement - much less, but still a large number.

[47] More recent figures for 2007, 2008, and 2009 are not available during the time of this research.

[48] Council Directie 99/31/EC

where domestic waste, limited quantities of dangerous waste and different kinds of commercial and industrial waste were illegally dumped (with open burning and report of dioxin emissions). After receiving complaints from local municipalities in 1987, the Commission began its inquiries with the Greek Government in 1988; then the case was brought to the ECJ after 1990 (case C-45/91). Although Greece defended that several studies on waste management and recycling in the Chania area were undergoing between 1989 and 1991 but implementation had to be suspended because of local opposition, the Court did not accept the argument. In July 1992, the first Court decision[49] ruled that Greece had failed to take necessary measures to ensure that waste and toxic and dangerous waste are disposed of, in the area of Chania, without endangering human health and without harming the environment, and failed to draw plans for disposal of waste and toxic and dangerous waste for the area therefore fail to comply with Article 4 and 6 of Directive 75/442/EEC (the Waste Framework Directive) and Directive 78/319/EEC (on toxic and dangerous waste). In this regard, Greece was ordered to comply with the Directives and pay the cost. When the situation was not improving, the ECJ in its judgment of 4 July 2005 ruled that Greece had not taken measures to comply with the previous judgment therefore failed to comply with Article 228 (then 171) of the EEC Treaty[50] and impose a fine of € 20,000 per day starting July 2000 as well as closure of the dumpsite. This was the first time that the European Court of Justice took a decision to fine a Member State under this Article of the Treaty. In March 2001, the site was closed and the waste was transferred in appropriate (temporary) installation so the case was closed. During almost 10 months, Greece had paid a total fine of *€ 5.4 million* for the case. (Andreou, 2004) & (Judgment of the Court of 7 April 1992)

Unfortunately, the case was not entirely solved. After closure of the Kouroupitos site, waste was moved to Messomouri for temporary storage until the construction of the permanent disposal site at Korakia is finished. But because the construction of the permanent site had been delayed, by 2005, waste was still stored in Messomouri for over a year (although Greek Government claimed that the site was closed in January 2003) and it had become an illegal dumpsite. The condition of temporary storage, as well as failure to clean up the original site at Kouroupitos, poses risks to human health and environment at both of the sites and the Commission decided to refer the case (again) to the ECJ. (EC, 20 December 2005) Other notorious cases are, for example, the case of illegal waste disposal in Paiania in eastern Attica, the case of illegal disposal in Maroulas in Crete (located in a Natura2000[51] site), and the case of unsatisfactory treatment of sewage sludge from the wastewater treatment plant of Psittalia Island. The later two cases were also referred to the ECJ. (Andreou, 2004)

These huge fines have been a clear pressure for the Greek Government to improve the situation of waste management in the country. The update national solid waste management plan, approved in 2003, identified the primary goal of its five-years plan to close all illegal dumpsites by the end of 2008, with details of number of dumpsites to be closed each year. However, there are still a large number of landfills operating in the country at present. In

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[49] Case C-45/91. Judgment of the Court of 7 April 1992. Commission of the European Communities vs. Hellenic Republic. Failure of a Member State to fulfill its obligations - Directive - Toxic and dangerous waste. (European Court reports 1992 Page I-02509).

[50] Consolidated Version of the Treaty Establishing the European Community. OJC 325: 24.12.2002

[51] Natura 2000 is an ecological network of protected areas in the territory of the European Union. "In May 1992, EU governments adopted legislation designed to protect the most seriously threatened habitats and species across Europe. This legislation is called the Habitats Directive and complements the Birds Directive adopted in 1979. At the heart of both Directives is the creation of a network of sites called Natura 2000." More information at www.natura.org

2008, the Commission had warned Greece that more stringent fines (estimated € 34,000 per day per site) might be imposed. At the end of the year, the government managed to avoid this fine by promising that the remaining landfills (uncontrolled dumpsites) were virtually ready to be closed. However, because of the lack of progress, the EU is preparing to impose another severe fine of € 10 million on Greece within the next six months (from May 2009) for its 400 illegal dumpsites still in operation. Government official claims that this problem is caused by local communities' opposition to plans for sanitary landfills (which will actually help closing down the illegal dumpsites) because they simply don't want them in their backyard. This is another characteristic of waste management problem in the country, the NIMBY syndrome. (Kathimerini, 4 May 2009), (AFP, 21 APRIL 2008) & (EC, 20 December 2005)

In summary, the case like Kouroupitos dumpsite which later creates further problems in other sites like Messomouri represents situation in Greece that it has not been easy to simply close down the dumpsites because the waste still needs to be disposed of somewhere. Moreover, locating and constructing a landfill, even a sanitary one, is not an easy task in the country since local communities are used to the idea that places to put waste, either controlled or uncontrolled, create problems.

3.1.4 Greek Recycling in Figures

Up until 2003, recycling accounts for only 8% of total municipal waste generated while the remaining 91% goes to landfill or dumpsites. Packaging waste accounts for around 20% of the total municipal waste. Recycling of all packaging waste during 1997 - 2002 increased a little, from 263,000 tonnes to 325,000 tonnes. However, the increased of packaging waste recycling was not growing fast enough to catch up with the growing amount of packaging waste generated. The share of recycled and recovered packaging waste only dropped from 37% by weight of total waste generated in 1997 to 33% in 2002. (EEA, 2006a) On the other hand, the introduction of the new law on packaging waste and other products in 2001 has recently improved the situation of recycling and recovery of particular waste streams in the country. Chapter 3.2.3 will discuss more detail of the alternative systems for management of packaging waste and other wastes.

3.2 Greek Waste Policy and Legal Framework

The following part of this chapter is developed from literature review on Greek waste policy and legal framework. It is divided into three subsections. First, development of waste policy is discussed to give a brief account of overall policy and legislation with regard to municipal solid waste. In order to understand the implications of the national policy and legislation on the local levels, the National legislative framework laying down National and Regional Solid Waste Management Plans are discussed in more detail. The last subsection explores existing national systems of alternative management (i.e. separate collection, recycling, and recovery) of packaging and other specific waste streams relevant to this research.

3.2.1 Development of the Greek Waste Policy and Legal Framework

Most of the earlier Greek waste legislation and their implementation focus mainly on how to deal with landfill and the uncontrolled dumpsites in the country. In 1986, the basic Law 1650 on Environment established a framework of sanctions and liabilities for the protection of the environment and set waste management issue *under the jurisdiction of Local Authorities.* The history of Greek modern waste policy started with the transposition of the first EU **Waste Framework Directive** (Directive 75/442/EEC) in 1996 as a Joint Ministerial

Decision (JMD) 69728/824/1996. The first national solid waste management plan was established in 2000 by the JMD 14312/1302/2000. Heavily criticized, among other reasons, because of the country's almost no progress at the local level and the estimated cost of implementation which far exceeded the fiscal capabilities of the state, a reform took place at the end of 2001. (Andreou, 2004)

Both pieces of legislation were later replaced in 2003 by **JMD 50910/2727** on measures and conditions for solid waste management. The new legislation also provides (updated) guideline for **national and regional solid waste management plan**. It also aims at full compliance with **the EU Waste Framework Directive**. However, the latest Waste Framework Directive (2008/98/EC) has not been transposed. In terms of waste treatment operations, **the EU Landfill Directive** (Directive 99/31/EC) was transposed by JMD 29407/3508 in 2002, and is known to translate the Directive word-by-word. **The EU Waste Incineration Directive** (2000/76/EC) was also transposed in 2005 by JMD 22912/1117.

To deal with specific waste streams, **the Law 2939/2001** was issued in 2001. It provides guideline for alternative management (in this sense, alternative from landfill[52]) of packaging and packaging waste and other products. At the same time, **the National Organization for Alternative Management of Packaging and other Products (EOEDSAP)** is to be established according to this Law. Although one of the main purposes of the law was to transpose **the EU Directive on Packaging and Packaging Waste** (Directive 94/52/EEC), it also applies the same framework for waste from other product streams. Article 2(4) of the Law 2939/2001 defines ***'other products'*** as products such as *"vehicle tires, vehicle catalysts, mineral oils, batteries and accumulators, electrical and electronic equipment, telecommunication equipment, demolition and excavation materials, furniture, newspaper and magazines, office paper, etc., which after use and having become waste,…, are going through reuse or recovery."*

In addition to the Law 2939/2001, some EU Directives on specific waste streams have been transposed (e.g. used oils, batteries and accumulators, WEEE, and PCB), while some others are waiting for transposition[53]. In the context of this research where the focus is household municipal waste, the Directive on Waste Electrical and Electronic Equipments (WEEE) and the Directive on Waste Batteries and Accumulators have been transposed. **The EU WEEE Directive** (2002/96/EC) was transposed into Presidential Decree (PD) 117/2004 with the Directive's amendment transposed in PD 15/2006. Targets to achieve separate collection of household WEEE 4kg/inhabitant/year and the recovery and reuse-recycle targets to be achieved by 31 December 2006 were all incorporated in this Greek legislation. **The EU Batteries and Accumulators Directive** (91/157/EEC) was transposed into PD 115/2004. Note that the transposition was before the issue of the new Batteries and Accumulators Directive which has set up collection target of 25% by year 2012. However, without the target set in the Presidential Decree, Greece has already achieved the 2012 target by collecting 26% in year 2008, performing the second in the EU after Germany (GEDSAP, 19 January 2009).

Table 3-1 below summarizes Greek national legislations with regard to household municipal waste management.

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[52] Article 2(19) provides definition of 'Alternative Management System'

[53] List of the EU Directives which have not been transposed into Greek laws (as of January 2009) and list of Greece's cases pending at the ECJ are available (in Greek) at: http://politics.wwf.gr/images/stories/docs/nomothesia/nomothesia_updates_01-09.pdf

Table 3-1 Summary of Greek Legislations related to household municipal solid waste management

Legislation Number	Legislation Title	Notes
(I) FRAMEWORK LEGISLATION		
1996 JMD 69728/824/1996 FEK 358/1996	General measures and conditions for solid waste management	WFD (1st transposition)
2000 JMD 14312/1302/2000 FEK 723B/2000	National Solid Waste Management Planning (General guidelines for solid waste management policy)	1st National Solid Waste Management Plan
2003 JMD 50910/2727 FEK 1909B/22-12-03	Measures and conditions for solid waste management / National Planning and Regional Management	Full transposition of the WFD (91/156/EEC); And updated National Solid Waste Management Plan
(II) LGISLATION ON WASTE MANAGEMENT OPERATIONS		
2002 MD 29407/3508/ 16.12.2002 FEK 1572B/2002	Measures and conditions for the Landfill	Transposition (late) of the Landfill Directive
2005 JMD 22912/1117 FEK 759B/06-06-05	Measures and conditions for preventing and reducing environmental pollution from waste incineration	Transposition of the Directive 2000/76/EC
(III) LEGISLATION ON SPECIFIC WASTE STREAMS		
(a) PACKAGING WASTE		
2001 Law 2939/2001 FEK 179A/2001	Packaging and alternative management of packaging and other products - Establishment of National Organization for Alternative Management of Packaging and Other Products (E.O.E.D.S.A.P.) and other provisions	Transposition of the Directive 94/62/EEC in the National Law
2004 JMD 104826/2004 FEK B 849/9.6.04	Determining fees for individual or collective alternative management of packaging and other products (as defined in Article 2, paragraph 4, Law 2939/2001) to implement Articles 7 (para. B1, a3, and para. B2, a5) and Section B.	
2007 MD 9268/469/2007 FEK 286/B/2.3.2007	Modification of the quantitative targets for recovery and recycling of packaging in accordance with Article 10 (paragraph A1, last paragraph) of Law 2939/2001 (179/A) and other provisions	
2008 PD 99/2008 FEK 154 A /31.7.08	Establishment and operation of the National Alternative management of packaging and other products (E.O.E.D.S.A.P.) Regulation and Financial Management and Procurement Agency»	
2008 PD 170/2008 FEK 228 A/ 7.11.08	Agency services and staff of the National Agency for Alternative Management of packaging and other products (E.O.E.D.S.A.P.)	

Legislation Number	Legislation Title	Notes
(b) WASTE ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)		
2004 PD 117/2004 FEK A 82/5.3.04	Measures and conditions for programme for the alternative management of waste electrical and electronic equipment	Transposition of Directives 2002/96/EC
2006 PD 15/2006 FEK 12 A/2006	Amendment of Presidential Decree 117/04 (82 / A) in compliance with the provisions of Directive 2003/108 (amending Directive 2002/96 on waste electrical and electronic equipment (WEEE)) of 8 December	
(c) WASTE BATTERIES & ACCUMULATORS		
2004 PD 115/2004 FEK A 80/5.3.04	Replacement of the JMD 73537/148/1995 on the Management of batteries and accumulators containing certain dangerous substances (B 781) and the Joint Ministerial Decision 19817/2000 (Amendment of Joint Ministerial Decision 73537/1995)	Transposition of the Batteries and Accumulator Directive

Note for abbreviations:

FEK (ΦΕΚ): Government Gazette (in which the legislation were published)

JMD (Κ.Υ.Α.): Joint Ministerial Decision

PD (Π.Δ.): Presidential Decree

Source: Adjusted from HSWMA, 2009

3.2.2 National Legislative Framework

The most recent consolidated and updated national legislative framework for Greece is the **Joint Ministerial Decision 50910/2727/2003 on "Measures and conditions for solid waste management / National Planning and Regional Management"**, issued at the end of 2003. One of the purposes of the law is full compliance with the EU Waste Framework Directive (75/442/EEC and 91/156/EEC). It updates and gives more details for the National Plan for Solid Waste Management (Article 5). Additionally, each of the 13 administrative regions of the country is required to make and submit Regional Plans for Solid Waste Management (Article 6). In order to understand implications of the national framework legislation on implementation at local levels, it is important to understand who are the competent authorities and their responsibilities assigned by the law. This is presented in the next sub-section (Chapter 3.2.2.1). The content of the law, in particular from the National Plan for solid waste management, with regard to waste prevention, reduction, recycling, and recovery will be highlighted in Chapter 3.2.2.2.

3.2.2.1 Competent Authorities

It is important to first understand the country's administrative structure, hence the relevant authorities. Greece is divided into 13 administrative units or Regions (Περιφέρεια or Peripheries). Local governments are divided into two levels. The first level of local government or Local Organization Authorities (OTAs) consists of municipalities (Δήμος or Dimos) and communities (Κοινότητα or Kinotita) – there are currently 900 municipalities and 133 communities in the country. The second level of government is the Prefecture (Νομαρχια or Nomarxia) – there are 54 prefectures and one autonomous administrative

region of Mount. Athos (Agios Oros)[54]. Each Region comprises of Prefectures which comprices of a number of municipalities (or communities).

With regard to competent authorities for policy planning assigned by the National Legislative Framework on solid waste management, it is worth mentioning that in the first National Plan[55], while responsibility for general policy directions was under the Ministry of Environment, competent authorities for the designing and implementation of local management strategies or plans are at the local levels. The management framework would be established by the Prefecture or the Region, while the plan itself would be drafted by the local councils or local associations for waste management (or the Prefecture or the Region in case of incapability). This was largely criticized as impractical because of the large number of local authorities and their lack of resources and capacity together with the complicated procedure of making and approving the plans. (Andreou, 2004)

For the new setting, each Regional Plan will integrate and supplement the pre-existing local plans (Prefecture plans). It is said to implicitly centralize waste management authorities from local levels (Prefecture and Municipality) to the Regional level. For example, responsibilities for locating sites for waste management facilities are assigned to the environmental planning department of the Regional Administrative Office, and the authority to approve plans now resides on the Regional Secretary. (Andreou, 2004) & (TCG, 2006)

Furthermore, for implementation, the provision on competent authorities (units responsible for the solid waste management) in the Article 7 of JMD 50910/2727 makes Local Organization Authorities (OTA) responsible for the organization of bins, the collection and transportation of MSW and to ensure that waste is disposed of in the infrastructure of the respective managerial entities as designated by the Regional Plan. The temporal storage, shipment, utilization, and disposal of waste are under responsibilities of the OTA (or the waste generator who shall be granted permission by the Prefecture in case the OTA refuses to accept to manage the waste[56]). Permits for these operations must be granted by the head of the Prefecture or by higher levels of government (e.g. regional office) if the operations will be done jointly between more than one OTA which belongs to different prefectures or regions.

3.2.2.2 Implication on Prevention, Reduction, Recycling, Recovery

Waste prevention, reduction, recycling and recovery were clearly stated in Article 4 of JMD 50910/2727 as one of its main principles for General Measures and Conditions for Solid Waste Management; for example, (a) the principle of waste prevention and reduction through reuse, material recovery, recycling, and energy recovery; (b) the polluter-pays principle, with emphasis on producers' responsibility. These principles were translated into the National Plan as aims for municipal waste management[57]. Among others are:

- prevention and reduction of municipal waste generation with strategic aims to focus on packaging waste and other products;

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[54] Regional Administration - Local Government, Ministry of Interior, Republic of Hellenic (In Greek) at: http://www.ypes.gr/el/Regions/

[55] JMD 69728/824/1996 repealed by the JMD 50910/2727

[56] Solid waste managerial authorities as designated by Article 12 of Law 1650/1986

[57] From Section B.I.2 of Annex II of JMD 50910/2727 (Aims for Municipal Wastes [management] in the National Planning for Management of (Non-Hazardous) Solid Wastes)

- utilization of different materials from municipal waste with energy recovery;
- in case the prevention and reuse is inevitable, waste should be driven to recycling and/or material and energy recovery where environmentally acceptable and economically efficient;
- reduce the biodegradable fractions of municipal waste going to landfill (obligation by the EU Landfill Directive).

In this regards, relevant actions[58] have been identified in the National Plan:

- ***Waste prevention and reduction:*** use of clean technology in the production process; use of incentives or disincentives measures to enhance the reuse of materials after the end-of-life of products; use of incentives or disincentives measures to reduce quantity of packaging waste and reuse of packaging materials at its end of life; use of incentives or disincentives measures to facilitate producers' responsibility to produce products that ensure re-utilization at its end-of-life
- ***Integrated solid waste management*** (as oppose to landfill disposal): establish and implement alternative management systems for packaging waste and other wastes to encourage reuse, recovery, and recycling. The system should include:
  - Source separation of recyclable materials with priority in urban areas.
  - Construction of recycling units
  - Construction of units for biological treatment for biodegradable components of solid waste, where economically and technically feasible and consider potential for energy recovery and potential to include treatment of sludge from wastewater treatment and residue from thermal treatment.

The National Plan shall consequently guide the 13 Regional Plans. Unfortunately, detail information for each Regional Plans is not available for the researcher to analyse their content regarding waste prevention, recycling, and recovery. However, the Technical Chamber of Greece (TCG, 2006). Note that as of May 2006, only eight out of 13 regional plans had been approved. Additionally, these plans focus on solving the phenomenon of uncontrolled dumpsites, resulting in more sanitary landfills planned to be constructed.

Several quantitative targets were also set in the National Plan (Section B.I.2 in Annex II of Article 17). In compliance with the EU Packaging and Packaging Waste Directive[59], recovery and recycling targets were set for year 2005 (see Table 2-2 in Chapter 2). The later targets for year 2011 were added by Ministerial Decision 9268/469/2007. Obligation/targets to reduce biodegradable municipal waste (BMW) going to landfills in compliance with the EU Landfill Directive were also transposed and included in this law with postponed targets years. In this regard, Greece postpones the years for the attainment of the targets for both Directives – see detail in Chapter 2.3.2 and Chapter 2.3.3.

3.2.3 Framework for Alternative Management of Specific Waste Streams

[58] From Section B.I.3 of Annex II of JMD 50910/2727 (Actions for Municipal Wastes [management] in the National Planning for Management of (Non-Hazardous) Solid Wastes)

[59] As amended by Directive 2004/12/EC

In terms of specific waste streams, Greece has transposed most of the EU Directives on specific waste streams. The fist one being transposed is the EU Packaging and Packaging Waste Directive (Directive 94/62/EEC) by Law 2939/2001. The Law 2939/2001 on *'Packaging and alternative management of packaging and other products - Establishment of National Organization for Alternative Management of Packaging and Other Products (E.O.E.D.S.A.P.) and other provisions'* was issued in 2001. The aim of the Law is to establish measures for the management of packaging and other products and their waste. It should be noted that, apart from packaging and packaging waste, this law also established the same framework for alternative management of other products/waste streams. It also recognizes the concept of waste hierarchy, by setting priorities, respectively in order, to reduce/prevent, reuse, recycle, energy recovery, and safe final disposal of municipal solid waste.

In this regard, Article 2 of the law gives definitions, among others, of objects regulated by the law (packaging, other products, waste packaging and other products) and definitions of different waste management operations (prevention, reuse, recovery, recycling, energy recovery, disposal, biological recycling, alternative management of packaging waste and other products, etc.). Important definitions that are not similar to those in the EU Directive on Packaging and Packaging Waste are provided at the end of Appendix I.

Subsequently, Article 18(2) describes '***alternative management of packaging and other products***' as the collection activities including bailment, transport, transhipment, temporary storage, reuse, and recovery of the waste from packaging and other products in order to return to the market flow after their reuse or recovery respectively. Thus, the 'systems' for these alternative management activities need to be set up. All operators (producers or importers) are obliged to either organize or participate in alternative management systems to achieve specific targets. The systems can be either individual (an operator organizing own system) or collective (system organized by one or more operators). The systems must be assessed and approved by the EOEDSAP (see paragraph below) and the Monitoring Committee of Alternative Management (EPED).

In terms of competent authority, the National Organization for Alternative Management of Packaging and Other Products (EOEDSAP) is to be established as the actor responsible for the design and implementation of the Law. EOEDSAP will have the power, among others, to propose programme of alternative management, to specify terms and conditions for the alternative management, to propose necessary legislative and administrative measures for effective implementation of the objectives of the Law, and to approve the Certificate of Alternative Management (i.e. required from any System for Alternative Management). Until the opening of the EOEDSAP, the Office of Alternative Management of Packaging and Other Products (GEDSAP)[60] shall exercise its power (TCG, 2006). The EOEDSAP was established in 2008, almost ten years after the law came into force[61]. However, until the moment when this research finish (June 2009), GEDSAP has still been acting as the competent authority.

[60] GEDSAP is established under the Directorate of Environmental Planning, Ministry of Environment, Physical Planning and Public Work.

[61] EOEDSAP was established in 2008 by the Presidential Decree 99/2008 on Establishment and operation of the National Alternative Management of Packaging and Other Products (E.O.E.D.S.A.P.) Regulation and Financial Management and Procurement Agency; accompanies by the Presidential Decree 170/2008 on Agency Services and Staff of the National Alternative Management of Packaging and Other Products (E.O.E.D.S.A.P.).

3.3 Existing National Systems for Alternative Management of Specific Waste Streams

At present, a number of systems for alternative management of specific waste streams have been established according to the Law 2939/2001 (discussed above in Chapter 3.2.3). Some of these systems operate nation-wide while others are operating only in specific locations. Most of these systems are collective systems except for one individual system for packaging waste which is operated by a supermarket chain.

According to the website 'Alternative management of packaging and other products'[62] run by the Office of Alternative Management of Packaging and Other Products (GEDSAP), the following are the systems in operation as of March 2009:

- three collective systems and one individual system for packaging waste;
- two collective systems for WEEE;
- one collective system for portable batteries;
- two collective systems for accumulators;
- one collective system for end-of-life vehicles;
- one collective system for used tires from vehicles;
- one collective system for waste lubricant oil.

Because the scope of this research is household municipal waste, three relevant waste streams are chosen to be explored further. They are household packaging waste, waste electrical and electronic equipment (WEEE), and waste portable batteries and accumulators. The following parts of this chapter discuss systems for alternative management of each of the three waste streams.

3.3.1 Systems for Household Packaging Waste

Packaging waste is the first waste stream for which systems for alternative management were established in Greece. Currently, there are three collective systems and one individual system (by a distributor) available for municipal packaging waste. From all the systems, around 50% or 525,000 tonnes of packaging waste generated in 2008 were recycled or recovered. (GEDSAP, 2009e) Since one of the collective systems deals with packaging of waste lubricating oil and is not household municipal waste, therefore left out of this discussion.

The first system for packaging waste is a collective system called **the Hellenic Recovery Recycling Corporation (HERRCO SA)**[63] (E.E.A.A. A.E.: Ελληνική Εταιρεία Αξιοποίησης Ανακύκλωσης)) which was established in 2003. It is the biggest system for alternative management of packaging waste in the country with more than 1,450 producers and importers as its members (as of June 1st, 2009) (HERRCO, 2009). According to the Office of Alternative Management of Packaging and Other Products (or GEDSAP), with regard to separate collection of municipal packaging waste, the System has to: fund and develop the network of ***blue bins*** in cooperation with local authorities, and make contracts with municipalities or OTAs aiming at energy recovery of packaging waste. (GEDSAP, 2009e) The blue bins are a waste container, in blue colour, placed around cities/municipalities to

[62] http://www.minenv.gr/anakyklosi/system/system.html

[63] http://www.herrco.gr

collect all types of recyclable packaging wastes. (See Figure 3-1) Additionally, HERRCO also provides[64] financial incentives to companies who engaged in the collection of packaging waste for recycling and recovery. (GEDSAP, 2009e)

Figure 3-3 Example of a 'blue-bin' for separate collection of municipal packaging waste by HERRCO

Source: Faikham Harnnarong, 3 April 2009, Thissio, Athens.

According to HERRCO's website, distribution of the system to municipalities or OTAs depends on the time-schedule of the region's integration resulting from the National Plan, the agreement between the state and the system, as well as the intention of every Municipality. By the end of 2008, it has contracts with 610 municipalities, covering residential areas of 6.8 million people. Note that in 2009, the company plans to give special attention to develop projects in island areas (HERRCO, 6 March 2009). In 2008, HERRCO system has provided 80,455 'blue bins' and had recycled 415,844 tonnes of packaging waste which accounted for 39.6% of total packaging waste produced in the country. In addition, it had also recycled 56,512 tonnes of waste printing paper in the same year. The system operates with 18[65] material recovery facilities (MRFs) across the countries with several other MRFs to

[64] No explanation is given as to the detail of these financial incentives. However, from interviews with two scrapyards/material recovery facilities/recycling companies in Lesvos, it can be assumed that the above mentioned incentives might be in terms of agreement with the facilities to buy packaging waste with a guaranteed cost which will be able to cover the cost of operation and transportation from the Island to HERRCO's material recycling facilities in mainland which will be otherwise not economically iable in a bussiness-as-usual condition. (S. Panagiotis, per.com., April 1, 2009) & (G. Vounassos, per.com., April 7, 2009)

[65] The 18 material recovery facilities are located in Athens (Marousi, Aspropyrgos, and Fili), Thessaloniki (Thermi, Tagarades, and Neochorouda), Katerini, Heraklion, Chania, Kalamata, Patras, Zakynthos, Lamia, Karditsa, Corfu, Ioannina, Volos, and Schimatari. (HERRCO, 6 March 2009)

be constructed or to start operation in the near future[66]. The company also claims to strengthen local employment as the number of its employee has increased to 1,052 in 2008 (almost doubled comparing to 680 employees in 2007). (HERRCO, 6 March 2009)

The second system for municipal packaging waste is another collective system called **Rewarding Recycling** (ΑΝΤΑΠΟΔΟΤΙΚΗ ΑΝΑΚΥΚΛΩΣΗ ΑΝΩΝΥΜΗ ΕΤΑΙΡΙΑ in Greek). It was established in 2008 by the Municipalities of Athens, Thessaloniki, Piraeus, Patras, and Iraklion together with several other private companies. The system aims to place 900 'Recycling Centers' in main public areas of municipalities (e.g. squares, parks, supermarkets, schools, etc.) within 6 years. No detail is available as to which municipalities these recycling centers will be placed but it can be assumed that the system will prioritize the big cities where their municipalities are shareholders of the system. The 'Recycling Center' is a container which has different slots separately for plastic, paper, metal, and glass packaging wastes. (GEDSAP, 2009e) Figure 3-2 shows an example of such Recycling Center found in a square in Athens. From observation[67], when consumer discarded the packaging waste in the Recycling Center, the consumer will be paid back some amount of money, the price varies between different packaging materials. The machine has options for consumer to choose between donating the money to charity/social causes (which causes are not specified on the machine) or to get a receipt which can be used to get discount for the amount of money in specific shops near the area. The list of the shops is provided on the receipt. Although the system is still new, it has been criticized by Greek environmental NGOs of its overall contribution to the recycling system of the country. Among other arguments, the different practices between this system and the pre-existing blue bin system might create confusion to the public. The blue bins system is seen as more practical because they are distributed in residential areas in the municipalities where as this new recycling center will be placed in only main public spaces which question the capability of the system to achieve the collection target it is mandated[68].

[66] One MRF in Elefsina is to start operation in 2009, one MRF in Alexandroupolis is under construction, and two MRFs in Rhodes Island and East Macedonia are in the process of authorization.

[67] More detail information is not available on-line and the researcher was not able to acquire further information by other means during the time of this research.

[68] http://ecorec.gr/index.php?option=com_content&task=view&id=265&Itemid=2

Figure 3-4 Recycling Center for Deposit-Refund of the Municipaity of Athens

Source: Faikham Harnnarong. 31 March 2009. Opposite Panepistimiou Metro Station, Athens

The third system for alternative management of municipal packaging waste in an individual system for private labeling and importing goods of a supermarket chain named **AB Vassilopoulos**[69] (ΑΒ ΒΑΣΙΛΟΠΟΥΛΟΣ) which was established in 2004. AB Vassilopoulos is a Greek chain of retail stores who also sells packed products under their own brand. As of June 2009, the company has put recycling centers similar to the ones from the Rewarding Recycling SA system at its 40 stores for recycling of plastic bottles, metal cans (aluminium, tin), glass bottles, plastic bags, batteries, metal and plastic containers. In addition, it has also put smaller recycling centers for aluminum, plastic, and tin in 20 of its stores and some automated machines for the return of empty (glass) bottles. In 2008, this system collected and recovered/recycled 5,241 tonnes of packaging waste, of which 1,148 tonnes are their own brand packaging (AB Vassilopoulos, 2009).

3.3.2 Systems for Household Waste Electrical and Electronic Equipment

Appliance Recycling SA[70] (ΑΝΑΚΥΚΛΩΣΗ ΣΥΣΚΕΥΩΝ ΑΕ in Greek) was established in 2004 as a collective take-back and recycling scheme for all WEEE categories, both from private households and from users other than private households, including historical waste[71]. (GEDSAP, 2009b) For the organization of separate collection of WEEE from private households, the company (Appliance Recycling, 2009):

[69] http://www.ab.gr

[70] www.electrocycle.gr

[71] According to the EU WEEE Directive, historical waste is waste electrical and electronic appliances (WEEE) from products put on the market before 13 August 2005. (Article 9 of Directive 2002/96/EC, as amended by Article 1 of the Directive 2003/108/EC)

(1) works with municipalities to organize special collection points in municipalities;

(2) works with scrap metals junkyards who receive WEEE from *'junkmen'*[72] in order to get the WEEE from them; and

(3) receives WEEE from shops which sell EEE and collect WEEE returned by the sale of new products.

As of 2008, the system has signed contracts with 420 local authority organizations (OTAs), and is obliged to cover the entire Greek territory. (No information as to when and how to achieve this is available.) The system was expected to cover 67% of the population in the year 2006 and expected to cover 90 % of the population (estimate) in year 2008. The system has collected approximately 47,140 tonnes of WEEE in 2008 nation-wide, of which 44,300 tonnes are from private household - thus exceeding the EU WEEE Directive' separate collection target of 4 kg/capital (44,000 tonnes). (GEDSAP, 2009b)

As of February 2009, a new national collective system for alternative management of lighting and light bulbs shops - **FOTOKYKLOSI SA**[73] (ΦΩΤΟΚΥΚΛΩΣΗ ΑΕ) was established. It will operate in addition to the system of Appliance Recycling SA in order to facilitate the country to achieve targets set by the EU. Collection points in municipalities are to be developed, as well as collection from non-household sources. (GEDSAP, 2009b) & (FOTOKYKLOSI, 2009)

3.3.3 System for Household Waste Portable Batteries and Accumulators

The collective system of alternative management of portable batteries and accumulators (ΣΣΕΔΦΗΣΣ) was established in 2004. It is now renamed as **AFIS SA**[74] (ΑΦΗΣ ΑΕ) or Recycling of Portable Batteries SA. The quantity of waste portable batteries and accumulators in Greece is estimated at 2,100 tonnes. Today, separate collection bins set up by AFIS SA has exceeded 39,300 nationwide. The system claims to have good geographical distribution. In 2008, the quantity of waste portable batteries and accumulators collected by the system amounted to 496 tonnes, 26% of sales which surpasses the EU targets for 2012 (25%). (GEDSAP, 2009f) & (AFIS, 2009)

[72] The word ***'junkmen'*** or ***'paliatzides' (παλιατζήδες)*** in Greece means people who come to buy old stuffs from household. It was traditionally done by Roma people (ethnic minority group in the country. The practice was almost vanished but now has become popular again. Now junkmen ask for money to collect old (i.e. big) WEEE from houses (sometimes they get, sometimes not) but they sell it to the junkyards that are collecting WEEE for scrap metals, or for recycling. (G. Giouzepas, per. com., May 7, 2009)

[73] www.fotokiklosi.gr

[74] www.afis.gr

4 Waste Management in Lesvos Island

In this chapter, the case study of Lesvos Island will be presented. The chapter is divided into three sections. The first section hopes to familiarize the readers to the context of the case study by giving a brief account on the Island's physical location, administrative structures, population, economic activities, and its waste management problem. The next section explores if and how options at the top of the waste hierarchy are included in local policy and planning (i.e. at the Prefecture level). It also describes roles and responsibilities of relevant local authorities and explores factors influencing their policy decisions.

The last section of this chapter presents existing systems for alternative management of municipal solid waste on the Island of Lesvos. There are currently three different types of systems for voluntary separate collection and recycling. Descriptions of these systems are given (e.g. how they came to exist, how they are operating, and what are the linkages between these systems and the national collective systems). The aim of this section is to find out what are the driving forces behind these initiatives and what makes them survive or not.

Information provided in this chapter is derived mostly from various interviews due to the limited availability of up-to-date literature on Lesvos waste management. The information was substantiated with some literature review and on-site observations during the period of field-research in March and April 2009. Interviews with those who are responsible now or were involved in the local policy and planning give account of what are 'formally' available or what are in the plan to be implemented. On the other hand, interviews with local researchers, local recycling business entities, and local environmental groups have added to make the picture of the existing alternative waste management options on the Island clearer.

4.1 Introduction to the Case Study

4.1.1 Lesvos Island in Perspective

Administratively, Lesvos Island belongs to the Prefecture of Lesvos which belongs to the Region of Northern Aegean. The Region of Northern Aegean consists of 3 prefectures: Lesvos, Chios, and Samos, with nine inhabited islands. Prefecture of Lesvos is the biggest among the three prefectures, having three main islands: Island of Lesvos, Island of Lemnos, and a small Island of Agios Efstratios. Figure 4-1 shows location of the Region, the Prefecture, and the Island. One main characteristic of this region is its 'insular character' which usually emerge as problems, such as: the isolation of the insular regions, the distance that divides them from the mainland, difficulties in transport and communications, difficulties in energy production, and obstacles which hinder the development of certain productive and economic sectors (e.g. industrial sector). The prefecture of Lesvos has 17 municipalities and one community: 13 municipalities are located on Lesvos Island; four municipalities are located on Lemnos Island; while Agios Efstratios Island has one community. (Region of North Aegean (RNA), 2009b & 2009a)

Lesvos Island is the third largest Island in Greece[75], with an area of 1,636 square kilometres. It is 188 nautical miles from Piraeus, the main port in Athens - the conventional ferry trip takes 12 hours, with 8.5 hours for the fast ferry. It is 218 nautical miles from Thessaloniki,

[75] The biggest is Crete Island and the second biggest is Evia Island.

and 55 nautical miles from Chios, the next big island. (RNA, 2009a & 2009c). The Island is classified as rural regions according to the EU Rural Development Policy (2007-2013) (Harnnarong, 2009).

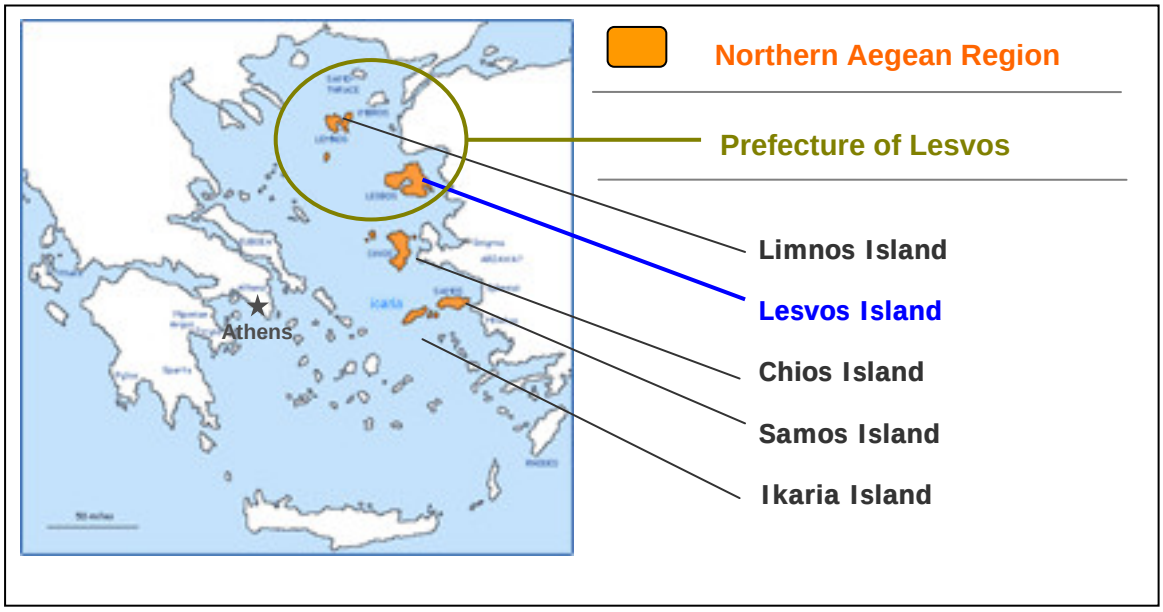

Figure 4-1 Map of the Prefecture of Lesvos, Northern Aegean Region, Greece

Source: modified from http://upload.wikimedia.org/wikipedia/commons/e/e2/GreeceNorthAegean.png

The local economy depends on rural production, specifically olive cultivation and production of olive oil, cattle breeding, and some small-scale fishery. Industrial production on the Island is limited and based on agricultural products, i.e. ouzo[76] distillation, dairy products productions, slaughter houses, and chicken farms. A considerable part of the population is professionally engaged in tourism. The tourism sector on the island (and in this region in general) is progressing during the last years. (RNA, 2009a)

Mytilene is the capital city (town) of the island as well as an administrative centre. It houses the Prefectural Administration of Lesvos, Ministry of the Aegean, Periphery of the Northern Aegean, and University of the Aegean. (RNA, 2009a & 2009b) According to the latest population census in 2001, the Island has 90,643 permanent residences. Population density of the whole island is 5.55 persons per square kilometer. However, most of the Island's population lives in Mytilene. The town has 28,880 residences, equal 31% of the Island's population, which makes it the most crowded place on the Island with population density 182.72 persons per square kilometer. (Waste Management Laboratory University of the Aegean (WMLUOA), 2009b) The rest of the population are scattered in other 12 municipalities. Appendix II provides a list of the 13 municipalities in Lesvos Island, their communities, their land areas, their population and population density.

Seasonal population (i.e. number of tourists visiting the island) is one of the issues that affect capacity of the Island's basic infrastructure. The latest available figures from 2005 and 2006 shows that tourists start to visit the island in May, the tourist season peaks in July and August when the number of tourists visiting the island account for around 15-18% of the number of

[76] Ouzo is a traditional Greek spirit of anise-flavored.

locals living there (permanent population). Municipalities having the most visitors in year 2006 as compared to the number of their local residences are the Municipalities of Mythimna (Molyvos) (29%), Petra (19%), and Eressos-Antissa (11%). (WMLUOA, 2009a)

4.1.2 Lesvos Waste and the Problem in Perspective

In 2009, it is estimated that 37,325 tonnes/year of municipal solid waste are generated on Lesvos Island (0.98 kg/capita/day). Of which, 57% are compostable (food-waste) and 36% are recyclable (7% plastics, 4% metals, 3% glass, 22% paper). (WMLUOA, 2009c) In terms of waste management, Lesvos is like other parts of the country where every community used to have their own dumpsite, one or more, to dispose of their municipal solid waste. In many cases, these sites also receive local agricultural and industrial wastes such as waste from slaughter houses. By 1988, approximately 50 uncontrolled dumpsites existed on the Island (Kontos, Komilis, & Halvadakis, 2003). When the EU Landfill Directive came into effect at the National level, these dumpsites needed to be closed and restored. A study for potential central sanitary landfill(s) for the Island was then commissioned. From this study, a central sanitary landfill was chosen for Lesvos to receive municipal solid waste from all municipalities on the Island. The agreed site is located between three municipalities: Agia Paraskevi, Loutropoli Thermis, and Mantamados. (A. Stathelli, per.com., April 6, 2009)

Construction of Lesvos' central sanitary landfill facility was completed by the end of 2008. But until June 2009, it has not started the operation and the municipalities are still disposing their waste in their dumpsites. There are several reasons to this. One major issue is that there is no waste-transfer station available yet and this is problematic especially for municipalities on the western side of the Island where distances to transport waste from the municipalities to the central landfill is too long to be economically feasible to make daily transfers. The study for waste transfer station was commissioned in 2008 and expected to finish within 2009. (C. P. Halvadakis, per.com., March 9, 2009) & (I. Tsampanis, per.com., April 8, 2009)

At one point, it was negotiated that each municipality, while still have no other options to dispose of their waste, should choose one of their local dumpsites for their waste disposal. They should then operate, control, and maintain this one site (semi-controlled dumpsite but not yet a sanitary-landfill) while closing the others (K. Zafeiro, per.com., April 9, 2009). Until May 2009, nine municipalities are maintaining their non-sanitary semi-controlled disposal sites within their boundaries. Mantamados is still using several uncontrolled sites. Some municipalities in the eastern part of the Island bring their waste to the site of Mytilene municipality. (WMLUOA, 2009d) However, these dumpsites are also pressured to cease their operation as otherwise they may have to pay fine to the EU due to infringement of the EU Landfill Directive (estimated € 34,000 per day per site). Several interviews with local authorities have revealed that this issue has been the major drive for municipalities to improve their waste management situation. Figure 4-2 shows a map of the Island with locations of the Central Sanitary Landfill and other municipal solid waste disposal sites (including the controlled and the uncontrolled sites, the active and non-active ones, and the ones under restoration)[77].

[77] This map was provided by the Waste Management Lab, the University of the Aegean, in May 2008. Exact data on the current (2009) status of the dumpsites may alter slightly (by few sites) since the limited research duration did not allow for field update of the sites situation. The intention of this map is to illustrate the overall picture to the readers.

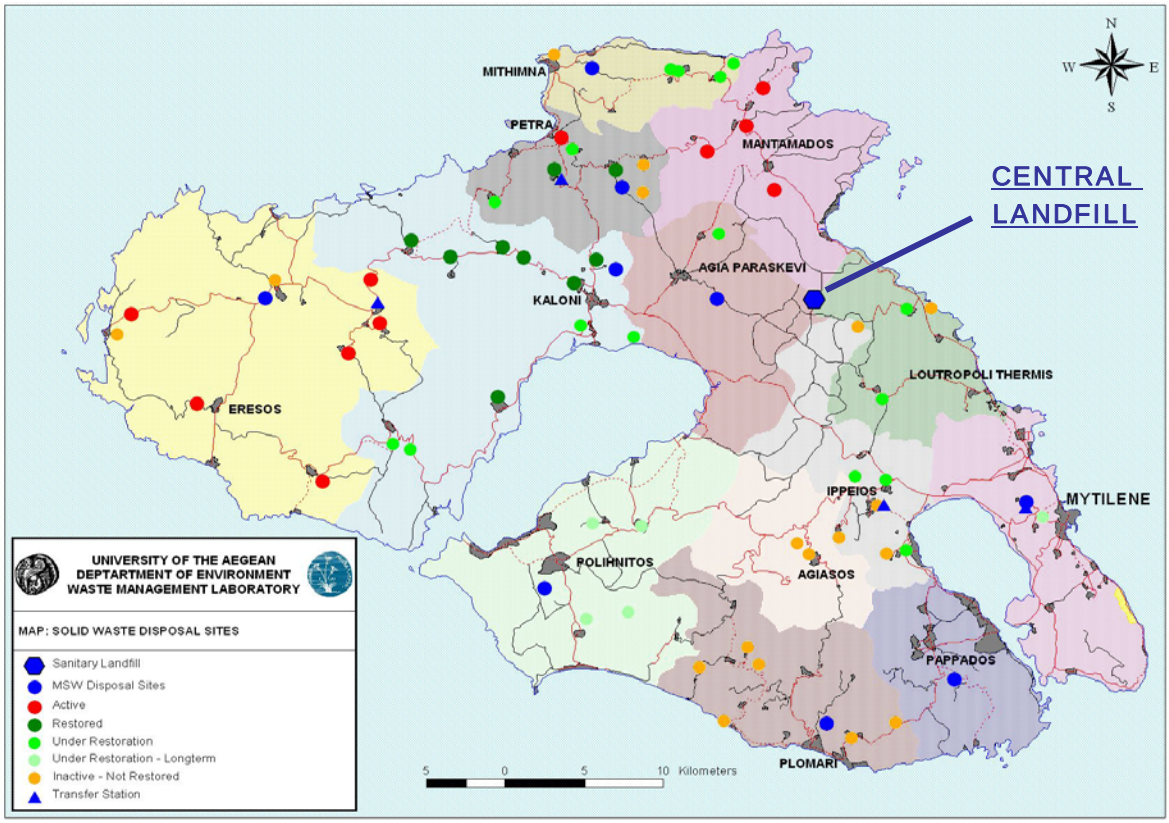

Figure 4-2 Solid Waste Disposal Sites on Lesvos Island

Source: Waste Management Laboratory, University of the Aegean, 2009.

From literature review, interviews, and observation - the current waste management situation on Lesvos Island and their problems can be summarized here:

(1) Municipalities on the island are relying on landfill as the main disposal method – however, the central sanitary landfill has not begun its operation; at the same time, the municipalities are under pressures to close their dumpsites as otherwise may face hefty fine from the European Union.

(2) It took around 10 years since the idea to construct the Island's central landfill was initiated until the time that the construction had finished. One of the main obstacles was the difficult situation in siting the landfill due to e.g. complex eco-systems of the island and local oppositions (C. P. Halvadakis, per.com., March 9, 2009). Moreover, it still needs some more years before it can begin to operate. Once the landfill reaches its capacity, it will not be easy or fast to build a new one.

(3) Waste is increasing, and the type of waste is changing – as a result of changes in consumption pattern and the increased amount of tourists. This is particularly observed in specific municipalities where tourism industry has been progressing, for example, the Municipality of Eressos-Antissa (K. Zafeiro, per.com., April 9, 2009)

(4) Distance is a problem which entails transportation cost. This is not only a problem to the island as a whole because of its remoteness from the mainland Greece; distance from some municipalities to the main city or the central landfill also incurs high transportation cost. This is particularly applied to municipalities on the western part of the island where not only the distances to the central landfill are great, but also the

geographical feature of the area makes it more difficult (e.g. access through roads which go through mountains).

4.2 Local Waste Mmanagement Policy and Planning

In this part of the Chapter, the Prefectural Planning on municipal solid waste management is first discussed as the legal framework for local implementation. The next section discusses roles and responsibilities of relevant local authorities (Prefecture and Municipalities) and the last section presents factors influencing waste management policy decisions of these local authorities.

4.2.1 The Prefectural Planning

According to the first National framework legislation on solid waste management framework (JMD 69728/824/96) and in compliance with the first National Planning (JMD 14312/1302/2000), the Prefecture of Lesvos was responsible to make plan for solid waste management for the islands of Lesvos, Limnos, and Agia Efstratios. The first study for the Prefecture's Solid Waste Management Master Plan (Framework Planning) was approved in November 2001. Subsequently, the next stage of the study to see detail of the Plan was done in 2002. The main purpose of the plan was to identify central sanitary landfills for islands under the Prefecture's responsibility. The plan was divided into two sections: one for Lesvos Island and another for Limnos Island and Agia Efstratios Island. The study included general information of the plan, criteria for siting of landfills for municipal solid waste and siting of landfills for inert waste. The central sanitary landfill for Lesvos municipal waste was decided to be located at Kleftovigla2 site. (Prefecture of Lesvos, n.d.) The site is located between three municipalities: Agia Paraskevi, Loutropoli Thermis, and Mantamados. The Prefecture then applied for funding from the EU Cohesion Fund to construct the landfill, the road to the site, and the waste transfer stations. The application was approved at the end of 2003[78]. The total cost of the project is € 17.28 million, and the amount to be contributed by the EU Cohesion Fund is € 12.96 million. (Commission Decision of 18/12/2003)

The Prefecture's planning was already done and approved before the new legislation on Measures and Conditions for Solid Waste Management and National and Regional Planning and Management (JMD 50910/2727 in 2003 see Chapter 3.2.1) was approved. Consequently, the new legislation does not have much effect on this prefectural planning (particularly planning of the Prefecture's landfills and waste transfer stations). The Regional Planning (of the Northern Aegean) which had to be conducted according to the new legislation was said to mostly gather the existing Prefectures' plans (A. Stathelli, per.com., April 6, 2009).

The Plan for the Prefecture of Lesvos was initiated before 2000 when no legislation regarding recycling existed in the country. Although the Prefecture has recognized that the Northern Aegean Regional Plan (approved in 2005) contains some provisions about recycling and composting, the Prefecture has not been actively acting on this issue. Table 4-1 below summarizes Actions according to the Regional Plan. According to an interview with the former Director of the Environment Department[79] at the Prefecture of Lesvos, part of

[78] Commission Decision of 18/12/2003 on the allowance of installments from the Cohesion Fund for the work on 'Solid Waste Management of Lesvos Prefecture' to the Hellenic Republic. [In Greek: N/A]. CCI : 2003 GR 16 C PE 014.

[79] Athina Stathelli had been Director of Environmental Department of the Prefecture of Lesvos for many years and involved in all the Prefectural Planning for waste management since the beginning. Until the end of this research (June 2009), the Environmental Department still has an interim Director. The researcher considered it more appropriate to interview the former Director for relavant information.

the reason is the high cost of transporting [recyclable] waste [to material recovery facilities in mainland Greece] due to the insular characteristic of the islands. (A. Stathelli, per.com., April 6, 2009)

Table 4-1 Summary of Actions for Solid Waste Management in the Northern Aegean Regional Planning

Management Options	Actions
Final Disposal Facilities	- Construct seven sanitary landfills in total for the Region: one for each the island of Lesvos, Limnos, Chios, and Fournous; and three landfills for the island of Samos.
Recycling	- Implement household sorting (separate collection) for packaging waste (in one compact waste stream); - Separation in facilities for material recovery for the islands of Lesvos and Chios; - Implement household sorting projects for specific materials (preferably paper but also plastics, glass, and metals) and the use compaction packaging to transfer to Lesvos Island for the island of Chios, Samos, and Ikaria.
Biological Treatment / Composting	- Implementation of household sorting projects for biodegradable components of municipal waste (33,248 tonnes/year for 2010; 47,402 tonnes/year for 2013; and 61,136 tonnes/year for 2020); - Treatment of biodegradable waste in five composting facilities – one each for the island of Lesvos, Limnos, and Chios, and two for Samos island.

Source: modified from TCG, 2006

The former Director also mentioned that because HERRCO (the national collective system for alternative management of packaging waste - see Chapter 3.3.1) can reach its targets on separate collection and recycling of packaging waste by working with main cities like Athens, Thessaloniki, and Petra. Consequently, the company has not been enthusiastic to operate on the islands; and neither has the Ministry of Environment been exerting pressure on the company. On the other hand, she also mentioned that the Prefecture has been willing to provide spaces in the vicinity of the central landfill site for the company to establish a recycling center [or a material recovery facility]. (A. Stathelli, per.com., April 6, 2009) However, a Press Release issued by HERRCO in March 2009 (HERRCO, 6 March 2009) briefly noted that the company will give special attention to develop projects in island areas in year 2009 - the outcome of which may benefit the situation of Lesvos in the future.

Nonetheless, pressure exists for the Prefecture to start acting on recycling and composting. It can be said that this pressure comes directly from the EU level. When applying for funding from the Cohesion Fund, the Committee Decision[80], i.e. the grant contract between the EU Cohesion Fund and the Prefecture of Lesvos, contains some special provisions as conditions for final payment of the grant. The final instalment will be given if[81]:

- The followings are in operation: the infrastructure of system(s) for alternative management of solid waste in the region, the system of preliminary treatment of solid waste before final disposal in a sanitary landfill (i.e. separation ad recycling/recovery of non-organic part of the waste), and the collection system for special waste.

[80] Comittee Decision CCI : 2003 GR 16 C PE 014

[81] Commission Decision of 18/12/2003 on the allowance of installments from the Cohesion Fund for the work on 'Solid Waste Management of Lesvos Prefecture' to the Hellenic Republic. [In Greek: N/A]. CCI : 2003 GR 16 C PE 014.

- The uncontrolled dumpsites which are destined to be closed[82] will cease their operation.
- The management entity/authority [of the central landfill facility] will be established and the road to the facility will be ready.

The contract also stipulates that biodegradable waste going to landfills [for the whole country of Greece] should be reduced by 25% from 1995 level before 2009 [i.e. target set by the EU Landfill Directive][83].

It should be noted, however, that these funding conditions/obligations are not quantitative; despite the fact that it mentioned the national target for the reduction of biodegradable waste going to landfills - it did not clearly mentioned if the Prefecture itself has to achieve the same target. Accordingly, the Prefecture's interpretation is that it is not obliged to meet any specific targets but only have to start doing something (i.e. having something in operation). On the other hand, since HERRCO is not interested in operating on the island, the Prefecture has had to look into possibilities of other waste streams. To secure the final payment, the Prefecture will have to show that there are some recycling activities on the Island. Therefore, it plans to report figures from separate collection and operations of the two private scrapyards/recycling facilities in Mytilene (see Chapter 4.3.1) and another system for separate collection of waste portable batteries (see Chapter 4.3.3) which exist on the Island. (A. Stathelli, per.com., April 6, 2009)

4.2.2 Roles and Responsibilities among Local Authorities

It is important to understand the roles and responsibilities of relevant local authority in municipal waste management. It will be a basis to understand at which levels that decisions are or shall be made regarding specific waste management planning, policy, or implementation. By local authorities, this research means the prefecture level and the municipality level.

The Prefecture, as discussed above, is responsible for making the 'Prefecture Waste Management Plan' as well as report to the Regional government and the EU Cohesion Fund. It is also responsible for the construction of waste treatment facilities (the central landfills, waste transfer stations, road to access the landfills); in this regard, its responsibility regarding waste management/disposal will end as soon as the central landfill begins its operation.

On the other hand, **each municipality** is responsible for provision of wastebins in residential areas, then collection and transportation of the collected waste to the final disposal site. At the moment, almost all municipalities still maintain their own semi-controlled disposal site(s). When the central landfill will start its operation, each municipality will be responsible for closing their own dumpsites and restoring them. Waste will be transported to the transfer station or the landfill site by the municipality and its responsibility will end when waste is delivered at the transfer stations or at the landfill site.

It is important to note an emerging actor through whom the municipalities will be exercising their decisions and roles regarding common waste management operations on the island in

[82] according to the letter from the Greek Local Authority dated 1.12.2003

[83] Commission Decision of 18/12/2003 on the allowance of installments from the Cohesion Fund for the work on 'Solid Waste Management of Lesvos Prefecture' to the Hellenic Republic. [In Greek: N/A]. CCI : 2003 GR 16 C PE 014.

the near future. **The Inter-Municipal Company for Waste Management and Environmental Development of Lesvos** or **DEDAPAL S.A.**[84] was established around 2006. The company was established from one of the Cohesion Fund's grant condition - to establish a management entity/authority. It consists of the 13 municipalities on the island and the Union of Municipalities of Lesvos. Decision making body of the company comprises eight representatives from the municipalities and one Technical Advisor. The main function of this company, as a collective entity of the 13 municipalities, is to operate and maintain the waste management facilities that are to be constructed by the Prefecture (i.e. the central landfill and the transfer station). The company will be responsible for waste after its delivery to the transfer station or to the landfill gate. Furthermore, it is interested in exploring business opportunities for alternative solutions to landfill. For example, it has commissioned a study on mechanical separation of biodegradable waste and composting unit at the central landfill and is currently exploring possibilities to cooperate with the existing private scrapyards/recycling facilities on the island in material recovery (e.g. paper or aluminum). (I. Tsampanis, per.com., April 8, 2009)

Table 4.2 below summarizes division of responsibilities among local authorities for waste management in Lesvos Island.

Table 4-2 Division of Responsibilities among Local Authorities for Waste Management on Lesvos Island

Local Authorities	Responsibilities
The Prefecture of Lesvos	- Make Prefectural Plan, as well as report to the Regional Government. - Secure funding (from the EU Cohesion Fund) and construction of the central treatment facilities, i.e. landfills, transfer stations, road to access facilities.
Municipalities (1st OTA Level)	- Provide bins for residence. - Collect municipal waste and transport them to the waste transfer station or the gate of the landfill. - Join the DEDAPAL for collective waste management operations on the island - Close and restore the dumpsites after operation of the central landfill starts.
The Inter-Municipal Company for Waste Management and Environmental Development of Lesvos S.A. (DEDAPAL S.A.)	- Operate and maintain waste treatment facilities (landfill, transfer station). - Explore possibilities for alternative solutions to landfill, based on business feasibility, i.e. - mechanical separation of biodegradable waste and composting unit; and - material recovery with private local facilities.

4.2.3 Factors Influencing Local Waste Policy Decisions

In order to understand what have been influencing the local waste policy decisions, several interviews were conducted with relevant local authorities. Because of several limitations in the research (e.g. time and language), it was not possible to interview all relevant authorities. Thus, key informants were chosen based on recommendations from local experts (i.e. researchers and faculty members from the University of the Aegean) and from snowballing technique. In the end, six interviews were conducted to gain perspective of local waste policy decision-makings. These interviews were:

[84] DEDAPAL SA or ΔΕΔΑΠΑΛ ΑΕ: Διαδημοτική Επιχείρηση Διαχείρισης Απορριμμάτων και Περιβαλλοντικής Ανάπτυξης Λέσβου Α.Ε.

- Two interviews with the Prefecture of Lesvos (a staff and a former Director) which represent local policy and planning at the Prefecture level.
- One interview with the Head of the Environmental Department, Municipality of Mytilene which represents perspective from the biggest municipality on the Island with most population as well as waste generation.
- One interview with the vice mayor of the Municipality of Eressos-Antissa which represents the most remote area from the Island's central landfill and reported to have the most difficulties in sending their wastes to the central landfill.
- One interview with the mayor of the Municipality of Agia Paraskevi which represents the small municipality closer to the central landfill and not having difficulties to send their waste to the central landfill.
- One interview with a representative of the Inter-Municipal Company for Waste Management and Environmental Development of Lesvos (DEDAPAL S.A.) which represent the main actor who will be fully responsible for central waste disposal of the Island in the near future.

A list of interviewees is included in Appendix III. The interviews were semi-structured in-depth interviews; meaning interview questions were formed as a check-list for the researcher and also to roughly guide the interviews, but discussions were not strictly limited to these questions. Appendix IV presents the guiding interview questions with Lesvos' local authorities. Additionally, particular attention was given to find out how and why the local authorities are or are not interested in implementing separate collection, recycling, composting, and material recovery. From their responses, factors influencing their decisions in waste management planning and policy can be derived. These factors can be grouped accordingly:

1) perception of local authorities on municipal waste management situation in their area of responsibility as a priority issue;
2) perception of local authorities on the challenges in municipal waste management in general;
3) perception of local authorities on the importance and challenges in implementing separate collection, recycling, and composting;
4) legal obligations for local authorities (by their roles and responsibilities) regarding separate collection, recycling, and composting;
5) perception and situation of local authorities on the resources issue (administrative and financial resources)

From the local authorities' explanation on how these factors influence their decisions, the results can be categorized as being drivers or hindrances in moving local waste management up the waste hierarchy (i.e. to implement separate collection, recycling, composting, and material recovery). They are presented in the following Table 4-3.

Table 4-3 Factors influencing local policy decisions (being drivers or hindrances to move up the waste hierarchy)

Factors influencing local policy decisions	Drivers	Hindrances
1) Perception on municipal waste management situation in their area of responsibility as a priority issue	1. The Department of Environment of the Prefecture of Lesvos recognizes waste management as their priority issue; part of this is due to the fact that they are obliged to deliver the central sanitary landfill in order to receive the last payment of grants from the EU and the situation of the uncontrolled dumpsites on the Island. 2. Municipal waste management issues are more related to closing the dumpsites and starting the operation of the central sanitary landfill for all municipalities. 3. However, pollution from dumpsites on groundwater and land is also recognized.	1. Waste management is not a priority issues for the 3 municipalities interviewed. Drinking water and the old water supply system has been rated as the main priority problem for 2 municipalities; other issues which are perceived as more priority problem than municipal waste include pollution from powerplant (Mytilene) road/transportation infrastructure (Eressos-Antissa), wastewater treatment (all 3 municipalities), and waste from industrial activities such as slaughterhouses, dairy units, and olive mills.
2) Perception on the challenges in waste management in general	1. Interviewees think that waste management situation on the Island has improved recently. 2. Some municipalities identify lack of awareness of citizens as the main challenge in municipal waste management. 3. Changing life-style thus change in nature of waste and increase in waste quantity has been a major problem in some municipality, especially in case of Eressos-Antissa where tourism is developing and the municipality's semi-controlled dumpsite is already overloaded. 4. Increase cost of transportation from municipalities to the central landfill is a challenge for municipalities.	1. Closing the municipalities' dumpsites has been the major challenges in terms of waste management, pressures by fearing that each municipality will have to pay fine to the EU (some of the municipalities still don't know where to find money to restore the sites). This can be viewed as a hindrance to move up the waste hierarchy since local authorities are busy with this issue. 2. Most municipalities have the attitude that waste problem can be solved by paying (to get rid of in landfills). Anticipation for the central sanitary landfill (which is not yet in operation) is identified as a hindrance since it will not change the waste management attitude of the local governments.
3) Perception on the importance and challenges on implementing separate collection, recycling, and composting	1. Every interviewee recognizes the existence of the two material recovery facilities (scrapyard/recycling centers - discussed in the following part of this Chapter (Chapter 4.3.1). Some municipalities have some contracts with the companies to collect ELVs and contacted the company to collect recyclable waste when organizing public awareness raising campaign in schools. 2. All municipalities recognize the existence of the initiatives of the NGO (YDATINOS) as well (some municipalities contact them to	1. The fact that the national collective system for alternative management of packaging waste (HERRCO) has not been interested in operating on the island was identified as hindrance to the implementation of wastes separation on the Island. (i.e. all packaging waste that has been collected so far from Eressos' campaign or in the 2 recycling centers in Mytilene are still stored because they have no channel to sell them profitably.) 2. Political willingness (own initiative of the municipalities) has

Factors influencing local policy decisions	Drivers	Hindrances
	receive WEEE; Mytilene used to join the initiative with YDATINOS on voluntary separate collection) 3. Municipalities recognize the system for separate collection of waste portable batteries and think they are successful. 4. Municipality of Eressos-Antissa started an awareness-raising campaign on recycling by putting bins for recyclables in schools and some squares in the municipality since 2007. The results from schools are good but not in residential areas.	been identified as the main reason for waste management decisions at the municipality level; and it can be assumed as low according to the allocation of municipal budgets to waste management projects. 3. On the other hand, there seems to be no pressures from citizens for the municipalities on the way municipalities manage their waste. 4. Environmental awareness and education of the citizens is generally seen as low and recycling or source separation is still an unknown thing for most of the citizen.
4) Legal obligations (by their roles and responsibilities) regarding separate collection, recycling, and composting	1. Direct obligations for the Prefecture to set up alternative management systems for waste (separate collection, recycling and recovery) comes from the conditions of the EU funding (Cohesion Fund) to the Prefecture for the central sanitary landfill. 2. Municipalities also recognize the above mentioned obligations but do not know yet when and how to implement it.	1. Although the Regional Plan has identified some actions regarding recycling and biological treatment (with specific targets) none of the interviewees recognize this as their obligation. The Prefecture of Lesvos recognizes that the Regional Plan has no effect on the Prefecture Plan.
5) Perceptions and their situation on resources issue (administrative and financial resources)	1. The fact that the inter-municipality company DEDAPAL SA was established can be a driver for changes in waste management on the island since the company may be able to increase collaboration between municipalities on the specific issue of waste management. 2. Municipalities and the Prefecture have experiences in other sources of funding, from the Greek government and the EU. In particular, municipalities experiences with the EU Cohesion Fund are mainly allocated to centralized or large scale facilities construction projects (e.g. wastewater treatment and water supply system, roads, central sanitary landfill construction). In this regard, although their experiences with the EU Rural Development Fund (which may be more suitable for small projects) although have been limited to tourism related activities (e.g. building small hotels, hiking and bird-watching trails, etc.) can be a driver for local authorities to further their possibility of funding in projects like community-based recycling programmes.	1. Lack of human resources and budget has been identified as a main problem for the Prefecture of Lesvos and the Mytilene Municipality. 2. None of the municipalities or the prefecture keeps record of their waste generation. (But most of them can estimate from number of trucks operate – although the also no official records for trucks) This is viewed as a hindrance since they may not recognize the need for waste reduction if they can not see what they are generating. 3. Money for waste management in municipalities comes mainly from municipality tax, although the municipalities don't like raising tax (political popularity) and they are more used to wait for funding coming from outside (i.e. the central government or the EU).

4.3 Alternative Waste Management Systems on Lesvos Island

One of the main focuses of this research is to find existing alternative waste management systems to landfill on Lesvos Island and explore how they work and what are the motivations behind them. The results will be analysed in order to find out potential to enhance these systems to a formal practice for the Island; that is, to move waste management in Lesvos up the waste hierarchy.

At the first glance, nothing about separate collection and recycling are apparent from the formal policy and planning. However, further investigation reveals that there exist several systems involving separate collection of some specific waste streams on the island. The sorted waste streams or materials are transported to Athens by ferries for material recovery. Most of the systems are initiated locally - either by local business sector or by local civil society group. All of them are either connected with or at least partially connected with some of the national systems for alternative management of waste (see these national systems in Chapter 3.2.3).

For the purpose of investigation and discussion, the systems are grouped based on type of their operators. *The first group* is operated by two private scrapyards which have gradually turned into certified material recovery facilities. *The second group* consists of several voluntary programmes for separate collection of municipal waste initiated by a local environmental NGO. These two groups are physically located within the boundary of Mytilene municipality, the capital of the island; however, they also receive waste materials from other municipalities as well. *The last group* comprises two national separate collection systems for two specific waste streams. One is for portable batteries and the other is for glass beverage bottles these two are operated separately in all municipalities across the island. Detail of each group's operations and their motivations are discussed separately in the following subsections.

For visualization, Figure 4-3 presents a diagram of solid municipal waste management operations on Lesvos Island. These systems are those which already exist and those which have been studied and planned for the near future. Apart from the alternative waste management systems mentioned above, the diagram includes the municipalities' semi-controlled dumpsites, the Island's central sanitary landfill, the prospective waste transfer station, and the potential material recovery facilities (i.e. mechanical sorting and composting units) which may be added to the waste transfer station.

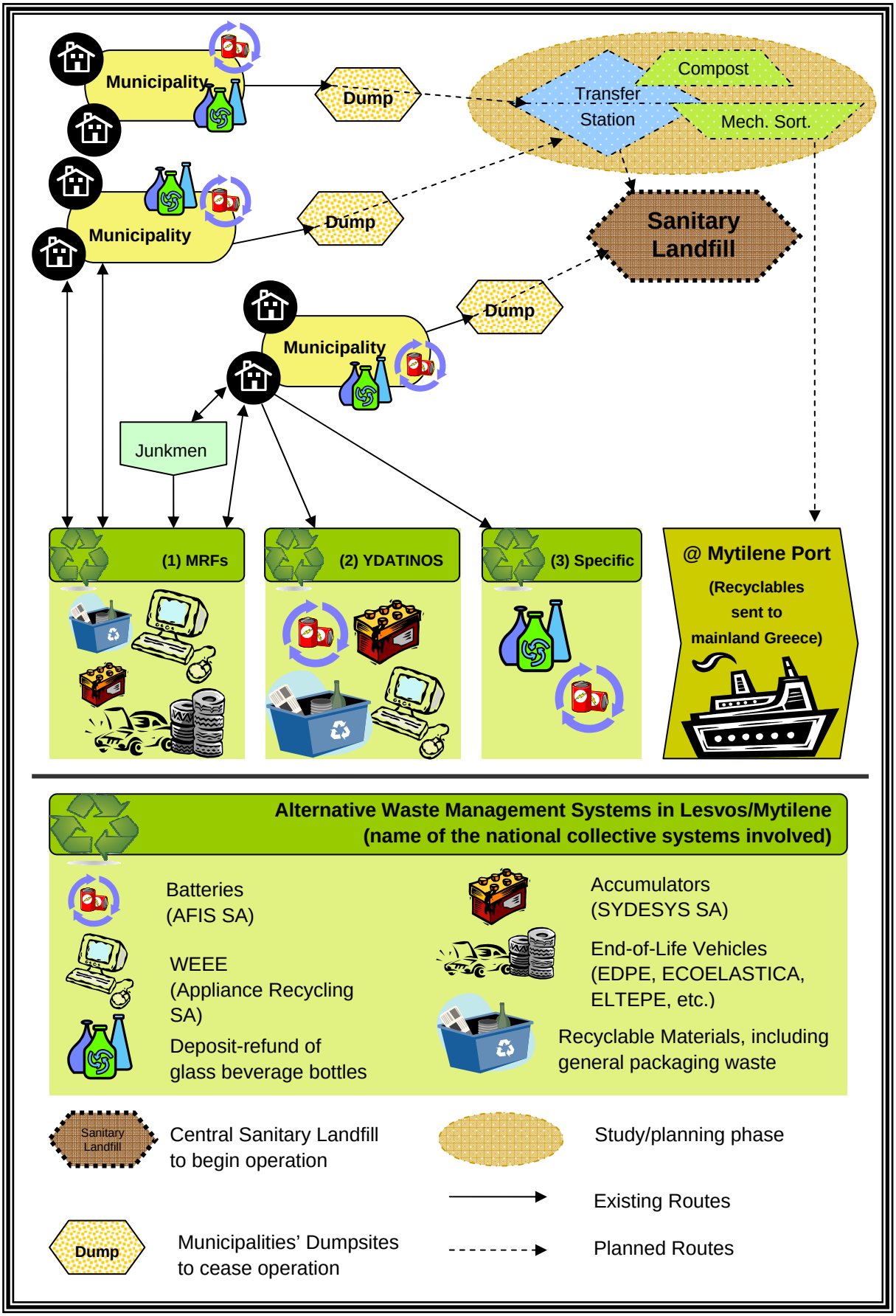

Figure 4-3 Solid Municipal Waste Management Operations on Lesvos Island (May 2009)

4.3.1 Local Material Recovery Facilities

At present, there are two material recovery faculties operating in Lesvos, both are located in Moria area of Mytilene, the Island's capital city, but the scope of their operation also includes some other municipalities. Both companies are family business which started their operation as scrapyards – i.e. gather certain kind of wastes, sort and dismantle them and sell them as scrap metals. They started because of the business potential in scrap metals market. The extents of the companies' operations are different in scale. One company began its operation more than 10 years ago while the other just started three years ago. However, their activities are moving toward the same directions – i.e. starting to expand their operations to include specific waste streams which are governed by the Law 2939/2001 on Packaging and Other Products by joining the national collective systems. This section discusses each company's operations and their business activities based on interviews with the companies' founders.

4.3.1.1 The Recycling Company of Samiotou Brothers

The Samiotou Brothers & Co E.E., or the Recycling-Foundry Lesvos, was founded in 1997 by three families. One of the founders of the company is Mr. Panagiotis Sinioros (per.com., April 1, 2009), the person with whom the researcher interviewed for information in this section. In terms of funding support, the company received some money to start its business from the government's support for local investments on islands[85]. It also received some amount of support from the EU Rural Development Fund through the EU LEADER programme in 2000-2001 to start a new metal recycling plant. At the moment, the company is in the period of expanding its operation and exploring other possibilities for funding. (S. Panagiotis, per.com., April 1, 2009)

The company started with receiving scrap metal waste to process in their foundry in which they processes to separate three types of iron, bronze, copper, and three types of aluminum. The operation was extended to include end-of-life vehicles (ELVs) which are dismantled, and materials are separated into different waste streams. For the operation on ELVs, the company is accredited based on the National Law which also complies with the EU End of Life Vehicles Directive, therefore can issue certificate of ELV management to the ELVs' owners. The situation of the ELVs on the island was that there were many cars abandoned and the municipalities had to pay to transport the cars to their landfill (uncontrolled); the company offers lower price for the municipality and therefore the company started to get into contract with several municipalities on the island. In this sense, the company has established its connection with various municipalities for the collection of specific waste streams. So far, to receive ELVs, the company has had contract with Mytilene, Polichnitos, Gera, Agioasos, Mantamados, and Evergetoula municipalities and plan to extend its contract to municipalities of Molyvos and Kalloni, etc. (S. Panagiotis, per.com., April 1, 2009)

For recyclable plastics and paper, after collection, the company packs them into 1 cubic meter size and sells them to material recovery facilities in Athens. However, for glass, because of the high cost of transportation and low prize of the material, the company has so far just stored them in the facility. For metal cans, at the moment, they are included in the scrap metals foundry process of the facility. The company recognizes that packaging waste does not make much profit in terms of the materials that can be sold. And because of the low quantity, they do not formally receiving packaging waste. However, the company already started discussion with HERRCO, the national collective system for packaging waste, in

[85] Furhter details about this were not available from the interviews.

order to see the possibility to extend its operation to packaging waste as well. The company believes that if they join the HERRCO system (and therefore will be paid from the system to collect the packaging waste), it may be economically viable to collect and transport packaging waste from the whole island of Lesvos, as well as other islands in the region (see operation on WEEE in the next paragraph). (S. Panagiotis, per.com., April 1, 2009)

The company then extended its activities to receive waste electronic and electrical equipments (WEEE), in contract with the national collective system for alternative management of WEEE (Appliance Recycling SA). For this specific waste stream, the company's activity has expanded to receive WEEE from other big islands in the Northern Aegean Region, i.e. Limnos, Samos, and Chios. The company has the licence to collect the WEEE and then sort them in categories, dismantle them manually, then pack them and send them to MRF in mainland Greece. The company handles all types of WEEE except for refrigerators which the company does not have the licence for dismantling (due to specific substances i.e. CFCs requiring specific handling which the company does not have the capacity). Additionally, from old television sets that it has been receiving, there are certain amount of CRT (cathode-ray-tube, containing lead and therefore problematic for disposal) which they have stockpiled since 2002. (S. Panagiotis, per.com., April 1, 2009)

The following table summarizes the company's operation on different waste streams, the connection to national collective systems for alternative management of specific waste streams, and the amount of waste material in each category that the company have collected in 2006 (where available).

Table 4-4 Summary of Operations by Samiotou Brothers Recycling Company

Waste Streams	Operations	Part of the national collective systems	Amount collected in 2006*
Paper and Plastic waste materials	Collect, pack, and send to MRFs in mainland Greece	-	Paper 48.8 tonnes (from schools) Plastics 7.6 tones (from industries)
Glass waste materials	Collect, store (not profitable at current business scenario)	-	N/A
Packaging Waste (in general)	Not intentionally collect	Potential to develop agreement with HERRCO	N/A
Waste Electrical and Electronic Equipment (WEEE)	Collect, sort, manual dismantling, recycle some materials, others that do not have capacity for recycling will be packed and send to MRF in mainland Greece.	Yes (Appliance Recycling SA.)	1,025 tonnes from general origin Collect from Lesvos and other big islands in the N. Aegean Region.
Metals	Mechanical separation, foundry/smelting to get iron, bronze, copper, and aluminum (received aluminum cans are currently processed in this waste stream)	-	Scrap metals 2,574 tonnes of general origin Other metals 133 tonnes from the company's operations and other origins
End-of-Life Vehicles (ELVs)	Dismantling and sorting materials to go to different waste streams (i.e. steel, irons, metals, electronic devices, plastics, etc)	Yes (EDOE)	N/A

Waste Streams	Operations	Part of the national collective systems	Amount collected in 2006*
Used Tires	Collect and send to MRF in mainland Greece	Yes (ECOELASTICA)	220 tonnes from company's operation (i.e. ELV dismantling)
Accumulators	Mostly from the operation of ELVs dismantling Sort, pack, send to MRF in mainland Greece	Yes (SYDESYS SA)	55 tonnes
Waste Lubricating Oils	Mostly from the operation of ELVs dismantling send to MRF in mainland Greece	Yes (ELTEPE SA)	N/A

Source: (S. Panagiotis, per.com., April 1, 2009) & (Samiotou Brothers, 2007)

As seen, the company of Samiotou Brothers has been one of the main actors in separate collection and recycling of various waste streams on the island. The activities for municipal solid waste started in 2000 when the company started to advertise in local newspaper that it receive waste for recycling based on door-to-door collection (people call the company to collect waste from their houses). Consequently, people also started to bring paper, glass, plastic and other wastes wastes to its facility. Another way to receive recyclable waste from municipal waste streams is based on the company's business with junkmen[86]. Junkmen go to houses or residential areas to collect or buy junks and bring them to sell to the company's recycling facility. This is especially working for bulky waste such as big electronic appliances like old TV or refrigerators. In this way, the company save the cost of transportation to collect waste and the junkmen earn some income. Additionally, another way to receive waste materials is through direct activities with municipalities and schools. (S. Panagiotis, per.com., April 1, 2009)

Distance and the incurring cost of transportation were identified as one of the main challenges/obstacles to the business' competitiveness and therefore the existence of the system on the island. In this regard, the company has joined (contracted with) some national collective systems for alternative management of some specific waste streams in order to secure buyers and the price of the waste materials and ensure that the operation on those specific waste will be economically viable. Because the prices of packaging materials are not profitable, plus the collection rate has not been high – joining or contracting with HERRCO will be a possibility for the company to be interested in operating on packaging waste, and this action has began. In addition, it was expressed in the interview that source separation can also reduce the cost of sorting at plant and make the business more attractive. In this aspect, the company also joins an initiative with one shop in the main shopping street of Mytilene where the owner of the shop put separate bins in front of the shop – the initiative is however experimental and more like an awareness raising programme. (S. Panagiotis, per.com., April 1, 2009)

Another challenge is related to the bureaucratic procedure of the administrative system, i.e. the fact that each operation requires separate certificates/licence (for example, this company

[86] 'Junkmen' or 'paliatzides' (παλιατζήδες) in Greece means people who come to buy old stuffs from household. It was traditionally done by Roma people (ethnic miniroty group in the country) or other group of (low income) people. The practice was almost vanished but now has become popular again. Now junkmen ask for money to collect old (i.e. big) WEEE from houses (sometimes they get, sometimes not) but they sell it to the junkyards that are collecting WEEE for scrap metal, or for recycling. (G. Giouzepas, per. com. May 7, 2009)

needs 15-20 certificates) and the procedure can take years. Lack of personnel in the Regional Office who are responsible for the issuance of various kinds of licenses makes the process even slower. (S. Panagiotis, per.com., April 1, 2009)

4.3.1.2 The Recycling Company of Vounassos

The company of Vounassos Dimitrios & Hariklia O.E. is quite new in recycling business comparing to the formed company. It started when Mr. Giorgos Vounatsos, the founder of the company, saw business opportunity in selling scrap metals from dismantling an old factory and building materials. The company started to engage more in the recycling business in 2006 when it made a contract with EDOE, the national collective system for alternative management of ELVs. At the moment it is operating on a temporary licence from the Prefecture of Lesvos for ELVs dismantling and about to acquire a permanent licence. It received funding from the EU Cohesion Fund (the 3rd Community Support Framework Programme) to initiate the business. (G. Vounassos, per.com., April 7, 2009)

The operation of the Vounassos Company is smaller than Samiotiou Brothers. The current main operation involves collection and sales of scrap metals. Hazardous substances from ELVs are removed mechanically and then the ELVs are dismantled manually. Materials recovered from ELVs are mainly sold as scrap metals. Specific wastes such as accumulators, used tires and used oils are sent to material recovery facilities in mainland Greece through contract with national collective systems for alternative management of these specific waste streams. Packaging waste and other waste materials such as plastic, paper and glass are not intentionally collected; however the company has so far received some amount along with collection of other waste. For WEEE, the company was in contract with the national collective system (Appliance Recycling SA) who provides containers for the company to put collected WEEE and comes to pick up the containers when they are full. Table 4-5 summarizes the company's operation on different waste streams, the relation to national collective systems for alternative management of specific waste streams, and the amount that the company sold in 2008 (where available).

Table 4-5 Summary of Operations by Vounatsos Recycling Company

Waste Streams	Operations	Part of the national collective systems	Amount sold in 2008
Paper waste materials	Not intentionally collect but has received some along with collection of other waste or people bring to the facility Pack and store in the facility	-	N/A
Packaging Waste	Not intentionally collect (like above) Pack and stored in the facility	Exploring possibility to develop agreement with HERRCO	N/A
Waste Electrical and Electronic Equipment (WEEE)	Collect. Appliance Recycling SA provides container and pick up the container from the facility.	Yes (Appliance Recycling SA)	120 tonnes
Scrap Metals	Pack, sell as scrap metals.	-	1,565 tonnes
End-of-Life	Dismantling (mechanical and	Yes	N/A

Waste Streams	Operations	Part of the national collective systems	Amount sold in 2008
Vehicles (ELVs)	Manual) and sorting materials to go to different waste streams	(EDOE)	
Used Tires	Only from the operation of ELVs dismantling Collect and send to MRF in mainland Greece	Yes (ECOELASTICA)	N/A
Accumulators	Only from the operation of ELVs dismantling Sort, pack, send to MRF in mainland Greece	Yes (SYDESYS SA)	44 tonnes
Waste Lubricating Oils	Mostly from the operation of ELVs dismantling send to MRF in mainland Greece	Yes (ELTEPE SA)	N/A

Source: (G. Vounassos, per.com., April 7, 2009) and observation from site visit (May 2009)

In terms of the ways to receive waste, the company advertises in local newspapers that people can call the company to collect the waste from their houses (mainly for ELVs and WEEE). The company also made contracts with some schools to collect WEEE from them; it also received other packaging and recyclable materials in these occasions. Additionally, the company also receives waste from junkmen, the same as the case of Samiotiou Brothers Company. (G. Vounassos, per.com., April 7, 2009)

As oppose to the Samiotiou Brothers, the Vounatsos Company has not considered distance and transportation cost as its main problems. This can be understood since the company has so far received waste materials from sources closer to their facilities, for example Mytilene and Kalloni municipalities. When asked about engaging in recycling of packaging waste or waste from municipalities, Mr. Vounassos, who is the owner of the company, mentioned that packaging waste is the most problematic waste streams to deal with because they need preparation (i.e. sorting and packing) and the materials are less profitable. However, the company plans to explore the opportunity to handle packaging waste through collaboration with HERRCO. Mr. Vounassos also observes that citizens have become more active in recycling as there are more people bringing recyclable materials to his facilities (when heard of his recycling company through advertisement). On the other hand, he also notices that citizens still do not separate garbage in the right bin (from observation on the blue bins initiative in Mytilene - see the next subsection). He commented that working with schools has better results; according to his experiences, the sorting quality of waste that he received from schools is quite good. (G. Vounassos, per.com., April 7, 2009)

4.3.2 Initiatives on Separate Collection in Mytilene

This section discusses several programmes of separate collection in Mytilene that were initiated and run by an environmental group, YDATINOS. These initiatives are the only citizen-initiated recycling-related programmes that the researcher has found to exist in Lesvos Island. These programmes resemble the idea of community-base recycling, which is a model that might be suitable to develop at the municipality/community level in other municipalities on the Island; therefore they are investigated in order to explore factors that contribute to the success or failure of such kind of programmes in the context of the case study.

Information in this section is mainly obtained by interview with Mr. Digran Matosian (per.com. March 27, 2009), one of the main members of YDATINOS and also a PhD student at the Department of Environment, University of the Aegean. Other information, especiall with regard to citizen's behaviour or perception on recycling, are obtained from another PhD candidate, Ms. Nikoleta Jones (per.com., March 10, 2009), who has been conducting research on the influence of social capital on environemtal policy instruments and had shared the result of one of her case study on household solid waste management in Mytilene.

YDATINOS is an environmental non-profit organization (NGO) founded in 2002 in Mytilene. The group has been working in various environmental issues; apart from waste management (i.e. recycling) the group also works on nature conservation, forest fire, as well as promoting quality of life. (YDATINOS, 2009) In 2002, the group initiated a voluntary recycling campaign in the town of Mytilene, by putting separate collection bins for recyclable waste (one single bin for all recyclable waste) in several places including residential areas and main streets of the town. The aim of the campaign is to raise awareness of the people on recycling (separate collection) practice. (D. A. Matosian, per.com., March 27, 2009) This voluntary recycling programme is the longest running separate collection programme ever exists on the Island. The experiences from the programme are useful for the analysis of this thesis.

In 2004, the municipality of Mytilene and another NGO called ILIAKTIDA who works with people with disabilities joined YDATINOS in this campaign; together they formed a non-profit company to operate this pilot voluntary recycling programme under the name YDALIOS DAMOS. Some more bins are provided and the municipality of Mytilene provided locations to place the bins. However, participation from the municipality and ILIAKTIDA were limited. ILIAKTIDA is a small group of NGO working with people with disabilities. Organizing these people to join waste collection and sorting activities in some occasions is their main contribution. In other words, ILIAKTIDA joined the project with specific intention to use the project to increase their members' (people with disabilities) social activities and social interaction. The situation of the group and its member may limit further contribution to the programme. As for the municipality of Mytilene, lack of resources (especially human resources) had limited its participation. YDATINOS, comprising six active volunteers, has been the centre of the project's operations, including activities such as manual sorting of recyclables from these bins, collecting to their centre, compacting, and sending them to mainland Greece for material recovery. (D. A. Matosian, per.com., March 27, 2009)

One of the results they have found from running the programme is that citizen's awareness, and hence participation, in recycling had been low. They even received more garbage (mixed waste, e.g. baby diapers) than the intended recyclable waste in the bins. Most of the time, volunteers of YDATIOS had to hand-pick recyclable components from the bin. Moreover, the group had to bear the operational cost, in particular the cost for fuel for pick-up truck used to transport the waste. For these reasons, the group decided to halt this programme in September 2008. (D. A. Matosian, per.com., March 27, 2009) However, in June 2009, it was reported that the programme has resumed its operation (I. Botetzagias, per. com., June 10, 2009). Further information on the reasons why they decided to continue the programme is not available for the researcher by the time this thesis is finished.

In 2004, YDATINOS also received funding support from the EU EQUAL programme of the European Social Fund to start a centre to receive recyclable wastes from specific waste streams. These include metals, aluminum cans, WEEE, printer toner/cartridge, compact

fluorescent lamp (CFLs), glass, wood, plastic, paper, batteries, accumulators and used oils. The group also bought a small waste compaction machine; before that, one-by-one manual compaction of aluminum cans was used. Most of the specific waste streams are sent to or bought by respective national collective systems for alternative waste management. This programme has been advertised in local newspapers and by word-of-mouth, people started to call the group to collect waste, especially big electrical appliances from their houses. (D. A. Matosian, per.com., March 27, 2009)

During the six years of its voluntary recycling (separate collection) activities, the group reported what they have collected and sent for recycling or reuse as presented in Table 4-6. Note that even though some of the waste streams are bought (subsidized) by the national collective systems for alternative waste management, they still can not cover all the operational cost - especially the cost of fuel for transportation of waste which is the only major cost incurred as they already operate on voluntary labours.

Table 4-6 Amount of recyclables collected by YDATINOS 2002 - September 2008

Waste Streams	Amount collected and sent for recycle/recovery/reuse	Relation to other systems for alternative waste management
Fermentable	7,110 Kg	-
Metals (except aluminium)	912 Kg	-
Aluminium	9,680 Kg	-
WEEE	37,425 Kg	Appliance Recycling SA
Printer toner/cartridge	399 pieces	Appliance Recycling SA
compact fluorescent lamp (CFLs)	692 bulbs	-
Glass (for reuse)	520 Kg	-
Wood	5,290 Kg	-
Portable Batteries	780 Kg	AFIS SA
Accumulators	2,882 Kg	SYDESYS SA
ELVs	2 vehicles (2,200 Kg)	N/A
Used oils (lubricant/machine oils)	1,000 Kg	N/A
Used cooking oils	3,250 Kg	REVIVE (industrial production of biofuels from used cooking oil)

Source: YDATINOS, 15 October 2008

Additionally, YDATINOS was organizing, with the Alpha Bank, a programme for voluntary recycling of packaging waste. This programme was running between 5 September – 21 Devember 2008, a very short period of time. YDATINOS used this programme as part of its awareness raising campaign (waste recycling). The bank used the programme as one of its promotional campaign. The bank provided (lend) one *'recycling center'* (machine) which was placed in front of the main supermarket area in the town of Mytilene. The 'recycling center' is a big automatic machine with different slots to receive different types of packaging waste. It resembles those that are used by the Rewarding Recycling SA system (see similar machine in Figure 3-4 in Chapter 3.3.1). Small incentives are given to people when delivering packaging waste – the machine gives coupons for discount in shops or for exchange of gifts according to the number of packaging put in the machine. The result was satisfactory; the machine received around 2,500 pieces of packaging waste (plastic, paper, metal) per day. During almost two and a half months, the machine had collected in total 298,944 pieces of

packaging waste (187,853 plastic packaging's, 69,411 metal packagings, and 41,680 glass packaging). (YDATINOS, 7 January 2009) (N. Jones, per.com., March 10, 2009) (D. A. Matosian, per.com., March 27, 2009)

From the experiences of YDATINOS on voluntary separate collection and recycling in the past six years, the group has observed gradual progress; that citizens in Mytilene are more aware and ready to participate in the recycling programmes. However, there is a need for stronger efforts from the municipality [e.g. to act on providing separate bins for recyclables]. (D. A. Matosian, per.com., March 27, 2009) On the other hand, a part of the research by Jones on *'environmental behaviour and attitudes toward voluntary recycling in Mytilene'* reveals that citizen participation in recycling programme is still low. 48% of the citizen said that they never participated in the recycling programme, 17% said some times, 12% said most of the time, while only 22% said they always participate in recycling programmes. (Jones, Halvadakis, & Sophoulis, n.d.)

Another aspect revealed by Jones' research is the level of social capital in Mytilene which may affect citizens' behaviour toward complying with the law or participating in such voluntary activities. It was revealed that the level of *'social trust'* in Mytilene is significantly low. This may significantly influence their individual behaviours. In effect, people think that the majority of their fellow citizens does not comply with the l aw or participate in recycling. The *'institutional trust'* is also weak. Comparatively, people trust NGOs more than the EU and trust the EU more than the municipality. This may be connected to citizens' perception toward environmental policies as not effective which may also be resulted from ineffective implementation of previous policies therefore significant level of distrust towards new initiatives such as the waste regulation and recycling. In addition, Greece is regarded as a country with high levels of corruption and a tendency to disobey regulations, with the belief that other fellow citizens do not act for the common benefit and the weak penalization of illegal actions. These factors may have resulted in the situation where several citizens justify non-compliance to certain social norms (e.g. avoid paying tax). (Jones, Halvadakis, & Sophoulis, n.d.) & (N. Jones, per.com., March 10, 2009)

Accordingly, the result of Jones' research on the influence of social capital in Mytilene may suggest some reasons for low citizen participation in the voluntary recycling programme. That is to say, because citizens do not know where the waste that are collected by NGOs go and because they see that waste in the separate collection bins are not really sorted, they do not trust the effectiveness or seriousness of the programme. Even though citizens think that everything should be run by the state (local authorities), paradoxically, they also do not trust the state (as described above). Consequently, participation of people in the voluntary recycling programme remains low. (N. Jones, per.com., March 10, 2009)

4.3.3 Systems for Separate Collection of Two Specific Waste Streams

This section mainly derived from observation of the researcher, discussions with local residents of the island, and discussions with various interviewees. In addition to the voluntary separate collection of municipal waste run by YDATIOS as mentioned above, there are two systems for separate collection of two specific waste streams. These two systems are separately operating in every municipality through out the island, and the country.

The first system is the national collective system for alternative management of **portable batteries**, in particular the systems of AFIS SA which has been established according to the Law 2939/2001 on Packaging and alternative management of packaging and other products.

The system distributed its special collection bins everywhere across the country. In Lesvos, the bins are placed in public places in every municipality, for example, municipalities' halls, supermarkets and shops (K. Zafeiro, per.com., April 9, 2009) & (G. Kyriazis, per.com., April 29, 2009). In this way, the system ensures high geographical distribution of collection. The bins can be easily noticed as they are usually placed near the cashier counters in supermarkets and shops. Consequently the bins are easy to access and consumers can easily bring the waste batteries to the designated bins when they go out for grocery shopping. In this way, the system acquire high collection rate. (See Chapter 3.3.3 for national performance of the AFIS system.)[87] It should be noted that the system may have some advantages over systems of other waste streams because of the fact that the waste (portable batteries) are small in size. The fist consequence is that they are easy for consumers to carry (i.e. bring them to designated bins) and secondly, the collection bins can be in small size which makes it easier to place the bins at the locations which are easy for citizens to notice and access. Unfortunately, the exact figure as to how many bins the system has distributed in Lesvos or how much the system has been able to collect from the Island is not available to the researcher.

The second system is a sort of deposited refund system of **glass beverage bottles** which has been operated in supermarkets and shops nation-wide. In most cases, the shops received only certain brands and sizes of beverage bottles. Consumers have to pay certain amount of money when they buy the products – upon returns, some shops (mostly smaller ones) give money back to the consumers and some (mostly big supermarkets) give coupon to consumers to use as discount for their next purchase from the shop. These bottles are mostly sent back to the production company and reused. This practice existed long before the national systems for alternative management of packaging and other wastes, in some places for more than 30 years (M. Bakas, per. com. May 7, 2009) & (G. Giouzepas, per. com. May 7, 2009). It is a way to reuse the glass bottles which every Greek is familiar with. In Greek term, this system is called 'Bailment System', one of the alternative management systems of packaging waste according to Article 2 (22) of the Law 2939/2001:

> *'Bailment System'* or *'Σύστημα εγγυοδοσίας'* means the alternative management of packaging in which the buyer of the packed product defrays to the seller bailment fee which he/she will get back upon return of packaging (one or multiple-use) aiming at its alternative management.

[87] The way this national system advertized itself (i.e. information dissimination to citizens) may also be an important part pf the system's success in hight collection rate. Unfortunately, this information is not available for this research.

5 Analysis

The previous Chapters (Chapter 2, 3, and 4) present data that have been gathered during the course of this thesis. This chapter analyses these data with the main purpose to find out how household municipal waste management in Lesvos Island can move up the waste hierarchy. Consequently, it shall lead to the conclusion of this research which will be presented in the next Chapter.

Recalling the analytical framework given in Figure 1-1 in Chapter 1.5, data analysis is divided into three sections; each intends to answer one of the three research questions which were previously described in Chapter 1.3. The first section analyses implications of the EU waste policy on the Greek national waste policy and implementation - since they are the foundation of waste management at local levels. Subsequently, Lesvos Island is utilized as a case study in order to find out what are the specific conditions that can help waste management in remote areas of the EU move up the waste hierarchy - both in terms of policy decisions and implementation. In other words, the second section of this Chapter analyses factors influencing local policy decisions while the last section analyses conditions for the existence of systems of alternative waste management on Lesvos Island.

5.1 Implication of the EU Waste Policy on the Greek National Waste Policy and Implementation

This section addresses the question "What are the implications of the EU waste policy on the Greek national municipal waste management policy, in particular on waste prevention, recycling, and recovery?" Results from literature review and interviews, as presented in Chapter 2 and Chapter 3, are used for this part of analysis.

According to literature review, there have been two main drivers for the development of the Greek national waste policy and legislation: (1) the EU waste policy and its legal instruments and (2) the country's huge amount of uncontrolled dumpsites. For the past decades, Greece's waste policy and legislation were focused on conventional waste management - that is, closing dumpsites and locating new sanitary landfills. At the same time, obligations according to the EU Waste Framework Directive[88] and the EU Landfill Directive[89] have been the major drive for its implementation. (See Chapter 3.1 and Chapter 3.2.1) With regard to waste prevention, recycling, reuse, and recovery, only in the last decade had a new legislation (Law 2939/2001) to facilitate alternative ways of waste management for specific waste streams been imposed. It was clear the law was a result of the EU Directive on Packaging and Packaging Waste Directive[90]. It has established legal framework for national systems for alternative management of packaging and packaging waste[91]. In addition, it laid down the same framework for some other specific products and waste streams. The term 'alternative management' refers to options other than landfill disposal, that is, waste reduction, separate collection, recycling, and recovery. (See detail in Chapter 3.2.3) It can be concluded that the

[88] Council Directive 2008/98/EC, see Chapter 2.3.1 of this thesis.

[89] Council Directive 99/31/EC, see Chapter 2.3.2 of this thesis.

[90] Directive 2004/12/EC, see Chapter 2.3.3.1 of this thesis.

[91] The 'national system for alternative management of specific waste streams' is a kind of 'producer responsibility organization'.

direction of the EU waste policy has been instrumental in the Greek waste policy transformation, to shift the attention toward the upper part of the waste hierarchy.

With regard to national implementation, only in 2003, as a result of the Law 2939/2001, that Greece started to have the first system for separate collection of specific waste streams from municipal waste (see Chapter 3.2.3). The first system to be established was a collective system for packaging wastes (HERRCO). There are many systems available today in order to deal with different waste streams (i.e., packaging waste, WEEE, batteries and accumulators, end-of-life vehicles, used tires from vehicles, and waste lubricant oils) and these systems are gradually progressing in terms of the amount of waste they have collected. Unfortunately, because these systems are quite new, their geographical distribution (e.g. their existence and their collection rates in local/remote areas) has not yet been comprehensively presented in any source. However, it is noticed from the literature review and observation that the system for separate collection of portable batteries has high geographical distribution - covering some remote parts of the country. This may contribute to its reportedly high collection rate. On the other hand, the national collective system for alternative management of packaging waste (HERRCO) has covered 610 municipalities which account for the area of 6.8 million residences. The system has been focusing in big cities in mainland Greece in the past. However, there have been efforts to expand its operation and the company plans to develop projects in islands areas in the year 2009. (See Chapter 3.3.1)

5.2 Influencing Local Waste Policy Decisions in Lesvos

As discussed in Chapter 3.2.2, the National Solid Waste Management Plan acknowledges the concept of waste hierarchy (prevention, reuse, recycling and recovery). Consecutively, it should be transferred into the Regional Plans. The Solid Waste Management Plan of the Northern Aegean Region has identified relevant actions for recycling and biological treatment (See Table 4-1 in Chapter 4.2.1). Nevertheless, how and if they will be implemented at the local levels depend largely on the Local Authorities Organizations who have all the responsibilities when it comes to implementation. Note that in the context of Greece, the first (lowest) level of local authority is the Municipality while the second level of local authority is the Prefecture. Local level in the context of the case study means these two levels of authorities (see Chapter 3.2.2.1).

Information presented in Chapter 4 on the case of Lesvos Island demonstrates that the implication of the regional waste policy on the local policies (at the prefecture and municipal levels) seems low. Specifically, there is no concrete plan from either the Prefecture of Lesvos or the 13 Municipalities for waste prevention, separate collection, recycling, and recovery (including biological treatment). However, several voluntary recycling (separate collection) programmes exist in some places on the Island - either with or without active participation from the local governments. In this regard, in-depth interviews with local governments were conducted to find out what influences their decisions on waste policy and their involvement with the local initiatives for voluntary recycling. The interviewees were representatives from the Prefecture of Lesvos, representatives from three municipalities, and one representative from the Inter-Municipality Company for Waste Management and Environmental Development of Lesvos (DEDAPAL SA). These key informants from local authorities are directly responsible for waste management in their areas. Their roles and responsibilities, relevant to the inquiry of this research, are summarized in Table 4-2 in Chapter 4.2.2.

Factors influencing local governments' related decisions are extracted from the interviews responses and presented in Table 4-3 in Chapter 4.2.3. To analyse, these factors can be

grouped into three categories according to their relation with (1) the political conditions; (2) the inherent conditions or context of the Island - as a remote area; and (3) the institutional settings. The analysis below describes how these factors have been, or can potentially be in the near future, influencing Lesvos' waste management options; in particular, to push it up the waste hierarchy:

5.2.1 Factors related to political conditions

Influences from higher levels of policy/government:
The National and Regional policy has little effects in terms of moving up the waste hierarchy at the local levels. Local authorities have identified the EU as a strong pressure in directly pushing them to improve their waste management situation (particularly to start recycling and other alternatives in order to divert waste from landfill disposal). The pressure comes particularly from the conditions under the EU's funding for Lesvos' central landfill and the threats for local uncontrolled dumpsites to be fined under the EU Landfill Directive.

Political willingness (of the local government) and citizen awareness:
Unfortunately, local governments' awareness and interest in source separation and recycling are still low because they are busy with closing and restoring their dumpsites while waiting for the central landfills to operate. Additionally, it was observed that their perception of waste diversification is limited to recycling; none of the interviewees had mentioned waste prevention or reuse. On the other hand, local governments don't have pressure or demand from local residents for alternative waste management (i.e. recycling and composting). This could relate to low level of awareness and low level of social capitals of the local inhabitants (see the end of Chapter 4.3.2). However, some municipalities have started initiative, either on their own (Municipality of Eressos) or in collaboration with local environmental NGOs (Municipality of Mytilene).

5.2.2 Factors related to inherent conditions or context of the Island (as a remote area)

Prioritization of environmental issues:
Although most municipalities do not put waste management as their first priority among their environmental problems, they have recognized waste management among their priority issues. Apart from the issue of pollution from the uncontrolled dumpsites, increase in waste generation and change in the types of waste as a consequence of changing consumption behaviour are also recognized.

The central sanitary landfill and cost of transportation:
Increasing cost of transportation from municipalities to the central landfill is an emerging challenge for all municipalities except for the three which the central landfill is located. This is a driver for change because the municipalities would be pressured to find cheaper alternatives, for example waste prevention/recycling which are more sustainable and self-sufficient way of handling waste. However, anticipation of the central landfill is a hindrance to move up the waste hierarchy since it may limit the change of paradigm of waste management in the local governments (i.e. pay to get rid of waste by burying it).

Recognition and anticipation of the existing alternative systems:
The fact that the local governments recognize the existing systems of alternative waste management on the Island (as described in Chapter 4.3) and that they have utilized these systems at a certain extent is an opportunity to enhance these practices to integrate them into formal local policy agenda. Local governments generally expect involvement of the national collective systems for alternative waste management to help improve their recycling situation.

Some of these systems, e.g. the systems for WEEE and portable batteries, are already operating on the island and being recognized by local actors - this is an opportunity for the local governments to further explore other waste streams. For packaging and packaging waste, it is clear that the local governments are anticipating HERRCO's involvement. Nonetheless, the fact that HERRCO had not actively expressed interest in operating on the Island has been a hindrance.

5.2.3 Factors related to institutional settings

Administration:

Because the Prefecture has limited its roles to construction of the central landfill, the Inter-Municipality company (DEDAPAL SA) was established to manage the central landfill. (See Chapter 4.2.2) DEDAPAL can potentially be a driver for changes, i.e. coordinated-actions among municipalities on recycling and composting. At this point, local governments, through DEDAPAL, have recognized the possibility of having a recycling facility (material recovery facility) and a central composting plant attached to the central sanitary landfill or a waste transfer station - although the idea is still being studied under DEDAPAL's commission.

Resources/Funding:

Limited funding resource from the central government, and thus human resource, is identified as an obstacle in waste management by all local authorities. However, the fact that the municipalities and the Prefecture are experienced with other funding for local development and environmental projects, especially from the EU Cohesion Fund, can increase the possibility of local governments to secure external funding for projects like community-based recycling. Yet, these opportunities have not been explored by the local governments. More holistic approach to waste management (i.e. to include aspects of rural community development) may increase the chance to get funding from other EU sources, for example, from the EU Rural Development Fund.

Table 5-1 below summarises this part of the analysis. Factors influencing the local government's decisions are presented as drivers and challenges for local governments in Lesvos to move away from landfill disposal and start other waste management alternatives.

Table 5-1 Drivers and Challenges for Local Governments to move up the Waste Hierarchy

Factors	Drivers	Challenges
1) Factors related to political conditions		
Influence from the higher levels of policy/government	There are clear pressures from the EU level.	Despite directions from the National and Regional policy, integration into local policies and enforcement remains a challenge.
Local political willingness to change	Some municipalities demonstrate their interest and had started initiatives (although limited to awareness raising campaign).	Perception of alternative waste management is still limited to recycling, not waste prevention and reuse. Low awareness and pressures from the local residents.
2) Factors related to the inherent conditions or context of the Island (as a remote area)		
Prioritization of environmental issues	Waste management is seen as a problem that needs dealing with (mostly in terms of non-sanitary dumpsites in municipalities).	Some other environmental problems are prioritized higher than waste management for some local governments.
Perception of municipal solid waste management	Local government realizes that recycling is inevitable.	Because of the practical reality, local governments' perspective on waste management has been limited to closing dumpsites. This could partly limit their

Factors	Drivers	Challenges
		resources and efforts put on waste prevention and recycling.
Cost of transportation	Cost of transportation of waste from some municipalities to the central landfill is an upcoming challenge. Although this may be an opportunity for the municipalities to consider waste reduction or recycling which can promote the local governments' self-sufficiency.	Cost of transportation of collected recyclables will remain a challenge for local government since some of them will have to be transported to material recovery facilities in the mainland.
The existing national and local systems for alternative management of specific waste streams	Local governments are familiar with the existing local initiatives. This is an opportunity to develop into formal local policy agenda.	On the other hand, they seem to passively rely on the evolution of these systems, for example, expectation of HERRCO involvement for packaging waste. Therefore, it is a challenge how local governments shall be more proactive in attracting these national systems; or be more self-reliance.
3) Factors related to the institutional settings		
Administrative instruments	The establishment of the Inter-Municipal company (DEDAPAL) will be an opportunity for coordinated-actions among municipalities.	On the other hand, this condition may favour centralized system, therefore a challenge to decentralized practices (for example community composting).
Resources and funding	Local governments have experiences with external funding (e.g. the EU Cohesion Fund) for building the central landfill and restoring the dumpsites. Funding for smaller-scale projects like community-based recycling programme have never been explored, this remains an opportunity.	Resources and funding is one of the main challenges voiced by local governments at the moment.

5.3 Existence of Alternative Waste Management Systems

As discussed in Chapter 4.3, it is now evident that there exist several alternative waste management systems on Lesvos Island. All of these systems are voluntary recycling programmes in nature, involving source separation (of recyclable wastes), separate collection, and material recovery (some materials are recovered on the Island while some are sent to facilities in mainland Greece). Although none of them are formally integrated into local waste management plans, some of which have cooperated with the municipalities. To facilitate further discussion, these systems can be grouped into three categories based on the type of their operators. The first group being two material recovery facilities, the second group is several separate-collection initiatives run by an environmental NGO, and the last group is two systems for separate collection of two specific waste streams.

To answer how household waste management in Lesvos shall move up the waste hierarchy, it is wise to learn from what already exist and to explore the possibility to enhance them. Therefore, this part of the analysis tries to understand conditions for their existence (i.e. motivations to start the initiatives and conditions to survive). Interviews were conducted mostly with people who are directly responsible for these systems and supplemented by other interviews, desk researches, and the researcher's observation in case an interview with the responsible person was not possible. The data was presented in Chapter 4.3.

Accordingly, the research has found that there are three main groups of actors involved: local government, business sector, and citizen or the public. Thus, the analysis is presented according to the systems' involvements with these actors: (1) cooperation with local government; (2) public participation; (3) economic viability of the system.

5.3.1 The Collection and Recycling by Material Recovery Facilities

The two material recovery facilities, Samiotou Brothers and Vounatsos, especially the first one which was established in 2000, have been the main actors in recycling and material recovery on the island. Although started with scrap-metals and End-of-Life Vehicles (ELVs), they have expanded their operation to cover other specific waste streams from municipal waste such as household WEEE and currently exploring possibility to operate on packaging waste as well. (Chapter 4.3.1) The conditions for their existence are summarized as follow:

1) Cooperation with local government:

The main condition for cooperation with the local government is that they have to attain licenses for their operations; however, bureaucratic systems in the procedures in attaining the licenses were mentioned as a hindrance for expanding their operations.

Both companies have established connections with some municipalities, especially municipality of Mytilene where they are located. In particular, the companies are contracted to manage abandoned cars for the municipalities. This is also a way to ensure their inflow of waste materials (metals and scrap metals are their main materials). Both companies reported that they were occasionally called to collect recyclable wastes when municipalities or schools have environmental awareness-raising activities.

2) Public participation:

Both companies said they have received good responses in terms of public participation (more calls for waste pick-up and more waste collected) and think that the citizens are gradually getting used to recycling. This may be attributed to the fact that more people starting to notice them and their activities through their advertisement in local newspapers and word-of-mouth. Another reason may be due to their ways of waste collection; calling for pick-up and door-to-door collection by junkmen are convenient for the people (who do not have to move to get rid of their waste) and free-of-charge.

3) Economic viability:

As private companies, one of their main goals is to make profit. Cost of transportation has been a main problem for their business because of their location - remote from material recovery facilities in mainland. It was clear that they worked on certain waste materials (e.g. WEEE, waste lubricating oil, accumulators, and used tires) even though their material prices are very low or of no economic value because the companies have contracts with the national systems for those wastes; thus, being subsidized or supported (e.g. guaranteed material prices, provision of containers and trucks and transport of the wastes). In this way, they are not going to invest on waste streams which material prices are not profitable when taking into account the transportation and pre-treatment costs. This is the case for packaging wastes which the companies are not currently operating on; instead, exploring opportunities to get contracts with HERRCO. On the other hand, when asked, the companies agreed that source-separation in municipalities may help to make packaging waste more interesting for them since it can ensure better quality and more constant inflow of waste materials. However, they are still skeptical if the municipalities will have the capacity to do it.

5.3.2 NGO's Initiatives on Separate Collection in Mytilene

The environmental NGO, YDATINOS, has had voluntary separate collection programme since 2002, putting bins for aggregated recyclables on the streets of Mytilene. (See Chapter 4.3.2) The programme was halted in September 2008 but reported to resume in June 2009. The short pause of the programme was said to due to economic difficulties. The programme was in cooperation with the Municipality of Mytilene and another NGO (ILIAKTIDA) from 2004.

YDATINOS also had 3-months long awareness-raising campaign together with a bank, putting an automatic machine receiving packaging waste in Mytilene. This programme was reported to gain high public participation but stopped because it was just an ad hoc campaign - basically part of a promotional campaign by the bank who supplied the machine. Currently, the group still maintains a waste collection center receiving specific waste streams such as batteries and accumulators, WEEE, and some packaging waste. The group has contracts with several national systems for alternative waste management and sends collected recyclable waste to material recycling facilities in mainland through these channels. Conditions for the operation of YDATINOS' waste programmes are summarized here:

1) Cooperation with local government:

Cooperation with the municipality of Mytilene in its voluntary recycling programme had been limited to only provision of spaces in the city to put up the collection bins. Municipality's capacity to support on work forces and budget was not possible.

2) Public participation:

As the only separate collection programme Lesvos has ever had, the group reported that people participation has gradually increased over the past six years of its operation; they have been able to collect more waste each year. However, in practice, they often found more non-recyclable wastes than recyclables in the bins. This may be because the programme is experimental and campaigning in nature, there was no law enforcement, and education and knowledge of the people about recycling and waste separation are still low. On the other hand, more and more people are using their waste collection center (bring to the center or call for pick-up) because the center became known in the city by word-of-mouth.

3) Economic viability:

As an NGO operating on volunteers, making profits is not the aim. The group operates on several funding from various EU sources for its different environmental projects. This is the main reason why the voluntary recycling bin programme was halted in September 2008. The programme was not economically viable even though it was already operating on unpaid workforces (volunteers). Transportation cost was the main operational cost yet they were not able to cover it. On the other hand, the waste collection center can still function with support from external funding and subsidies, i.e. the EU grant to establish the center, support from the local ferry company (free shipments to mainland), and supports from some national systems for specific waste streams (e.g. guaranteed buying prices and free pick-up).

5.3.3 Systems for Separate Collection of two Specific Waste Streams in Supermarkets and Shops

Furthermore, two types of wastes are being separately collected in supermarkets or shops in Lesvos: waste portable batteries and glass beverage bottles; each has its own system. (See Chapter 4.3.3) The system for waste portable batteries belongs to AFIS SA, one of the national systems established after the Law in 2001. It distributes special bins (a cylindrical

transparent column) for collection of portable batteries all over the countries in shops, super markets, and public places like municipalities' halls. The system for returning glass beverage bottles existed in most shops and supermarkets long before the 2001 Law. It is a kind of deposit-refund system. The collected glasses are refilled or recycled.

1) Cooperation with local government:

These two systems are not integrated into local governments' waste management plan. The only cooperation is that separate collection bins for waste portable batteries are put in municipalities' halls.

2) Public participation:

Public participation in these two systems is high. For the glass bottles deposit-refund system, observation and talking with local people reveals that everyone acknowledge and use this long-standing system. Direct economic incentive seems to work here, since consumers know they are paying (deposit) for the bottles, they usually return the bottles to get their money back. The system for waste portable batteries gets high participation because the bins are highly visible and easily accessible to consumers, together with the fact that the waste is small and easy for consumers to bring to the collection point.

3) Economic viability:

The waste portable batteries system operates because of the obligation by Law and is one of the national producer responsibility organizations (AFIS SA). There is no information available for the glass beverage bottles system but it must be economically viable since it has been operating for more than 30 years.

Learning from the analysis on the existence of alternative waste management in Lesvos, if any of the three types of the above mentioned alternatives are to be enhanced and integrated into formal local waste management agenda, some of their conditions could be drivers for such change while some others would remain challenges. Table 5-2 summarizes this analysis.

Table 5-2 Drivers and Challenges in Enhancing and Formalizing the Existing Alternatives

Conditions	Drivers	Challenges
1) Cooperation with local government	Cooperation and contract between private or citizen initiatives with local governments exist. This can help the operations in terms of constant supply of waste materials.	Acquiring licenses is sometimes a challenge to local initiatives (i.e. private sector to start material recovery facility).
2) Public Participation	Local residents start to acknowledge these initiatives and public participation has been increasing during the recent years; this shows that people are gradually ready for change. High visibility and easy accessibilities of some systems ensures high public participation.	Although more people are aware of the voluntary recycling initiatives, the concept of recycling is not yet widespread among the Island's residents. Awareness raising and education are still challenges to further improve citizens' participation and collection rate.
3) Economic viability	Linkages with the national systems are crucial for certain waste streams which are not economically viable considering their material prices (e.g. packaging waste). Funding (i.e. EU or national sources) exist for private and non-profit projects.	High transportation cost and low price of some waste materials hinder alternative management of certain waste streams (e.g. packaging waste).

6 Conclusions and Recommendations

To contribute to the knowledge of sustainable waste management in remote areas of the European Union, this research focuses on how to move waste management policy and practices in these areas up the waste hierarchy. The case-study approach is employed, choosing Lesvos Island as a case study of a remote area within the EU. The research tries to document waste management policies and practices in Lesvos as well as issues and factors surrounding them. Guided by the research questions proposed in Chapter 1.3, this chapter now concludes the research findings. Subsequently, the second part of this chapter provides recommendations which can help stakeholders to achieve sustainable waste management in Lesvos. These recommendations are applicable for other remote areas of the EU provided that their specific contexts are taken into account. The last section of this chapter presents what the researcher thinks are still gaps in available literature and are not covered in this research but should be fulfilled in order to facilitate local policy making and planning for sustainable waste management in remote areas of the EU.

6.1 Conclusions

The ultimate goal of this research is to contribute to appropriate solutions for sustainable waste management in remote areas of the EU. Because waste hierarchy is an underlying principle of the EU waste policy, it should help to deliver the research goal; thus setting direction of this research. Apart from its clear environmental benefits, waste prevention and waste recovery may contribute to various aspects of sustainable development in remote/rural areas where available land, resources, and cost of transportation are of main concerns. That is, having less waste to manage and being able to manage waste in one's own territory is a self-sufficient approach in terms of resources and energy. Additionally, community recycling programme may create more jobs for the local people as oppose to landfill or incineration which usually rely on high-technologies and require large amount of waste supply in order to be economically viable; hence not applicable for a single-small rural area.

Lesvos Island of Greece is chosen as a case study to represent one of the remote and rural areas in an EU Member State which is still lacking behind most of the others in terms of moving up the waste hierarchy. The research starts from looking into implications of the EU waste policy on the national (Greek) waste policy, especially on waste prevention, recycling, and recovery. Under the contexts of the case study, the research explores how these EU and national policies, together with other factors, have influenced waste management in Lesvos at the local levels. Consequently seeking to answer how the local waste policy agenda can be altered toward a more sustainable one. Furthermore, alternative waste management systems available in Lesvos are investigated. Learning about the conditions which favour the existence of these alternatives shall lead to the knowledge of how to strengthen and formalize the existing practices into the local waste management agenda. Drawing from the analyses in Chapter 5, this chapter now presents conclusions to the research.

6.1.1 Influences of the EU Waste Policy on the Greek Waste Policy

From literature review, it is clear that the EU waste policy has always guided the direction of the Greek waste policy. However, the EU waste policy has already evolved to focus on enhancing waste prevention and recycling (exhibited in e.g. the Thematic Strategy on the Prevention and Recycling of Waste, the EU's goal to become a recycling society, etc.) while the Greek national policy and practices have not yet progressed to the same level. Situation

of uncontrolled dumpsites in Greece has hindered development of other waste management alternatives in the country, both at the national and local levels. Moreover, influences of the EU's waste hierarchy concept on the local waste policy are not evident albeit the concept being recognized in the Nation Solid Waste Management Plan and (some of the) Regional Plan (e.g. the Northern Aegean Region).

6.1.2 The National Framework for Alternative Management of Specific Waste Streams

The Greek national framework for alternative management of specific waste streams has been highly influenced by the EU Packaging and Packaging Waste Directive and some other EU legislation on specific waste streams. Since 2001, the establishment of the Greek Law on Alternative Management of Packaging and Other Products has been instrumental in starting the country's separate collection systems. Among others, packaging waste, waste electrical and electronic equipments (WEEE), and waste portable batteries are the main household wastes for which respective national collective systems for their alternative management have been developed. However, geographical distribution of these systems is still limited in remote regions; for example, as evident in the national collective system of packaging waste.

6.1.3 Local Municipal Waste Management and the Need to Move up the Waste Hierarchy

In case of Lesvos, local governments recognize waste management among their priority environmental issues. Most of this is due to the current situation that every local authority has its own dumpsite(s) which need to be closed and restored. At the same time, they are also facing problems from the growing amount of waste which they have to find a way to manage. The local governments are anticipating the central sanitary landfill of the Island to dispose of their waste in the near future. However, they should not rely solely on this option. Not only because landfill disposal is the least preferable option in the waste hierarchy, but also because many municipalities on the Island are far away from the central landfill location which incur higher cost of waste transportation. In this aspect, high cost of transportation is a main problem for most remote areas (i.e. insular or mountainous), like Lesvos and most of the areas in Greece. Additionally, once the central landfill is full, building a new landfill (or incineration) will not be an easy task and will be time consuming since they are likely to face local oppositions (as happened during the 10-years-long process of this central landfill).

The circumstances suggest that it is necessary for local governments in Lesvos to explore other alternatives which are more sustainable than the current waste management practices. Accordingly, the conditions seem to favour decentralized and small-scale waste management systems, for example community recycling and composting programmes, over centralized and large-scale systems. This is because large-scale waste disposals (e.g. central landfill or incineration) generally need large amount of waste input therefore require most communities (who are not hosting the facilities) to transport waste in long distance for disposal.

6.1.4 Facilitating Change in Local Waste Policy Agenda

It is evident that the EU waste hierarchy has not been brought down to the local waste policy agenda in Lesvos albeit the concept being realized at national and regional levels. In order to facilitate changes, (i.e. moving away from landfill toward recycling), the research has explored factors which have been influencing the local waste policy decisions. Consequently, it is able to identify key factors which are hindrances and drivers for such changes. Detailed analysis was given in Chapter 5.2; thus the following conclusions:

Although the concept of waste hierarchy has not been integrated into the local waste management plans (i.e. the prefecture of Lesvos and the municipalities), pressures to implement the concept exist. Such pressures come directly from the EU through requirements for funding on waste management infrastructures (i.e. the Island's central landfill). Furthermore, local governments also recognize that recycling is eventually inevitable and some have demonstrated interest in recycling programme. Some municipalities have started voluntary recycling initiatives, in cooperation with the local recycling businesses and the local NGO. Although these initiatives are voluntary and more likely to be limited to awareness raising campaign, the fact that they are recognized by various stakeholders in different sectors means more chances for them to be integrated into the formal waste policy agenda.

The establishment of the Inter-Municipal company (DEDAPAL) presents an opportunity for collective action of the local governments on the Island. Further, it can drive the Island waste management to move up the waste hierarchy since it has already started to explore possibilities of recycling and composting. Nevertheless, it should be noted that the structure of the company may favour centralized system (i.e. promoting central landfill, central composting, and central mechanical sorting facility) which would require all waste to be transported from every municipality to the central landfill; therefore will not solve the problem of high transportation cost from some remote municipalities.

Another condition which has been hindering the change is that local governments seem to passively rely on the private and civil society sectors in initiating and implementing separate collection and recycling. The fact that they are used to burying waste (in dumpsites or now in landfill) as an ultimate practice in waste management has hindered them to pursue other options. Additionally, low awareness and no pressure from local residents may be a part of the reasons why the local governments have not been active on the issue.

Lastly, resources and funding is one of the main challenges voiced by local governments. It is an advantage that the local governments are familiar with external funding for their waste management projects, i.e. the EU Cohesion Fund for building the Island's central landfill and for restoring some municipalities' dumpsites. In this regard, as discussed with various local governments, potentials for other sources of funding for small-scale waste management projects (e.g. community-based recycling programme in remote/rural areas of the Island) have not been much explored. This remains an opportunity.

6.1.5 Learning from the Past to start the Change

From the previous conclusion, because of the local governments' limited resources, it will be wise to consider enhancing the existing systems, to maximize available resources and their use-efficiency, instead of starting one anew. In this regard, Lesvos Island has the advantage of already having some alternatives for management of specific waste streams. These alternatives are (1) two local recycling businesses (material recovery facilities) - accepting recyclable wastes mainly by call-to-collect and drop-off methods; (2) several voluntary recycling programmes initiated by a local NGO which have provided separate collection bins for aggregated recyclable wastes in public spaces and having recycling centres in residential areas which offer call-to-collect service for some waste streams like large electronic and electrical appliances; and (3) two separate collection systems in shops or public spaces for waste portable batteries and glass beverage bottles. The household municipal waste streams which have been covered by these systems are: waste portable batteries, glass beverage bottles, waste electrical and electronic equipments, and packaging wastes (to a certain extent).

It is valuable to learn from these existing systems what have been contributing to their successes or failures; in order to develop and integrate them into the formal local waste management practices. As discussed in detail in Chapter 4.3, the following are the key learning points resulting from this research:

(1) The need for local governments to explore real potentials of the existing systems.

Many of these alternatives have survived, with some being successful on their own. Local governments should explore real potentials of these systems, how to support and utilize their full potentials and integrate them into the local waste policy/practices. The fact that some of them have already had established relationships with various local governments is an advantage. On the other hand, it is worth noting that the bureaucratic systems of acquiring licenses have been voiced as one of the obstacles for the local recycling business operation.

(2) Successful public participation still requires awareness-raising and adequate knowledge.

Public participation is a pre-requisite for the success of waste prevention/reduction which is at the top of the waste hierarchy. Although it has been observed that more and more people started to recycle (increasing collection rates of recyclables by the business and NGO initiatives each year), results from particularly the voluntary separate collection programme in Mytilene demonstrated that awareness and knowledge of the Island's general public on recycling (and the issues surrounding it) is still low. This, in turn, results in low public pressures on the local governments to become active in recycling activities.

(3) Other factors for successful public participation.

Additionally, the findings from this research help to identify some other factors which have contributed to the level of public participation in various voluntary recycling programmes in Lesvos. *Collection bins visibility* - e.g. in the case of waste portable batteries collection tubes in supermarkets and municipalities halls, the highly visible collection bins make it easy for the people to recognize and access the collection points. *Convenience for the consumers (disposers)* - collection methods like call-to-collect (e.g. of large WEEE by the material recovery facilities or the NGO recycling centre) makes it easier for people to recycle their bulky wastes since they do not have to transport the waste by themselves. *Economic incentives* have been used to a limited degree in some systems which have proved to be successful, e.g. giving reduction coupons in returns of packaging waste for recycling by the supermarket (in the NGO and bank recycling campaign), and deposit-refund for the return of glass-beverage bottles.

(4) Linkages with and support from the national systems are necessary for economic viability.

For remote areas such as Lesvos Island, high cost of transportation, high cost of sorting and low material prices for some waste streams are main challenges for economic viability of recycling and material recovery. Consequently, linkages and support from the national collective systems for management of some specific waste streams have been crucial to sustain their separate collection and recycling in Lesvos which will otherwise be impossible to cover the costs or to make profit. As demonstrated in the case of Lesvos, the low cost of most packaging waste materials makes it not attractive for the recycling business, particularly when the national collective system for packaging waste has not been involved. This is also why the voluntary recycling bin project by the NGO was halted in September 2008; the group was already operating on voluntary un-paid labour for manual sorting and still can not cover the cost of transportation. In this aspect, the recycling businesses also mentioned that packaging waste will be more interesting if municipalities will start source separation so as to reduce the sorting cost, improve the quality of waste input, and ensure more constant recyclables supply to their operation.

(5) The need to further explore external funding for local/small-scale waste management alternatives.

Currently, the local private and civil society sectors have had experiences with several EU funding to start their recycling initiatives. Samiotou company received grant from the EU Rural Development Fund through the LEADER programme to start a new metal recycling plant; Vounassos company was initiated by support from the EU Cohesion Fund (the 3rd Community Support Framework Programme); the NGO, YDATINOS, also received funding from the EU EQUAL programme of the European Social Fund to start a recycling centre. These funding have been helpful for the local initiatives to deal with limited local resources and their economic viability. This also means that there exist opportunities to support local/small-scale waste management activities. Consequently, further opportunities for external funding should be explored.

6.2 Recommendations for Stakeholders and Policy Makers

To build up on the research findings, the following recommendations have been formulated to present some of the steps that Lesvos can take in order to move toward more sustainable ways of waste management. Local authorities are the main target audience for these recommendations because they are policy makers as well as implementing bodies who have direct responsibilities to transform policies into practices. Additionally, several recommendations targeting other stakeholders are also presented here. Moreover, because the recommendations are based on the case study, they are specifically aiming to improve waste management situation in Lesvos Island in the present situation around the time of this research. However, since the case study was selected to represent remote areas of the EU, they can be applied to other remote areas of Greece and the EU provided that the context of each case is taken into account.

(1) National obligations under the relevant EU Directives, in particular, the targets (e.g. collection and recycling rates for specific waste streams, the amount of biodegradable to be diverted from landfills, etc.) should be clearly distributed down to the local level. These obligations will help to exert pressures on the local governments to find ways to reach the targets; hence moving up the waste hierarchy.

(2) In designing waste management policy and action plans, local governments should employ holistic approach which takes into account environmental as well as socio-economic benefits that different types of waste management options can bring; i.e. contribute to all aspects of sustainable development in the localities. For example, if each municipality in Lesvos is to implement source-separation with recycling and on-site composting of biodegradable waste, various socio-economical benefits which may follow includes: (a) local jobs will be created (i.e. manual sorting, collection, operation of recycling and composting facilities) which are different from jobs created by landfills and incinerations (i.e. jobs requiring technical expertise which may not be practicable by local people in rural remote areas); (b) the amount of waste to be transported for final disposal in the central landfill will be reduced, therefore prolonging the landfill's life span and reduce energy consumption thus contribute to the community's energy independent. Accordingly, the local governments may want to consider decentralized municipality-scale recycling and composting.

(3) Along the same line, employing holistic approach will increase channels and opportunities for local initiatives to apply for external funding. For example, a study for

or the establishment of community-based recycling programmes in remote/rural areas will be eligible for the EU Rural Development Fund (under the LEADER programme).

(4) Since resources (financial and human resources) in remote areas are limited, the local governments in Lesvos should consider enhancing the existing alternative waste management systems in order to maximize the available resources and their efficiency. As previously discussed in Chapter 6.1.5, lessons can be learned from these existing practices when designing a new sustainable waste management plan.

(5) In Lesvos, alternative management of biodegradable waste is still under-investigated. Although biodegradable waste contributes to 57% of all municipal waste, unfortunately, there had been no local initiative on composting. The obligation of the EU Landfill Directive to reduce biodegradable waste going to landfill has been transposed to the National Waste Management Plan - with quantitative targets set for years 2010, 2013, and 2020. However, it seems to have no effect on local implementation in Lesvos. The only visible plan for the near future is an on-going study commissioned by the Inter-Municipality Company (DEDAPAL SA) to see potential for mechanical sorting of aggregated municipal waste and composting at the central landfill site. This idea, however, will not help to reduce the cost of transporting waste from municipalities to the central landfill.

Accordingly the municipalities may want to consider source-separation of biodegradable waste and on-site composting[92] within their own municipalities. This can reduce the total amount of waste each municipality will have to bring to the central landfill therefore reduce transportation cost.

(6) Environmental economic instruments, such as landfill tax and landfill charge being used in some countries in the EU, can be used as incentives for municipalities to divert waste from landfill and seek for alternative solutions. Yet, this has not been explored in Lesvos. In this regard, the instruments can be employed when setting fees which municipalities are going to pay to the Inter-Municipal company (e.g. for central landfill management and maintenance). Note that during the time of this research, the issue is still under debate. It should be highly cautioned that if every municipality is to pay according to their population (as currently proposed), it may discourage municipalities to take actions toward waste reduction or source-separation. This is because the municipalities will have to pay a fixed amount according to their population whether they reduce their waste or not. A possible alternative is for the municipalities to pay according to the actual amount of waste and types of waste that they will send to the central landfill (i.e. a kind of landfill charge) which can encourage them to divert recyclable and biodegradable wastes from landfill disposal.

(7) As concluded in point (4) of Chapter 6.1.5, it is evident that supports from the national collective systems have been crucial to sustain separate collection and recycling of some waste streams in Lesvos which will otherwise be impossible to cover the costs of transportation and to make it economically viable. Local governments should be proactive in engaging the producer responsibility organizations (established according to respective EU Directives) in order to set up separate collection of the waste streams which are not yet dealt with in Lesvos, in particular, packaging waste. This will also

[92] The Ecological Recycling Society (OEA: Οικολογική Εταιρεία Ανακύκλωσης), a Greek NGO based in Athens, have had experiences in several pilot projects on community-based composting around the country; their experiences will be useful for Lesvos.

ensure that the extended producer responsibility (EPR) principle, as intended by the EU Directives, is implemented.

(8) Local governments should make source separation and separate collection mandatory as a serious step to move up the waste hierarchy. Consequently, it will improve quality of (sorted) recyclable waste going to the local material recovery facilities which will help to reduce their operation cost; additionally, it will ensure more stable supply of recyclable waste materials which can make recycling/recovery of the particular waste streams more attractive.

(9) At the same time, local governments need to strengthen public awareness and disseminating adequate knowledge in order to gain more public participation in source separation and separate collection, as learned in point (2) of Chapter 6.1.5. Some municipalities in Lesvos (e.g. Eressos-Antissa) have started educational programme in schools; the result have been satisfactory. This can be an initial step for other municipalities.

(10) Last but not least, local governments should see the advantage of involving more stakeholders, in particular the local NGO and the local academics, in their awareness raising and educational activities. The local NGO in Lesvos originally started their voluntary recycling programme without local governments' involvement. Their accumulated knowledge and ability to campaign for public awareness-raising should be recognized and empowered. Furthermore, it is advantageous that the Island is hosting the University of the Aegean. Its experts and students are valuable local resources which the municipalities can engage to utilize their knowledge and capacity, especially in educational programme.

6.3 Recommendations for Further Research

Take into account the research' scopes and limitations, it was not possible to cover everything ones need to know how to move waste management in Lesvos and other remote areas of the EU up the waste hierarchy. Following the proposed recommendations, there are four main areas which have not been explored in this research but will be instrumental for decision makers in designing a functional waste management policy and plans. They are presented here as research gaps, or recommendations for further researches.

(1) Contribution of community-based recycling and composting programmes in sustainable development for remote and rural areas.

During literature review, the researcher had come across some literatures on community-based recycling and composting programmes; unfortunately most of them are not focusing on remote and rural aspects of the communities. Knowledge on the benefits of such programmes, especially their contribution in various aspects of sustainable development to the communities, will be useful for policy makers in order to gain holistic perspective of different waste management options.

(2) Consumers or citizens' environmental behaviour and decisions.

This research was only able to touch upon the issue only at times. For example, easily accessible collection bins and convenient collection methods contribute to increasing separate collection of some waste streams; low public awareness contributes to failure of the NGO's aggregated recyclable waste bins. However, in order to design a functional and

successful recycling/composting programme, it is important for policy makers to acquire deeper knowledge of consumers or citizen's environmental behavior and decisions since they are direct determining factors for public participation.

(3) Appropriate environmental economic instruments and economic incentives.

There are various environmental economic instruments which can be employed in waste management policy. This research has tentatively recommend landfill charge to encourage local governments in Lesvos to divert waste from landfill with the purpose to open a discussion. Other economic incentives for consumers are also being utilized in some of the existing systems, i.e. the deposit-refund of glass beverage bottles and supermarket reduction coupon when bringing back recyclable packaging waste (ad-hoc awareness raising campaign). There are still wide ranges of instruments and incentives which may be appropriate for Lesvos (and other remote areas) thus should be further explored.

(4) How to facilitate financial and technical supports for local actors.

The inherent conditions of remote areas (i.e. distance) incur higher cost of transportation and recycling and material recovery operations. This is usually exacerbated by limited resources, a common obstacle faced by local actors in remote areas to initiate alternative waste management, potentially because these areas are not main development targets in their countries as oppose to cities. It is thus necessary to facilitate the local actors (private sectors, NGOs, and local governments) to have access to external supports, either in terms of financial support or technical expertise.

For example, there are in fact various EU Funds for which community development programmes such as community recycling, material recovery, and composting may be eligible. Among others, the major ones aiming to develop rural regions of the EU are: the EU Regional or Cohesion Fund, the EU Social Fund, and the EU Rural Development Fund. However, each of these Funds has its own specific funding programmes, mechanisms, and conditions which are usually complicated therefore not known or easily understood by all local actors. From observations during this research, a simple idea to facilitate supports for the local actors could be to conduct an accessible database of available funds (and other technical aids) with explanation of their conditions and applicability. The database can serve as a practical tool for local actors in remote areas who want to initiate or strengthen their community recycling or composting programmes. Nonetheless, the research has not fully explored this topic.

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Abbreviations

BMW	:	Biodegradable Municipal Waste
DEDAPAL	:	The Inter-Municipal Company for Waste Management and Environmental Development of Lesvos (Greek: ΔΕΔΑΠΑΛ ΑΕ: Διαδημοτική Επιχείρηση Διαχείρισης Απορριμμάτων και Περιβαλλοντικής Ανάπτυξης Λέσβου Α.Ε.)
DG Environment	:	Directorate-General for the Environment (European Community)
EC	:	European Commission
EEA	:	European Environmental Agency
EEC	:	European Economic Community
ELV	:	End-of-Life Vehicles
EOEDSAP	:	National Organization for Alternative Management of Packaging and Other Products (Greek: ΕΟΕΔΣΑΠ: Εθνικού Οργανισμού Εναλλακτικής Διαχείρισης Συσκευασιών και Άλλων Προϊόντων)
EPED	:	Monitoring Committee of Alternative Management (Greek: ΕΠΕΔ: Επιτροπή Παρακολούθησης Εναλλακτικής Διαχείρισης)
EU	:	European Union
FEK	:	Government Gazzette (Greek: ΦΕΚ)
GDP	:	Gross Domestic Product
GEDSAP	:	The Office of Alternative Management of Packaging and Other Products (Greek: ΓΕΔΣΑΠ: Γραφείο Εναλλακτικής Διαχείρισης Συσκευασιών και Άλλων Προϊόντων)
HERRCO	:	Hellenic Recovery Recycling Corporation (HE.R.R.Co SA) (Greek: E.E.A.A. A.E.: Ελληνική Εταιρεία Αξιοποίησης Ανακύκλωσης)
IPPC	:	Integrated Pollution Prevention and Control
JMD	:	Joint Ministerial Decision (Greek: Κ.Υ.Α.)
MRF	:	Material Recovery Facility
MS	:	Member States of the European Union
MSW	:	Municipal Solid Waste
NGOs	:	Non Governmental Organizations
NIMBY	:	Not In My Back Yard
NMS	:	New Member States of the European Union
OTA	:	Local Organization Authorities (Greek: Οργανισμός Τοπικής Αυτοδιοίκησης)
PD	:	Pesidential Decree (Greek: Π.Δ.)
SA	:	Société Anonyme; Public limited company (Plc.) in the U.K. and Ireland; and Ανώνυμη Εταιρία in Greek [a type of limited liability company]
TCG	:	Technical Chamber of Greece (Greek: ΤΕΕ: Τεχνικο Επιμελητηριο Ελλαδασ)
WEEE	:	Waste Electrical and Electronic Equipment
WFD	:	Waste Framework Directive (European Communicy)
YPEHODE	:	Ministry of Environment, Physical Planning and Public Work (Greek: ΥΠΕΧΩΔΕ)

Appendix

Appendix I: Definitions

Some terminologies used in this research are specific to waste management policy and planning employed by the EU and the Greek authorities. This Appendix provides a non-exhaustive list of definitions of these terminologies, excerpted from the relevant EU Directives and the Greek Legistlation.

Definitions form the EU Waste Framework Directive (Directive 2008/98/EC)

1. 'waste hierarchy'

"The waste hierarchy generally lays down a priority order of what constitutes the best overall environmental option in waste legislation and policy, …" (preamble 31)

Article 4 on **'Waste hierarchy'** stipulates that "The following waste hierarchy shall apply as a priority order in waste prevention and management legislation and policy:

(a) prevention;

(b) preparing for re-use;

(c) recycling;

(d) other recovery, e.g. energy recovery; and

(e) disposal.

2. 'waste' means any substance or object which the holder discards or intends or is required to discard.

3. 'bio-waste' means biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises and comparable waste from food processing plants.

4. 'waste producer' means anyone whose activities produce waste (original waste producer) or anyone who carries out pre-processing, mixing or other operations resulting in a change in the nature or composition of this waste.

5. 'waste holder' means the waste producer or the natural or legal person who is in possession of the waste.

6. 'dealer' means any undertaking which acts in the role of principal to piirchase and subsequently sell waste, including such dealers who do not take physical possession of the waste.

7. 'broker' means any undertaking arranging the recovery or disposal of waste on behalf of others, including such brokers who do not take physical possession of the waste.

8. 'waste management' means the collection, transport, recover and disposal of waste, including the supervision of such operations and the after-care of disposal sites, and including actions taken as a dealer or broker.

9. 'collection' means the gathering of waste, including the preliminary sorting and preliminary storage of waste for the purposes of transport to a waste treatment facility.

10. 'separate collection' means the collection where a waste stream is kept separately by type and nature so as to facilitiate a specific treatment.

11. 'prevention' measures taken before a substance, material, or product have become waste, which reduces the quantity, the adverse impacts, and the content of harmful substances in materials and products.

12. 'reuse' means any operation by which products or components that are not waste are used again for the same purpose for which they were conceived.

13. 'treatment' means recovery or disposal operations, including preparation prior to recovery and disposal.

14. 'recovery' means any operation the principal result of which is waste serving a useful purpose by replacing other materials which would otherwise have been used to fulfil a particular function, or waste being prepared to fulfil that function, in the plant or in the wider economy, Annex II sets out a non-exhaustive list of recovery operations.

15. 'preparing for reuse' means checking, cleaning or repairing recovery operations, by which products or components of products that have become waste are prepared so that they can be reused without any other pre-processing.

16. 'recycling' means any recovery operation by which waste materials are reprocessed into products, materials or substances whether for the original or other purposes. It includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfillig operations.

17. 'disposal' means any operation which is not recovery even where the operatin has a secondary consequence the reclamation of substances or energy. Annex I sets out non-exhausive list of disposal operations.

Definitions from the EU Landfill Directive (Directive 1999/31/EC)

18. 'municipal waste' means waste from households, as well as other waste which, because of its nature or composition, is similar to waste from household.

19. 'inert waste' means waste that does not undergo any significant physical, chemical or biological transformations. Inert waste will not dissolve, burn or otherwise physically or chemically react, biodegrade or adversely affect other matter with which it comes into contact in a way likely to give rise to environmental pollution or harm human health. The total leachability and pollutant content of the waste and the ecotoxicity of the leachate must be insignificant, and in particular not endanger the quality of surface water and/or groundwater.

20. 'biodegradable waste' means any waste that is capable of undergoing anaerobic or aerobic decomposition, such as food and garden waste, and paper and paperboard.

21. 'landfill' means a waste disposal site for the deposit of the waste onto or into land (i.e. underground),

including:

- internal waste disposal sites (i.e. landfill where a producer of waste is carrying out its own waste disposal at the place of production), and
- a permanent site (i.e. more than one year) which is used for temporary storage of waste,

but excluding:

- facilities where waste is unloaded in order to permit its preparation for further transport for recovery, treatment or dispsal elsewhere, and

- stoarage of waste prior to recovery or treatment for a period less than three years as a general rule, or
- storage of waste prior to disposal for a period less than one year

22. 'leachate' means any liquid percolating through the deposited waste and emitted from or contained within a landfill.

Definitions from the Greek Law on Packaging and Alternative Management of Packaging and Other Products (Law 2939/2001)

23. 'other products' means products such as vehicles tires, vehicle catalysts, mineral oils, batteries and accumulators, electrical goods, electrical and electronic devices, telecommunications' equipment, demolition and excavation materials, furniture, newspapers and magazines, office paper types, etc.; which after use and having become waste (solid or dangerous), over the meaning of the proposed legislation, are going through reuse or recovery.

24. 'alternative management of packaging and other products' means the collection activities including bailment, transport, transhipment, temporary storage, reuse and recovery of the waste from multiple-use packaging or waste from packaging and other products in order to return back to the market flow after their reuse or their recovery respectively.

25. 'alternative Management System' means the organization of individual or collective basis with any legal form of collection activities, including bailment, transport, reuse and recovery of used packaging and other products.

- The re-use of the multiple-use packaging after collection, including bailment or transportation and;
- the recovery of packaging waste or other products after their collection, transport, transhipment or temporary storage, so that packaging wastes and other products wastes return back to the market flow.

26. 'bailment system' [93] means the alternative management of packaging in which the buyer of the packed product defrays to the seller bailment fee which he/she will get back upon return of packaging (one or multiple-use) aiming at its alternative management.

[93] An example of this is the separate collection and deposit-refund system of glass beverage bottles in shops and supermarkets, as discussed in Chapter 4.3.3 in this research.

Appendix II: Lesvos Municipalities, Communities, Population Density

Table below shows a list of 13 municipalities on Lesvos Island with its population and percentage of each municipality's population comparing to the whole island.

Municipality	Population 2001	% from Total
Agia Paraskevi	2,628	3
Agiasos	2,587	3
Gera	6,985	8
Eresou-Antissis (Eressos-Antissa)	5,530	6
Evergetoula	3,336	4
Kalloni	8,194	9
Loutropoli Thermis	3,809	4
Mantamados	3,210	4
Mythimna (Molyvos)	2,433	3
Mytilene	36,196	40
Petra	3,749	4
Plomari	6,698	7
Polichnitos	5,288	6
Total – the Island of Lesvos	**90,643**	**100%**

Source: adapted from WMLUOA, 2009b

Table below provides brake-down figures of communities within the 13 municipalities on Lesvos Island including their population, and areas, and population density.

Municipality	Community	Land Area (Sq.Km)	Population 2001	Population density 2001
Agia Paraskevi	Agia Paraskevi	100	2,346	2.34
	Napi	17	282	1.64
Agiasos	Agiasos	80	2,587	3.24
Gera	Pappados	9	1,640	19.01
	Mesagros	15	1,048	7.10
	Palaiokipos	12	1,283	10.94
	Perama	4	633	16.23
	Plakados	5	343	6.41
	Skopelos	42	2,038	4.85
Eresou-Antissis	Eresos	66	1,581	2.41
	Antissa	77	1,340	1.73
	Vatoussa	23	570	2.49
	Mesotopos	38	1,039	2.71
	Pterounta	19	150	0.79
	Sigri	40	402	1.01
	Chidira	28	448	1.61

Municipality	Community	Land Area (Sq.Km)	Population 2001	Population density 2001
Evergetoula	Sikounta	5	368	6.78
	Asomatos	7	328	4.81
	Ippios	10	900	9.32
	Kato Tritos	6	767	13.76
	Keramion	8	446	5.56
	Lampou Mili	49	164	0.34
	Michou	5	363	7.48
Kalloni	Kalloni	37	2,027	5.54
	Agra	60	1,030	1.71
	Anemotia	24	534	2.20
	Arisvi*	3	465	18.06
	Dafiou*	10	869	8.33
	Keramiou*	4	1,000	28.57
	Parakila*	36	926	2.58
	Skalochori	46	666	1.44
	Filia	22	677	3.05
Loutropoli Thermis	Loutropoli Thermis	18	1,113	6.28
	Komi	11	227	2.09
	Mistegna	12	905	7.44
	Nees Kidonies	24	643	2.66
	Pigi	12	502	4.08
	Pyrgi Thermis	2	419	19.05
Mantamados	Mantamados	64	1,452	2.26
	Kapi	18	654	3.73
	Klio	16	592	3.65
	Pelopi	22	512	2.36
Mythimna (Molyvos)	Mythimna	28	1,667	5.93
	Argennos	9	240	2.53
	Lepetymnos	5	155	3.42
	Sykaminia	8	371	4.62
Mytilene	Mytilene	16	28,879	182.72
	Agia Marina	20	732	3.57
	Alifanta	10	638	6.63
	Afalonas	8	514	6.44
	Loutra	22	1,414	6.39
	Moria	16	1,662	10.27
	Pamfilla	11	1,308	11.57
	Panagiouda	1	705	85.45
	Taxiarches	3	344	11.00

Municipality	Community	Land Area (Sq.Km)	Population 2001	Population density 2001
Petra	Petra	13	1,305	10.13
	Lafionas**	10	224	2.35
	Skoutaros**	13	1,100	8.51
	Stipsi	25	1,024	4.05
	Ipsilometopo	15	96	0.65
Plomari	Plomari	40	3,673	9.07
	Akrasi	12	445	3.68
	Ampeliko	21	230	1.08
	Megalochori	11	455	4.19
	Neochori	8	302	3.77
	Palaiochori	10	530	5.23
	Plagia	11	723	6.72
	Trigona	9	340	3.87
Polichnitos	Polichnitos	61	2,975	4.90
	Vasilika	48	608	1.27
	Vrisa	38	999	2.65
	Lisvorio	13	562	4.33
	Stauros	13	144	1.08
Total – the Island of Lesvos		**1,633**	**90,643**	**5.55**

* included as part of Kalloni Municipality since 1995

** included as part of Petra Municipality since 1995

Source: adapted from WMLUOA, 2009b

Appendix III: List of Interviews

The following table provides the list of interviewees and the date and place of interviews conducted for this research. The list is devided by types of stakeholders then ranked according to the dates of the interviews. Where necessary, the interviews are reffered to in the text of this thesis as personal communications.

Name	Organization	Date and Place of Interviews
Academics		
Constantinos P. Halvadakis	Department Chairman and Director of Waste Management Laboratory, Department of Environment, University of the Aegean (UoA)	9 March 2009 Office, Dept. of Environment, UoA, Mytilene
Nikoleta Jones	PhD. Candidate, Centre for Environmental Policy and Strategic Environmental Management, Department of Environment, University of the Aegean (UoA)	10 March 2009 Office, Dept. of Environment, UoA, Mytilene
Themistocles D. Lekkas	Professor and Director of Water and Air Analysis Laboratory, Department of Environment, University of the Aegean (UoA)	31 March 2009 Office, Dept. of Environment, UoA, Athens
Thanasis Kizos	Lecturer in Rural Geography, Department of Geography, University of the Aegean (UoA)	8 May 2009 Office, Dept. of Geology, UoA, Mytilene
Civil Society/NGOs		
Digran Almper Matosian	Member, YDATINOS Nature Group Mytilene (ΦΥΣΙΟΛΑΤΡΙΚΟΣ ΟΜΙΛΟΣ ΜΥΤΙΛΗΝΗΣ ΥΔΑΤΙΝΟΣ)	27 March 2009 Waste Management Lab, Dept. of Environment, UoA, Mytilene
Antigone Dalamaga	Managing Director The Ecological Recycling Society (OEA) (Οικολογική Εταιρεία Ανακύκλωσης) Athens	8 May 2009 Phone interview
Dimitri Homatidis	Project Coordinator, Community Composting The Ecological Recycling Society (OEA) (Οικολογική Εταιρεία Ανακύκλωσης) Athens	8 May 2009 Phone interview
Local Authorities - Prefecture of Lesvos		
Eleni Vagianni	Staff, Environment Department, Prefecture of Lesvos	26 March 2009 Office, Prefecture of Lesvos, Mytilene
Athina Stathelli	Director, Cultural, Tourism, and Education Department, Prefecture of Lesvos (since	6 April 2009 Environment Department, Prefecture of Lesvos,

Name	Organization	Date and Place of Interviews
	March 2009) (Former Director of Environment Department until February 2009)	Mytilene
Local Authorities - Municipalities (selected representatives)		
Costas Tzelais	Head of Departement, Environment Department, Municipality of Mytilene	7 April 2009 Environment Departement Municipality of Mytilene
Karavasili Zafeiro	Vice Mayor, Municipality of Eressos-Antissa	9 April 2009 At a Café near Mytilene Port
Giorgos Kyriazis	Mayor, Municipality of Agia Paraskevi	29 April 2009 Café near the bus station of Mytilene
Local Development Companies, Lesvos		
Ioanis Tsampanis	Technical Advisor to the Managing Council, Inter-municipal Company for Waste Management and Environmental Development of Lesvos S.A. Διαδημοτική Επιχείρηση Διαχείρισης Απορριμμάτων και Περιβαλλοντικής Ανάπτυξης Λέσβου Α.Ε. (Δ.Ε.Δ.Α.Π.Α.Λ. Α.Ε. or DEDAPAL SA)	8 April 2009 DEDAPAL Office, Ermou Street, Mytilene
Anastasios Perimenis	General Director, Lesvos Local Development Company Εταιρεία Τοπικής Ανάπτυξης Λέσβου (ETAL S.A.)	15 April 2009 ETAL office, Ermou Street, Mytilene
Local Material Recovery Facilities in Lesvos		
Sinioros, Panagiotis	Samiotou Brothers & Co E.E. (Recycling-Foundry Lesvos) in Moria, Mytilene, Lesvos	1 April 2009 IASP Hospital, Athens
Giorgos Vounassos	Vounatsos Dimitrios & Hariklia O.E. in Moria, Mytilene, Lesvos	7 April 2009 Vounatsos recycling facility, Moria, Mytilene

Appendix IV: Guiding Interview Questions with the Local Authorities

The main purposes for interviewing the local authorities in Lesvos are to seek understanding on how their waste policies and plans have been constructed hence knowing what have influenced their waste policy decisions. In total, six semi-structured in-depth interviews were conducted to represent the local authorities' perspective. Details of the interviewees are given in Chapter 4.2.3. The following are questions which were used as a check-list and guideline for the interviewer.

1) Rural area and experiences in funding for rural development

1.1 Is the authority (e.g. the municipality, the prefecture) aware that it is classified as a rural area (or is it not) according to the EU and other national classification?

1.2 Have the municipality experiences with funding from the EU Rural Development Fund, or other EU Funds, for environmental/rural development projects? Could you try to elaborate on the types of the projects and the funds?

2) Prioritization of problems

2.1 What are the main environmental problems that the Municipality/Prefecture is facing. Please gives 3 to 5 which you think are the most serious and explain why and in what way they are problematic?
[Example of potential answer to elaborate the question: wastewater, waste, air pollution, traffic, waste from ships, etc.]

3) Responsibilities and roles of the authority/municipality/organization

3.1 What is the extent of your authority/organization's responsibility on planning and implementation of household solid waste management? Please elaborate.
[Tentative list of waste management activities which should be covered are for example: waste disposal (landfill siting, operation, and maintenance), waste collection and transfer, waste prevention and recycling.]

3.2 And these responsibilities are obligations according to which (national or EU) legislation?

3.3 What will happen if these obligations are not followed (fine, penalty)?
[To be specific, the EU funding for the central landfill requires closing and restoration of the dumpsites and starting waste prevention/recovery; what will happen if these requirements are not met?]

4) How are waste management activities paid for or funded?

4.1 What are the main sources of funding for each activity answered in the above question, e.g. the national government, local tax revenue, or the EU development Funds?

4.2 Could you please elaborate your answer, e.g. how are the residences taxed and paid for their municipality's waste management cost.

4.3 How are the municipalities paying to the Inter-municipality Company for the central landfill management and maintenance? What are the proposed scenarios?

4.4 Do you consider raising the local residence tax in the future since sending waste to the central landfill will incur cost for the waste transfer?

5) Current situation, main problems, and challenges for the municipality/prefecture on household municipal waste management

5.1 What is the current practice of waste management in the municipality?

5.2 Does the municipality keep record/statistics of household waste generation and management? What kind of record are kept, are there separate statistics for different types of wastes?

5.3 What are the main problems and challenges for household municipal waste management that your municipality faces, please elaborate?
[E.g. citizens, resources, spaces, budgets, peak waste load during summer, etc.]

5.4 And how have the problems been dealt with?

6) Factors influencing the authority's waste policy decisions

6.1 What are the main factors that the municipality considered when making waste management plan/policy?

6.2 How are these factors considered?

- direction or obligations from the national governments (regional government or prefecture)?
- own initiatives of the authority?
- complaints or pressures from the citizens or local NGO?

7) On waste separation, recycling, composting

7.1 Does the municipality/prefecture/organization have plan or programme for waste separation, recycling, and composting?

7.2 If yes, please elaborate, what are the results or performance of the plan or programme?

7.3 If not, has it been considered for the future?

7.4 What do you think of waste sorting at source (i.e. separation of waste at household)?

7.5 What do you think of potential to do municipality's composting of biodegradable waste?

8) On local initiatives and existing practices

8.1 Is there any local initiative (by communities, NGOs, etc) in the municipality to do source separation, recycling, or composting? For example the voluntary recycling bins by YDATINOS.

8.2 If there is, please elaborate. How do you contribute to the initiative? Do you think it is successful? Has the municipality considered formalizing the initiative in the future (e.g. integrating it into the municipality's waste management plan)?