Deliverable 1-1ES(+): Report on the existing situation concerning solid waste management in the Municipality of Tinos – Extended summary in English

Action 1: Preparatory activities
Activity 1-1: Identification of needs and review of existing systems concerning municipal solid waste management in the Municipality of Tinos

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LIFE+ Environmental Policy & Governance

The Project is co-financed by LIFE+, the EU financial instrument for the environment.
Background

This report was produced under co-finance of the European financial instrument for the Environment (LIFE+) as the extended summary in English language of the first Deliverable (D1.1) of the first Action (Action 1) of the project “Development and implementation of a demonstration system on Integrated Solid Waste Management for Tinos in line with the Waste Framework Directive” (LIFE10/ENV/GR/000610) during the implementation of its first Activity (Activity 1.1), entitled “Identification of needs and review of existing systems concerning municipal solid waste management in the Municipality of Tinos”. The detailed report is available in Greek on the project’s website - http://uest.ntua.gr/iswm-tinos/.

This report reviews the current situation in regard to MSW management in Tinos Island in order to identify the needs for an integrated and sustainable MSW management. Therefore, it incorporates information on the natural and human environment of the area under investigation and it specifies the sources, quantities and composition of MSW along with the existing management practices that are currently being employed in the wider area of Tinos Municipality.

Acknowledgements

The ISWM-TINOS team would like to acknowledge the European financial instrument for the Environment (LIFE+) for the financial support.

Disclaimer

The information included herein is legal and true to the best possible knowledge of the authors, as it is the product of the utilization and synthesis of the referenced sources, for which the authors cannot be held accountable.
**Summary**

Waste is an inevitable product of society. On average, each European citizen generated 460 kg Municipal Solid Waste (MSW) in 1995. This amount rose to 520 kg per person in 2004, and a further increase to 680 kg per person is projected by 2020. In total, this corresponds to an increase of almost 50% in 25 years. Managing MSW more effectively is now a need that society has to address. Uncontrolled dumping and improper waste handling causes a variety of problems, including contaminating water, attracting insects and rodents, and increasing flooding due to blocked drainage canals or gullies. In addition, it may result in safety hazards from fires or explosions. Improper waste management also increases greenhouse gas (GHG) emissions, which contribute to climate change.

During the last few decades, Europe has progressively established a consistent political and regulatory framework on waste management. The new Waste Framework Directive (2008/98/EC) establishes the principles of waste hierarchy and sets material recovery targets in order to encourage member states to carry out waste treatment operations and waste management schemes. Over the last years the concept of Integrated Solid Waste Management (ISWM) has been proposed as the most appropriate action to avoid the adverse effects on public health that are caused by the increasing amounts of solid waste being discarded without appropriate collection or disposal. ISWM is a comprehensive waste prevention, recycling, treatment, and disposal program. An effective ISWM system considers how to prevent, recycle, and manage solid waste in ways that most effectively protect human health and the environment. ISWM involves evaluating local needs and conditions, and then selecting and combining the most appropriate waste management activities for those conditions. MSW management in Greece still remains a challenge.

This report aims to capture a clear picture concerning the quantitative and qualitative composition of municipal waste generated and with the applicable management practices and treatment of the various waste streams in the Municipality of Tinos. For the assessment of the current status of MSW management and the nature of the special solid waste streams in the Municipality of Tinos, the most recent data included in the Regional Waste Management Planning (RWMP) for the South Aegean area, data collected after direct communication with the competent bodies of the island and various related studies were examined.
Abbreviations and Acronyms

C&D  Construction and Demolition Waste
EC   European Commission
EEC  European Economic Community
EL.STAT.  Hellenic Statistical Authority
ELVs End-of-life vehicles
EWC  European Waste Catalogue
G.S. of Aegean & I.P.  General Secretariat of Aegean & Island Policy
GDP  Gross Domestic Product
GVA  Gross Value Added
HEC  Hellenic Environmental Center
HNMS  Hellenic Natural Meteorological Service
ISWM  Integrated Solid Waste Management
kt   knots
LPNB  Landscapes of Particular Natural Beauty
MEECC Ministry of Environment, Energy and Climate Change of Greece
MI   Ministry of Interior, Greece
MoT  Municipality of Tinos
MSW  Municipal Solid Waste
MU   Municipal Unity
NTUA  National Technical University of Athens
OG   Official Gazette of
PSA  Prefecture of the South Aegean
RWMP Regional Waste Management Plan
SCI  Site of Community Importance
SPA  Special Protected Areas
USEPA  United States Environmental Protection Agency
WEEE Waste Electrical and Electronic Equipment
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1. Introduction

This report entitled "Report on the existing systems concerning municipal solid waste management in the Municipality of Tinos - Extended summary in English" was produced under co-finance of the European financial instrument for the Environment (LIFE+). It was prepared as an extended summing up in English language of the first Deliverable (D1.1) of the first Action (Action 1) of the ISWM-TINOS project (LIFE10/ENV/GR/000610). This was done during the implementation of its first Activity (Activity 1.1), entitled “Identification of needs and review of existing systems concerning municipal solid waste management in the Municipality of Tinos”.

This report addresses issues of origin, composition, quantity and technologies/practices of treatment and disposal of the solid waste streams on the island of Tinos, and presents the existing condition of the natural and built environment of the region concerned. The present deliverable is an integral part of the preparatory activities of the Action 1 of the ISWM-TINOS project and its main objective is to collect and assess the data required for the development of the necessary background that will lead to the implementation of the design for the integrated management of municipal solid waste in the selected area of the Municipality of Tinos. In particular, the report focuses on the identification of needs and assessment of the current situation regarding the quantities and the management of solid waste at local level, laying the groundwork for the successful completion and implementation of the subsequent actions of the project.

Specifically, Chapter 2 includes general information on the geographical location of the Municipality of Tinos, in the Prefecture of South Aegean Region, as well as information on the new administrative division as it is nowadays defined under the Plan "Kallikratis". Chapters 3 and 4 describe the natural and built environment of the Municipality of Tinos, respectively, in order to depict the main features on the geomorphology, climatology, seismic activity, hydrogeology, flora-fauna as well as demographic and economic data of the region. Chapter 5 presents the data regarding the origin, the quantity and the composition of municipal solid waste and special waste streams generated in the Municipality of Tinos. The same chapter also describes the current waste management practices including information relevant to the collection, transport, treatment and disposal of waste. Finally, Chapter 6 presents the general conclusions of the report and in Annexes I, II and III additional information is provided.
2. Study area of the project

2.1. Geographical location

Tinos is situated in the Aegean Sea and located in the complex of Cyclades. The closest islands are Andros in the northwest, while Delos and Mykonos are located in the southeast of Tinos. Moreover, it is the third largest island of Cyclades after Andros and Naxos, occupying a land area of approximately 197.04 square kilometers. The coastline has a rich and deep division, with many bays and headlands, with a total length of 114 km including the rocky islets ‘Kalogeroi’ at the northern edge and the islets Drakonisi, Prasonisia, and Planitis at the northern coast. The circumnavigation of the island, within short distance from the coast, is estimated to require a 37-mile voyage.

The capital of Tinos island is the town of Tinos (Chora), while the village of Pyrgos has been declared as the historic centre. Administratively, Tinos belongs to the Prefecture of the South Aegean (PSA). The following figure (Figure 2-1) shows the location of Tinos within the PSA, and a detailed map of the island where the capital (Tinos) and its historical centre (Pyrgos) are marked (http://www.tinosisland.gr; http://www.notioaigaio.gr/).

![Figure 2-1 Location of Tinos island in the PSA and detailed map (MoT, 2011)](image-url)
2.2. Administrative division of Tinos island

2.2.1. “Kallikratis” plan

The new administrative reform plan "Kallikratis" (Law 3852/2010, OG¹ A’ 87/07-06-2010) came into effect from 01.01.2011, with the aim of optimizing the local administration of the country. Tinos is a separate regional unit of the South Aegean region, and the only municipality of the regional unit. As a part of the 2011 “Kallikratis” government reform, the unit was created out of the former Cyclades Prefecture. Tinos, today, includes two municipal unities and a community, as follows:

- Municipal Unity (MU) of Tinos which occupies the southern part of the island (seat of the unity: Tinos (Chora))
- Municipal Unity (MU) of Exomvourgo which occupies the central part of the island (seat of the unity: Xinara)
- Municipal Unity of Panormos which occupies the northern part of the island (seat of the community: Pyrgos)

The new administrative division of the Municipality of Tinos is presented geographically in Figure 2-2 (MoT, 2011). According to “Kallikratis” plan, one (1) Municipal Commune of Tinos and twelve (12) Local Communes were formed, namely:

- Local Commune of Agapi
  - >> >> of Dyo Horia
- >> >> of Falatados
- >> >> of Kalloni
- >> >> of Kampos
- >> >> of Kardiani
- >> >> of Ktikados
- >> >> of Komi
- >> >> of Panormos
- >> >> of Steni
- >> >> of Triantaros
- >> >> of Ysternia

2.2.2. “Kapodistrias” plan

In accordance with the “Kapodistrias” plan (Law 2539/97, OG 244/A'/1997), Tinos, from 1997 until 2010, was divided into three autonomous municipalities: 1) the Municipality of Tinos, 2) the Municipality of Exomvourgo and 3) the Community of Panormos. The most important change was the unification of 35 inland villages, which formed the Municipality of Exombourgo. The other two unities preexisted almost with the same administrative structure (MI, 2011; http://www.tinosisland.gr).

¹ The abbreviation OG stands for the Official Gazette of Greece
As it can be observed by examining the island maps in Figure 2-3, the administrative division of the island, until 2010, was much more complicated and it is commonly accepted that this affected negatively the functionality of the local authorities, not only in the area under investigation but within the boundaries of the whole country. Therefore, the implementation of the new “Kallikratis” reform plan came to create more efficient and stable municipal authorities with important responsibilities at local level.

3. Natural Environment

3.1. Soil - Geomorphology

The terrain of the island is classified as mountainous, with a maximum altitude of 726 m and 61% of the total land area lying between 100 and 400 contour level. In order of decreasing height, the highest mountains are Tsiknias (726 m), located in the southeastern part of the island, followed by Myrovigilia (649 m) in the western section, Kechrovouni (604 m) and finally Xobourgo (558 m) in the central part of the island. The island has a very small percentage of forest cover and there are no large plains formed. The lowlands which constitute 29% of the total surface are mainly created at the mouth of the larger streams. At the northern part of the island, the plain of Kolympithra is found, where citrus and vegetable crops are cultivated.

The soil is characterized as rocky, with low organic matter content. Over the years, the increasing erosion phenomena have led to the reduction of its fertility. Soil degradation is also attributed to (a) the climate of the region where rainfall usually has the form of thunderstorms, as well as to (b) the poor vegetation. The majority of the island surface has steep slopes and numerous artificial terraces known as “kserolithia” have been developed to control the erosion. This artificial mechanism is widespread in the Cyclades and it is employed by farmers in order to enable the growing of crops in arid and steep slopes of the mountains.

Finally, the mineral wealth of the island is considerable, as in the long and steep mountain range which has direction from the northwest to the northeast, granite, slate, marble and serpentinite resources are found in great abundance (MoT, 2006; Maris & Marinos, 2004, http://www.hellenica.de).
3.2. Climatology - Meteorology

Tinos island experiences a Mediterranean climate (Köppen climate classification: Csa) which is generally characterized by cool summers, with temperatures rarely exceeding 37 °C and mild winters, with the thermometer rarely descending to zero. From a meteorological and climate perspective, the year is divided into two seasons: the cold season, which lasts from October through March and the warm season, which lasts from April until September. Chart 3-1 shows the average, maximum and minimum monthly temperature of the area based on data collected from the meteorological station of Naxos.

The wind, on the island of Tinos, is drier exhibiting relative humidity values of approximately 65-70% versus 70-75% comparing to other Cycladic islands. According to the Hellenic National Meteorological Service (HNMS), throughout the year, northerly winds prevail, reaching a peak intensity of 9.9 - 15.8 knots (kt) (HNMS, 2010). Specifically, during the cold season the prevailing winds blow from the north and northeast directions, while during the warm season the ‘Annual Northern Winds’, known as ‘Meltemia’ which are a common feature of the Cycladic Complex prevail (Theoharatos, 1978; Katsoulis, 1970; Leonidopoulou, 2008; MoT, 2006; www.tinosisland.gr).

Moreover, the monthly rainfall ranges from 0.5-18.0 cm in summer and 34.7-70.3 cm in winter. These quantities do not favor the development of surface water or the replenishment of groundwater aquifers (HNMS, 2010).

![Chart 3-1 Monthly temperatures recorded in Tinos island for the period 1958 – 2010 (HNMS, 2010)](image)

3.3. Seismic activity

Tinos island belongs to a zone with a weak seismic activity. According to the seismicity map of the Cyclades region shown in Figure 3-1, during the period 1950 until 2003, there were numerous earthquakes recorded with magnitude greater than 3.0 between Santorini and Amorgos, many earthquakes recorded in the area between Kythnos and Syros and fewer between Milos and Kimolos (map on the left). Furthermore, in the area between Santorini and Amorgos, epicenters with
magnitude above 4.0 were reported. Based on the map on the right, the epicenters marked were the result of a strong earthquake (7.5 units of the magnitude scale of Richter) which occurred on July 9, 1956, at 03:11. Since then, no other incident of similar intensity has been noted (Leonidopoulou, 2008).

![Seismicity map of Cyclades](image1)

**Figure 3-1** Seismicity map of Cyclades for the period 1950-2003, distinguishing values greater than 3.0 (on the left) and above 4.0 (on the right), according to the magnitude scale of Richter (Leonidopoulou, 2008)

### 3.4. Hydrogeology

The hydrographic network which is characterized by the locality, the size and shape of the water streams depends on the physiographic features of the basin (i.e. morphological, soil and vegetation characteristics). The hydrographic network of the Municipality of Tinos has a complex structure which is attributed to the particularities of the draining basins due to the geological and tectonic features of the area. The prevailing direction of the network, on the island of Tinos, is NE-SW and consists of 314 sections, which in turn account for 16 rivers - streams, as they are depicted on the maps in Figure 3-2 (Malamos et al, 2008; Anagnostou et al, 2009).

![Hydrographic network of Tinos](image2)

**Figure 3-2** Hydrographic network of the island of Tinos (Malamos et al, 2008; Anagnostou et al. 2009)
3.5. Flora – Fauna

Despite the poor vegetation covering the island, there are various rare and interesting plant species presented. Bushy plants like cedars (Cedrus), myrtle (Myrtus communis), oaks (Quercus coccifera L.), sedges (Spartium junceum) and various other plants suitable for tea and cooking as sage (Salvia officinalis), mountain tea (Sideridis raeseri), wild chamomile (Anthemis cotula), fennel (Foeniculum vulgare), ‘agriomenta’ (Mentha spicata), oregano (Origanum onites), capers (Capparis spinosa), thyme (Thymus capitatus), etc. constitute the rich flora of the area under investigation.

Many mammals such as rabbits (Oryctolagus cuniculus), badgers (Meles meles), hare (Lepus capensis), hedgehogs (Erinaceus concolor), monk seal (Monachus monachus *), various birds, including pigeons (Columba livia), partridge (Alectoris chukar), ravens (Corvus corax), gulls (Larus cachinnans/audouinii) and amphibians and reptiles, including slow worm (Cyrtopodion kotschyi), crocodile (Agama stellio mykonensis *), spitofida (Elaphe situla *), water snakes (Natrix natrix), turtles (Mauremys caspia rivulata *) and vipers (Vipera ammodytes meridonallis *) are included in the fauna of the island.

Moreover, the island serves as a transit station for various migratory birds (quail, ducks, etc.) from September until February (http://www.tinos.biz/; http://www.exombourgo.gr/).

[* Endangered species - CORINE 1988]

3.6. Natural landscapes – Protected areas

The island of Tinos includes areas which are under protection, defined by the related local, national and European legislation. From the abovementioned areas, three (3) are protected by international networks (NATURA, CORINE) and two (2) of them have been designated as Landscapes of Particular Natural Beauty (L.P.N.B.) (see Figure 3-3) (NTUA, 2011).

The names, the relevant reference codes, the surface area covered and the main characteristics of the protected environmental assets found in the island of Tinos, are presented in the following table (Table 3-1).
### Table 3-1 Details of protected areas on the island of Tinos (NTUA, 2011; Kykladesnews.gr, 2011)

<table>
<thead>
<tr>
<th>TYPE OF AREA</th>
<th>CODE</th>
<th>CATEGORY</th>
<th>SITENAME</th>
<th>SURFACE (ha)</th>
<th>PRIORITY OF PROTECTION</th>
<th>FEATURES</th>
<th>COLOURED/HIGHLIGHTED AREA</th>
</tr>
</thead>
<tbody>
<tr>
<td>NATURA biotope</td>
<td>GR4220019</td>
<td>SCI *</td>
<td>TINOS: MYRSINI - AKROTIRIO LIVADA</td>
<td>1949.1</td>
<td>-</td>
<td>Uninhabited part of the island, without tourism activities, with standing and running water, riparian vegetation, forest of oaks and plane trees, bush, protected species: mammals, reptiles, amphibians</td>
<td>PINK</td>
</tr>
<tr>
<td>NATURA biotope</td>
<td>GR4220031</td>
<td>SPA **</td>
<td>VOREIOANATOLIKI TINOS KAI NISIDES</td>
<td>5055.95</td>
<td>-</td>
<td>Uninhabited part of the island, without tourism activities, with standing and running water, riparian vegetation, forest of oaks and plane trees, bush, protected species: mammals, birds, reptiles, amphibians</td>
<td>PINK</td>
</tr>
<tr>
<td>L.P.N.B. ***</td>
<td>AT5011031</td>
<td>-</td>
<td>VOLAKAS TINOU</td>
<td>485.14</td>
<td>Primary</td>
<td>Protected settlement/Historical buildings: Bare rocks, inland cliffs, heathlands, grassland</td>
<td>GREEN</td>
</tr>
<tr>
<td>L.P.N.B. ***</td>
<td>AT5011032</td>
<td>-</td>
<td>CHORA TINOU</td>
<td>18.72</td>
<td>Secondary</td>
<td>Historic Place and Buildings, State under Special Governmental Protection</td>
<td>GREEN</td>
</tr>
<tr>
<td>CORINE biotope</td>
<td>A00060031</td>
<td>-</td>
<td>EKSO MERIA &amp; VORIOANATOLIKI TINOS</td>
<td>5578.01</td>
<td>Primary</td>
<td>Uninhabited part of the island, Mediterranean features, protected species: mammals, birds, amphibians, reptiles</td>
<td>YELLOW</td>
</tr>
</tbody>
</table>

*SCI: Sites of Community Importance  
**SPA: Special Protected Areas  
***L.P.N.B.: Landscapes of Particular Natural Beauty
3.7. Other environmental sites of archaeological importance

Following, the most important natural monuments and sites of archaeological and historical importance found on the island of Tinos are listed below.

- **Natural monuments**: Mygospilia or Kameni Spilia, Gastria’s Cave, Vrekastrou Cave, Fournakion Cave, Voulismenon Cave, Kithara Cave, Drakolaka Cave, Spilias Cave, Mourounia Cave, Koufagreli Cave, Krouftres Cave, Panormos Cave, Kamara Cave.

- **Archaeological sites and monuments**: Poseidon and Amphitrite Sanctuary at Kionia, Xobourgo, Prehistoric settlement in Vryokastro, Mycenaean tombs near Kardiani and St. Thekla, Pigeon (Tsonos & Mpazini, 2005).

4. Built Environment

4.1. Demographic data

According to the most recent General Population Census of May 2011 which was conducted by the Hellenic Statistical Authority (EL.STAT.), the permanent population on the island of Tinos was 8,590 inhabitants. Table 4-1 below gives data on the demographic change observed on the island for the last seventy years, while Table 4-2 includes demographic data for the PSA and the Municipality of Tinos which is the project study area. It can be observed that the population density of the Municipality is less than the respective density value concerning the national level (44.17 versus 81.75 inhabitants per square kilometer) (G.S. of Aegean & I.P., 2011; EL.STAT., 2011a)

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Population</td>
<td>11380</td>
<td>10187</td>
<td>9273</td>
<td>8232</td>
<td>7730</td>
<td>7747</td>
<td>8574</td>
<td>8590</td>
</tr>
<tr>
<td>Change (%)</td>
<td>-24</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>10.7</td>
<td>0.19</td>
</tr>
<tr>
<td>Population density (inhab/sq.km.)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>39.32</td>
<td>42.02</td>
<td>44.17</td>
</tr>
</tbody>
</table>

Table 4-2 Data retrieved from the General Population Census in 2011 (EL.STAT., 2011a)

<table>
<thead>
<tr>
<th>Administrative division</th>
<th>Total number of inhabitants</th>
<th>Men</th>
<th>Women</th>
<th>Permanent population density (inhab/sq.km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greece</td>
<td>10,787,690</td>
<td>5,303,690</td>
<td>5,484,000</td>
<td>81.75</td>
</tr>
<tr>
<td>Prefecture of the South Aegean</td>
<td>308,610</td>
<td>155,990</td>
<td>152,620</td>
<td>58.38</td>
</tr>
<tr>
<td>Municipality of Tinos</td>
<td>8,590</td>
<td>4,270</td>
<td>4,320</td>
<td>44.17</td>
</tr>
</tbody>
</table>

Based on the official results from the Censuses of Greece, the population of the island of Tinos had been constantly declining from 1940 to 1981. From 1981 until 1991, a minor increase was noted, whereas from 1991 to 2001 the population growth rate was around 10.7%. During the decade from 2001 to 2011 the total number of inhabitants showed no significant change (8590 inhabitants in 2011 over 8574 in 2001). It should be mentioned that the rate of population decline was halted and the main responsible for this was the rapid development of the tourism industry, as well as the significant improvement of the island’s infrastructure.
4.2. Economic data – Productive Sectors – Employment

The following illustrations, Table 4-3 and Chart 4-1, present data concerning the share of the PSA in the total GDP of the country for the period 2008-2009. As it can be observed, the contribution of the South Aegean Region in the total GDP of Greece remains unchanged for the period 2008-2009, and equal to 3.3% (EL.STAT., 2011b).

Table 4-3 Gross Domestic Product (GDP) (EL.STAT., 2011b)

<table>
<thead>
<tr>
<th>GDP (million €, current prices)</th>
<th>2008</th>
<th>Contribution to the country’s GDP (%)</th>
<th>2009</th>
<th>Contribution to the country’s GDP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefecture of the South Aegean</td>
<td>7,815</td>
<td>3.3</td>
<td>7,788</td>
<td>3.3</td>
</tr>
<tr>
<td>Greece</td>
<td>236,917</td>
<td>100</td>
<td>235,017</td>
<td>100</td>
</tr>
</tbody>
</table>

In 2009, the average per capita GDP in Greece amounted to 20,830 €, recording a decrease of 1.2%. According to the latest figures published by Eurostat, the average per capita GDP in Greece has reached 94.3% comparing to the respective average value of the European Community. Specifically, it is noted that the highest per capita GDP was recorded in PSA, which amounted to 25,290 €, surpassing the corresponding value of the whole country. The regions of Attica (24,884 €) and Central Greece (22,534 €) are coming next, while the lowest per capita GDP appeared in the regions of Eastern Macedonia and Thrace, Epirus and Western Greece. The variations of this important indicator of the production system of the region that calculates the wealth produced within and presented in Chart 4-2 (Eurostat, 2012).

Similarly, with respect to the Gross Value Added (GVA) indicator of the whole country, an increase of 0.4% was observed. The changes observed regarding the sectors of the economy of the PSA region and the contribution of the area per sector to the country’s GDP is given in Table 4-4. More specifically, in the Southern Aegean region, GVA of the primary sector showed a slight increase of 0.6%. The GVA in the secondary sector was significantly reduced by 5.2%, while the tertiary sector GVA increased by 1.8%. It can be also mentioned that the tertiary sector contributed by a 85.7% share to the total GVA for the Region of South Aegean, a fact which suggests that the Municipality of Tinos is one of the areas of the country that is
highly and almost exclusively economically dependent on the tertiary sector. In more detail, tourism accounted for 24% of the gross product of the Region and resulted from providing services of hotels and restaurants, achieving the highest proportion among the other prefectures of the country. Indicatively, it should be mentioned that, within the PSA 34% of overnight stays of foreigners are recorded, while the highest proportion of overnight stays per inhabitant is achieved as well (EL. STAT., 2011b).

Even though, the Prefecture of the South Aegean displayed the highest per capita GDP, the region had at the same time the high unemployment rates for the year 2009, occupying the third place after the regions of Western Macedonia and Western Greece, at a rate equal to 15.0% which is mainly due to the economic crisis in Greece and the elongation of the recession, but also because of the seasonal character of the employment (INE/GSEE-ADEDY, 2010).

Furthermore, the sectors of agriculture, livestock production and fisheries are the traditional sectors of economic activity in PSA, since the development of tourism is seasonal. The main agricultural products are annual crops, animal feed and certain vegetables and fruit. In terms of economic value, the most important permanent crops are wine grapes, citrus fruit and olive trees. Further organization is needed in order to exploit the animal and plant resources in an effective way to meet the market demand in local level, but also consider the possibility of exporting products (EL. STAT., 2011b; MoT, 2006).

![Chart 4-2 per capita Gross Domestic Product for the year 2009 (EL. STAT., 2011b)](image)

<table>
<thead>
<tr>
<th>GDP</th>
<th>Primary sector</th>
<th>Secondary sector</th>
<th>Tertiary sector</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefecture of the South Aegean</td>
<td>2.4%</td>
<td>2.4%</td>
<td>2.3%</td>
</tr>
<tr>
<td>Greece</td>
<td>3.1%</td>
<td>3.1%</td>
<td>18.1%</td>
</tr>
</tbody>
</table>
5. Origin, quantity and composition of MSW in the Municipality of Tinos

The objective of the present chapter is to portray a clear picture concerning the quantitative and qualitative composition of municipal waste generated within the Municipality of Tinos and describe the applied practices of treatment and management of the various MSW streams. In order to record the current state of MSW management and define the nature of solid waste produced on the island, the most recent data included in the RWMP of the South Aegean Prefecture, information collected after direct communication with the competent bodies of the island and related scientific studies concerning the study area were taken into consideration.

5.1. Municipal solid waste

The largest portion of MSW comes from household waste. Additionally, waste generated from a variety of other activities (eg. agricultural and manufacturing production, the tourism industry, etc.) that resemble household are also included in the MSW. Moreover, this category incorporates waste produced from public services, institutions, schools, retailers, accommodation units, industrial plants, street cleaning services and public spaces. Finally, waste from public gardens and parks (eg. prunings, leaves, vegetables), a part of waste related to sanitary units, non-hazardous industrial solid wastes which are similar to those generated by household (kitchen waste, restaurant food waste etc.) are considered as MSW.

The ‘European Waste Catalogue and Hazardous Waste List\(^2\)’ is a harmonised list of wastes. It is periodically reviewed on the basis of new knowledge and, in particular, of research results, and if necessary revised in accordance with Article 18 of Directive 75/442/EEC\(^3\). However, the inclusion of a material in the list does not mean that the material is a waste in all circumstances. Materials are considered to be waste only where the definition of waste in Article 1(a) of Directive 75/442/EEC is met. Wastes included in the list are subject to the provisions of Directive 75/442/EEC except where Article 2 (1)(b) of this Directive applies. The different types of wastes in the list are fully defined by the six-digit code for the waste and the respective two-digit and four-digit chapter headings (USEPA, 2002). Especially, in the European Waste Catalogue (EWC) (Decision 2001/118/EC\(^4\)) the municipal waste and similar waste are characterized by the code 20 - some waste streams which are collected separately are excluded. The following table (Table 5-1) is part of the EWC involving the reference code 20 and includes the different types of municipal waste. Note that the wastes marked with an asterisk are considered as potentially hazardous waste and as a consequence they do not comply with the framework of the present study. Therefore the management of this waste is regulated under the relevant provisions of the legislation on hazardous waste.

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\(^2\) European Waste Catalogue and Hazardous Waste List – Valid from 1 January 2002


Similarly, the table below (Table 5-2) shows the types of packaging materials according to the EWC. Note that the waste listed with an asterisk are considered potentially hazardous waste and do not comply with the framework of this study.
15 WASTE PACKAGING; ABSORBENTS, WIPING CLOTHS, FILTER MATERIALS AND PROTECTIVE CLOTHING NOT OTHERWISE SPECIFIED

15 01 packaging (including separately collected municipal packaging waste)
15 01 01 paper and cardboard packaging
15 01 02 plastic packaging
15 01 03 wooden packaging
15 01 04 metallic packaging
15 01 05 composite packaging
15 01 06 mixed packaging
15 01 07 glass packaging
15 01 09 textile packaging
15 01 10* packaging containing residues of or contaminated by dangerous substances
15 01 11* metallic packaging containing a dangerous solid porous matrix (for example asbestos), including empty pressure containers

5.2. Quantities of municipal solid waste

Based on the Regional Waste Management Plan (RWMP) prepared for the Southern Aegean region, in 2008, Table 5-3 shows the estimated quantities of MSW, both for the Municipality of Tinos as well as for the PSA. The areas are listed according to the new administrative division (‘Kallikratis’ plan) and the former one (‘Kapodistrias’ plan).

<table>
<thead>
<tr>
<th>MUNICIPALITIES</th>
<th>MSW of permanent population</th>
<th>MSW of visitors</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>tonnes/year</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Amorgos</td>
<td>935</td>
<td>159</td>
<td>1,094</td>
</tr>
<tr>
<td>Anafi</td>
<td>137</td>
<td>2</td>
<td>139</td>
</tr>
<tr>
<td>Andros</td>
<td>2,066</td>
<td>48</td>
<td>2,114</td>
</tr>
<tr>
<td>Korthi</td>
<td>1,281</td>
<td>0</td>
<td>1,281</td>
</tr>
<tr>
<td>Hydroussa</td>
<td>1,688</td>
<td>101</td>
<td>1,789</td>
</tr>
<tr>
<td>Antiparos</td>
<td>522</td>
<td>86</td>
<td>607</td>
</tr>
<tr>
<td>Thira</td>
<td>6,259</td>
<td>2,310</td>
<td>8,569</td>
</tr>
<tr>
<td>Oia community</td>
<td>619</td>
<td>97</td>
<td>716</td>
</tr>
<tr>
<td>Ios</td>
<td>925</td>
<td>455</td>
<td>1,380</td>
</tr>
<tr>
<td>Kea</td>
<td>1,216</td>
<td>70</td>
<td>1,286</td>
</tr>
<tr>
<td>Kimolos</td>
<td>387</td>
<td>0</td>
<td>387</td>
</tr>
<tr>
<td>Kithnos</td>
<td>809</td>
<td>14</td>
<td>823</td>
</tr>
<tr>
<td>Milos</td>
<td>2,400</td>
<td>229</td>
<td>2,630</td>
</tr>
<tr>
<td>Mikonos</td>
<td>4,689</td>
<td>2,833</td>
<td>7,522</td>
</tr>
<tr>
<td>Naxos</td>
<td>6,082</td>
<td>1,116</td>
<td>7,198</td>
</tr>
<tr>
<td>Naxos &amp; Small Cyclades</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
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<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-3 MSW generated in the Prefecture of the South Aegean (estimated quantities) (PSA, 2008)
Deliverable 1-1: Report on the existing situation concerning solid waste management in the Municipality of Tinos – Extended summary in English

According to the studies of RWMP of 2008, on the island of Tinos with 8,590 inhabitants (Census 2011) it is estimated that 4,314 tonnes of waste were produced by the permanent population and 402 tonnes by visitors. Overall, the amount of solid waste on the island amounted to 4,715 tonnes. Furthermore, across the region of PSA 238,555 tonnes of waste were generated, of which 184,756 tonnes resulted from activities of the inhabitants and 53,798 tonnes due to visitors. The average rate of MSW production, resulting from these data, corresponds to 1.87 kg/capita/day or 682.55 kg/inhabitant/year. Of the total MSW generated in PSA, it is noteworthy that the quantities of discarded packaging material accounted for a percentage equal to 59%.

Furthermore, it is important to mention that the quantities of MSW produced within the study area, vary significantly throughout the year, since the developed tourism industry has a strong effect on the waste production. According to data provided by the Municipality of Tinos (2011), the volume of MSW per year is calculated 48 cubic meters/day in winter and 93 cubic meters/day during the summer time. In addition, appropriate coefficients of variation of seasonal waste generation regarding the average annual production for the Municipality of Tinos are presented in Table 5-4. These coefficients are determined from systematic measurements of waste disposed in the Municipality of Naxos.

<table>
<thead>
<tr>
<th>Season</th>
<th>Coefficient of variation</th>
<th>Production of MSW for 2008 (kg/inhabitant/day)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Winter</td>
<td>1.10</td>
<td>1.66</td>
</tr>
<tr>
<td>Spring</td>
<td>1.01</td>
<td>1.52</td>
</tr>
<tr>
<td>Summer</td>
<td>0.96</td>
<td>1.45</td>
</tr>
<tr>
<td>Autumn</td>
<td>0.90</td>
<td>1.36</td>
</tr>
<tr>
<td>Average annual</td>
<td>1.00</td>
<td>1.50</td>
</tr>
</tbody>
</table>

Other parameters that affect the production rate of MSW in an area are the following:

- Geographic features (urban, rural area)
- Socio-economic conditions (standard of living, household size, consumption patterns, etc.)
Regarding the evolution of MSW in PSA, the RWMP also includes the estimated and projected annual production of MSW expressed in units of “tons per year” in the region, for the years 2008-2038, which is summarized in Table 5-5 (PSA, 2008). The estimates in Table 5-3 are associated with the evolution of the production of MSW in PSA based on the fact that during the decade 1991-2001 there was a significant population growth recorded (19.8% in the Cyclades prefecture and 10.6% for the Municipality of Tinos) which resulted in an annual increase (3.5%) of the waste produced. However, the situation has changed considerably during the period 2001-2011 due to:

- significant reduction in the rate of population increase (0.72% for the Cyclades prefecture and 0.59% for the Municipality of Tinos)
- economic downturn occurred in Greece is expected to further reduce the production rate of MSW since the purchasing power at national level has decreased significantly and
- preventive measures regarding MSW production, information and awareness of the public can lead to a progressively reduction of MSW.

Given the above conditions, the expected increase in MSW in PSA is not expected to exceed the 1.2% rate which is similar to other European countries (Karagiannidis, 2012).

Table 5-5 Estimated quantities of MSW of the PSA region for the years 2008-2038 (PSA, 2008)

<table>
<thead>
<tr>
<th>PREFECTURE OF THE SOUTH AEGEAN</th>
<th>ANNUAL PRODUCTION OF WASTE (tonnes/year)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Production rate of MSW (%)</td>
<td></td>
</tr>
<tr>
<td>Cyclades Prefecture</td>
<td>3.54</td>
</tr>
<tr>
<td>Municipality of Tinos</td>
<td>66,785</td>
</tr>
<tr>
<td>Dodecanese Prefecture</td>
<td>4,715</td>
</tr>
<tr>
<td>TOTAL</td>
<td>238,555</td>
</tr>
</tbody>
</table>

5.3. Composition of municipal solid waste

There is no information available for the Municipality of Tinos regarding to the composition of MSW generated in the area. For this reason, data included in the RWMP for the PSA (RWMP of 2005 & 2008) were analyzed. The results were based on measurements conducting during the weighing of the incoming waste quantities at the landfill of Northern Rhodes. Therefore, the categories of materials that exhibit the greatest contribution are as follows:

- The organic fraction in PSA accounted for approximately 28.50%
- The plastic materials were discarded at a rate of about 20.68%
- Cardboard/paper amounted to 27.68% of the total mass of MSW
- Glass displayed share of about 7.10%
- Other groups involved, contributed from 0.38 to 4.08%.
5.4. Current practices of municipal solid waste management

Currently, there are not any treatment facilities operating in the Municipality of Tinos or safe waste disposal sites, even though the authorized RWMP of 2005 for the region foresees the construction of controlled landfills for safe disposal of MSW. In addition, the updated but not authorized RWMP of 2008 foresees the separation at source of MSW and the composting of biowaste in closed systems.

5.4.1. Safe disposal practices

The Municipality of Tinos, in December 2011, launched a contest entitled "Study and design of a controlled landfill site for Tinos". This study has been included in the National Strategic Reference Framework (NSRF) for funding. The construction and operation of the landfill in Tinos in conjunction with the closure and restoration of the uncontrolled landfills will ensure public health and protect the natural environment (Municipality of Tinos, 2012).

5.4.2. Restoration of uncontrolled landfill sites

The closure and restoration of the existing and uncontrolled disposal sites are the main objectives of RWMP of the South Aegean Region. Within the PSA, there are 88 illegal disposal sites. According to the updated records of the Ministry of Environment, Energy and Climate Change, there are 18 active uncontrolled landfills in the PSA. For most of them, their closure and restoration have been officially recommended by the Operational Programme ‘Environment and Sustainable Development’ for the South Aegean Prefecture (MEECC, 2011). The following uncontrolled waste disposal sites are found in the Municipality of Tinos.

- Uncontrolled landfill ‘Dyo Horia’. Inactive site, in the MU of Tinos, which has been restored, and it is expected to be certified by a competent committee.

- Uncontrolled landfill ‘Aspro Klisma’. Inactive site, M.U. of Panormos, which has obtained the authorization for restoration since 2009 (degree of risk 20).

- Uncontrolled landfill ‘Marmaries - Kokkina’. Inactive site, which is licensed for restoration (risk level 59). There are approved conclusive studies for the restoration of the site, which should be updated and modified.

- Uncontrolled landfill ‘Faneromenis’. Inactive site, M.U. of Panormos. A decision is expected for its pause and a technical study for environmental remediation should be prepared.

- Uncontrolled landfill ‘Tsiknias’. Active site, in the M.U. Exomvourgo. The decision for its closure has been taken by the PSA (No. of the Decision: ΑΔΑ ΒΟΖΛ7ΛΞ-ΡΗΩ 31/01/2012). The technical study for the environmental remediation has been carried out and has been sent for approval in order to obtain a restoration licence.

The restorations of the uncontrolled landfill sites of ‘Marmaries – Kokkina’, ‘Faneromeni’, Tsiknias’ and the relevant technical studies have been included for funding for a proposed amount of 1,300,000 euros in the Operational Programme ‘Environment and Sustainable Development’ (PSA, 2012).
5.4.3. Collection and transport of municipal solid waste

For the collection of MSW, the majority of bins used have a 1,100 liter capacity and serve for the temporary storage of mixed waste which are then collected mechanically by vehicles, usually of mill type. Moreover, within the M.U. of Tinos, where the production of waste is higher comparing to other parts of the island, waste containers (of 10 – 20 cm³ capacity) are available along with the necessary type of vehicles for their collection and transport. For special cases, such as bulky waste or packaging waste, there is another waste collection vehicle to collect this type of solid waste within the town. Finally, for the regular cleaning of the collection bins, there is a suitable vehicle operating which performs the decontamination of the containers. Given the fact that there is no scheme encouraging the separate collection of waste and in particular the collection of biowaste, a high frequency of waste collection is required, especially in the summertime, as shown in Table 5-6.

The Cleaning Department of the Municipality of Tinos is consisted of 16 permanent employees, who are responsible for collecting and transporting the waste produced in the area. During the summer, when the highest loads of MSW are recorded, the permanent workforce is reinforced by employing 20 additional persons.

<table>
<thead>
<tr>
<th>Municipal Units of the Municipality of Tinos</th>
<th>Frequency of MSW collection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Winter season</td>
</tr>
<tr>
<td>M.U. Tinos</td>
<td>Bins: twice per day,</td>
</tr>
<tr>
<td></td>
<td>6 days per week</td>
</tr>
<tr>
<td></td>
<td>Container: once per week</td>
</tr>
<tr>
<td>M.U. Exomvourgo</td>
<td>Once per day,</td>
</tr>
<tr>
<td></td>
<td>6 days per week</td>
</tr>
<tr>
<td>M.U. Panormos</td>
<td>Once per day,</td>
</tr>
<tr>
<td></td>
<td>6 days per week</td>
</tr>
</tbody>
</table>

5.5. Management of Special Waste Streams on Tinos island

In this subchapter, based on the existing legal framework, the solid, non-hazardous waste which are excluded from the category of MSW, as defined in paragraph 5.1 above, and their respective management practices operating in the region are described. The special waste streams considered are:

1) Waste of Electrical and Electronic Equipment (WEEE)
2) Batteries and accumulators
3) End-of-life vehicles (ELVs)
4) Used tires
5) Waste from excavation, construction and demolition activities (C& D waste)
6) Sludges from waste water treatment facilities
7) Agricultural and livestock residues
8) Ship-generated waste

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6 Data collected after personal communication with the Cleaning Services Department of Tinos Municipality
5.5.1. Waste of Electrical and Electronic Equipment (WEEE)

The national targets for separate collection of WEEE is 4 kg/inhabitant/year or 44,000 tons/year, including specific percentages regarding the degree of recovery, reuse and recycling of this waste stream, ranging from 50-80% by minimum average weight per unit depending on the category of the equipment. In Greece, the annual production of WEEE from private households is estimated at approximately 200,000 tonnes. The generated quantities of WEEE are equivalent to an average of 18 kg/inhabitant/year. The average annual production of WEEE in PSA reaches about 5,555 tonnes. Under current legislation, the collection targets have been met; as the collected amount of WEEE was 46,337 tonnes in 2010 (see Chart 5-1) (Appliances Recycling S.A., 2012).

![Chart 5-1](http://www.bianatt.gr/)

Regarding the Municipality of Tinos, it must be noted that there is a three-year contract with the competent body, which came into effect from July 15, 2009. In PSA, there are 85 available WEEE collection points, and for the case of Tinos, there are two points of collection and transport. In particular, the containers are placed one (1) in the M.U. of Tinos and one (1) in the M.U. of Exomvourgo. Moreover, there are also 20 boxes available for the collection of lamps. The quantities of WEEE collected from Tinos island as well as from the entire PSA are transported to processing units in Attica (VIANATT S.A.\(^7\), Aspropyrgos) and Agioi Theodoroi in Corinth (Hellenic Recycling Center S.A., \(^8\), Ag. Theodoroi Corinth).

For the collection of larger quantities from the area of the South Aegean and especially the Cyclades prefecture, the WEEE Recycling Centers plan to extend the collection points in cooperation with the Municipalities and other industrial establishments, including shops selling electronic equipment and lamps. The establishment of a new, more extended, supply network in the region of Cyclades will also help to tackle the objective difficulties of handling the specific waste.

\(^8\) Hellenic Recycling Center S.A. More information available at: [http://www.ekanrecycling.gr/](http://www.ekanrecycling.gr/)
5.5.2. Batteries

The total quantity of portable batteries and accumulators at national level for the year 2008 amounted to approximately 43,400 tons/year of which 33,500 tons/year were collected and taken for recycling (MEECC, 2011d). In these figures, 41,000 tons/year of vehicle batteries and industrial batteries are included and 2,100 tons/year of portable batteries and accumulators. In Greece, in 2011, the competent company for the alternative management of portable batteries and accumulators, AFIS S.A.9 had placed a total of 56,500 collection bins a figure that in absolute numbers is the second largest after Germany. To this point precisely lies the success of the AFIS S.A. collective system. The collection of portable batteries and accumulators in the Cyclades Prefecture and the Municipality of Tinos were equal to 8.41 and 0.80 tons for 2011 (Table 5-7).

Moreover, the Alternative Management system for batteries, "SYDESYS SA”10, from 2008 until today lists more than 232 collection points in Cyclades region, of which 50 points are located on the island of Tinos. At these points, "SYDESYS SE" has freely supplied the appropriate bins for temporary storage and performs collections regularly of used nickel - cadmium and lead-acid batteries. It should also be noted that where required, the corresponding manuals for handling batteries have been distributed without extra cost.

Table 5-7 Evolution of collected portable batteries and accumulators and capacity collection bins in the Cyclades and the Municipality of Tinos (Municipality of Tinos, 2011)

<table>
<thead>
<tr>
<th>Year</th>
<th>Annual No. of Collection bins in Cyclades</th>
<th>Cumulative No. of collection bins in Cyclades</th>
<th>Quantities of collected portable batteries and accumulators (tons)</th>
<th>Cyclades</th>
<th>MoT</th>
</tr>
</thead>
<tbody>
<tr>
<td>2005</td>
<td>61</td>
<td>61</td>
<td>0.08</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>2006</td>
<td>150</td>
<td>211</td>
<td>1.46</td>
<td>0.15</td>
<td></td>
</tr>
<tr>
<td>2007</td>
<td>187</td>
<td>398</td>
<td>3.13</td>
<td>0.31</td>
<td></td>
</tr>
<tr>
<td>2008</td>
<td>181</td>
<td>579</td>
<td>5.28</td>
<td>0.51</td>
<td></td>
</tr>
<tr>
<td>2009</td>
<td>144</td>
<td>723</td>
<td>7.85</td>
<td>0.64</td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>94</td>
<td>817</td>
<td>7.43</td>
<td>0.75</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>75</td>
<td>892</td>
<td>8.41</td>
<td>0.80</td>
<td></td>
</tr>
</tbody>
</table>

5.5.3. End-of-life vehicles (ELVs)

Nationally, in 2011, 116,596 ELVs were led to the appropriate points of collection, treatment and recycling. The network of collection centers, spread in 35 provinces of the country, includes 56 sites and 15 collection points. The operation of the alternative management EDOE SA has helped to surpass the 80% target set by the European Union.

According to official data of the RWMP of South Aegean and from the population of the region (2.76% of the country), the annual quantity of ELVs is estimated approximately at 1,500 vehicles. In the Cyclades

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9 AFIS S.A. - The company was founded in March 2004 with the aim to organize a collective alternative management system for portable batteries and accumulators. More information available at: http://www.afis.gr/

there are two (2) ELV collection points, authorised EDOE, which started operating in early 2011 and is affiliated with the Center for Recycling "Recycling Ltd. Tsivolas" which is located in Kalivia, Attica. Specifically, according to collected information, in 2011, the company "Tsivolas Recycling Ltd" received 35 vehicles from Paros and Syros, which came from Tinos. The following tables (Table 5-8 & Table 5-9) present data on the quantity of recycled ELVs and the points of delivery of such vehicles by residents of Tinos (EDOE, 2012). Note that it is not a rare phenomenon to abandon ELVs in the islands of the country, given the high cost of transporting a vehicle by ship. This fact acts as a constraint on its delivery to licensed collection points, especially during periods of absence of financial incentives to purchase new vehicles, as nowadays.

Table 5-8 Data per year of recycled ELVs for Tinos (EDOE, 2012)

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. recycled ELVs from the Municipality of Tinos</td>
<td>0</td>
<td>0</td>
<td>40</td>
<td>3</td>
<td>56</td>
</tr>
</tbody>
</table>

Table 5-9 Points for recycling ELVs and corresponding quantities for Tinos Municipality (EDOE, 2012)

<table>
<thead>
<tr>
<th>Point of delivery from Tinos residents</th>
<th>No. ELVs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Siros (Αλιφραγκής Νικόλαος)</td>
<td>40</td>
</tr>
<tr>
<td>Paros (Εμμανουήλ Πατέλης – Μ. Σπανού ΟΕ)</td>
<td>1</td>
</tr>
<tr>
<td>Attica</td>
<td>15</td>
</tr>
<tr>
<td>Total (for 2011)</td>
<td>56</td>
</tr>
</tbody>
</table>

5.5.4. Used tires

In Greece, in 2010, the quantities of collected used tires amounted to 41,522 tons. The largest percentage of the collected tires was utilized (95% or 43,957 tonnes) and only 0.5% (282 tons) was stored and subsequently exported for reuse. Nationally, there are eleven (11) tire processing units, as shown in Table 5-10. It is important to note that the rates of recovery and recycling of old tires meet and exceed their specific objectives set out in existing legislation.

According to the RWMP of the South Aegean Region (2008), the estimated production quantity of used tires was approximately 3,000 tonnes per year, and on the basis of «Ecoelastika SA" for the year 2011, 575 tons were collected for recovery. Within the Municipality of Tinos, the majority of tire repair shops are affiliated to the company Ecoelastika S.A. More specifically, used tires can be collected from 13 collection points (tire repair shops, garages, scrap vehicles, etc.) on the island.

Table 5-10 Units for processing used tires, authorized by Ecoelastika S.A. (Ecoelastika, 2011)

<table>
<thead>
<tr>
<th>SITENAME</th>
<th>LOCATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>ΑΞΕΛ ΕΠΕ</td>
<td>Magoula, Attica</td>
</tr>
<tr>
<td>ΕΛΒΑΝ ΑΒΕΕ</td>
<td>Aspropyrgos, Attica</td>
</tr>
<tr>
<td>ΕΒΙΑΝ ΑΒΕΕ</td>
<td>Inofyta, Viotia</td>
</tr>
<tr>
<td>ΚΑΡΑΜΠΑΣ ΑΒΕΕ</td>
<td>Livanates, Fthiotida</td>
</tr>
<tr>
<td>ΗΕΛΕΣΙΣ ΑΕ</td>
<td>Industrial Zone of Komotini</td>
</tr>
<tr>
<td>ΗΕΡΚΟ ΑΕ</td>
<td>Industrial Zone of Patra</td>
</tr>
<tr>
<td>TRIAS –HOLCIM</td>
<td>Vratza District, Bulgaria</td>
</tr>
</tbody>
</table>
Ecoelastika through affiliated partners collects used tires from specific collection points on the island and forwards them to the final space utilization. Since 2007 he is a frequent gathering on the island of Tinos. The total amount of used tires which were collected each year is given in Table 5-11. The management of lubricating oil is provided by "GREEK ENVIRONMENTAL TECHNOLOGY SA" (EL.TE.PE, Aspropyrgos - National Collective Alternative Management for used oils).

<table>
<thead>
<tr>
<th>Year</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quantity of used tires in the MoT (tonnes)</td>
<td>135.11</td>
<td>78.52</td>
<td>54.22</td>
<td>19.88</td>
<td>40.42</td>
</tr>
</tbody>
</table>

5.5.5. Construction & Demolition waste (C&D waste)

Across the country, the quantities of such waste are important (4.5 million tonnes for the year 2002). The amount of C&D waste in Greece is estimated at 5.5 million tonnes in 2005 excluding excavation waste. The quantities produced in PSA amounted to 175,000 thousand tons annually. It is important to note that so far the management of C&D waste is not fully controlled due to the absence of accurate data related to volumes and loads going to landfills or illegal dump sites. Specifically, for the island of Tinos, it is estimated that the production of C&D waste reaches 4,925 tons per year.

5.5.6. Sludge management

Until now, in PSA, the volume of sludge generated from the WWTP receives no special treatment, apart from partial evaporation and then disposal with municipal waste. Regionally, the overall objective for the proper management of sludge from wastewater treatment is primarily to safeguard the environmental principles of operation of the WWTP and then exploit it to reduce the rate of disposal (PSA, 2008). For the Municipality of Tinos, it is estimated that the quantity of sludge produced is approximately 1,100 tonnes per year considering that the produced sludge (total solids 20%) is equal to 0.36 kg per capita per day (NTUA, 2010).

5.5.7. Agricultural waste

In PSA, it is estimated, according to the RWMP of 2008, that waste from agricultural activities amount to approximately 43,000 tons/year. More specifically, the island of Tinos, where the arable land covers 7.02% of the island, the quantities of agricultural and livestock waste reach 2,973 tons/year (Municipality of Tinos, 2011).

5.5.8. Ship-generated waste

Concerning the district of Tinos, the Port Authority has a contract from 7/12/2009 with the company Hellenic Environmental Center HEC - Kondylis Coast Piraeus. This contract is expected to be renewed for an additional period of two (2) years. However, the Convention has not yet been implemented because the
waste does not remain on the island of Tinos, but they are transferred to Rafina or Piraeus (http://www.hec.gr/).

6. Conclusions

Currently, within the Municipality of Tinos there are not any treatment facilities operating or safe disposal sites for MSW and is a key priority of the competent authorities in both central and local level to take actions in order to pause and restore the uncontrolled disposal sites. Given the above conditions, it is a major and urgent need to solve the problem of MSW management in the Municipality of Tinos.

The design of an integrated solid waste management plan in a selected community of the Municipality of Tinos and the pilot project, as foreseen by the following actions of the project ISWM-TINOS, will be an important initiative towards rational and sustainable management of MSW at municipal level. To this end, the report successfully incorporated all the information required for the recording of (a) the current state of the environment (natural and built environment) and (b) the sources, quantity and composition of MSW (including special waste streams) and their relevant management systems operating within the area of the Municipality of Tinos.
7. References


Ecoelastika (2011) Available at: http://www.ecoelastika.gr/


Hellenic Environmental Center S.A. Available at: http://www.hec.gr/


Katsoulis, D.V. (1970) The anemologic conditions in the Aegean Sea, PhD thesis written in Greek, Athens


Law 2539/97, OG 244/A’/1997: N. 2539/97 (ΦΕΚ 244/t.A’/1997) ‘Establishment of Local Authorities’


Municipality of Tinos (MoT) (2011) Data from presentations during the launching event of the “ISWM-TINOS” project, October 2011, Tinos island


http://www.afis.gr/
http://www.bianatt.gr/
http://www.ekanrecycling.gr/
http://www.eltepe.gr/
http://www.exombourgo.gr/
http://www.hellenica.de/Griechenland/Geo/GR/Tinos.html
http://www.houmas-sa.com/
http://www.notioaigaio.gr/
http://www.tinos.biz/
http://www.tinosisland.gr