

Reference case for the Region of Eastern Macedonia and Thrace (REMTH)

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1 Introduction

The knowledge of the whole framework of a solid waste management system is crucial for the appropriate assessment of the available options to process and handle the waste. Consequently in this chapter a brief background regarding the Municipal Solid Waste (MSW) management system in the Region of Eastern Macedonia and Thrace (REMTH) is given.

The Region of EMTH has an official Regional Waste Management Plan (RWMP 2009) that was approved by the General Secretary of REMTH on 03/09/2009. The RWMP provides strategic goals, as well objectives, regarding the solid waste management in the Region of Eastern Macedonia and Thrace. More especially, for the management of Municipal Solid Waste (MSW) there are guidelines and plans for utilization of Transfer Stations (TS) for transferring MSW, for utilization of Material Recycling Facilities (MRF) thus enhancing the levels of recycling of waste packaging material, for utilization of central treatment facilities to treat the whole amount of MSW through mechanical-biological treatment and finally for the landfilling of residue.

2 Demographics and Waste Production

2.1 Location, Population

The region of Eastern Macedonia – Thrace (REMTH) lies in the North East part of Greece. REMTH is divided in five Regional Units with a total of 22 municipalities. The five Regional Units of REMTH are Drama, Kavala, Xanthi, Rodopi and Evros with the main respective municipalities being Drama, Kavala, Xanthi, Komotini and Alexandroupolis. The rest of the municipalities are rural based. In REMTH also the two islands/municipalities of Thasos and Samothrace are included.

The total population of REMTH is approximately 610.000 inhabitants. More specifically according to results of 2001 population census and to the preliminary results of 2011 population census the inhabitants can be seen in Table 1..

Table 1: Population in REMTH

Regional Unit	2001 Population census (inhabitants)	2011 Population census (preliminary results - inhabitants)
Drama	103.975	98.540
Kavala	145.054	138.200
Evros	149.354	147.530
Xanthi	101.856	110.290
Rodopi	110.828	111.610
REMTH - Total	611.067	606.170

Source: ELSTAT

2.2 Waste streams and quantities

2.2.1 Quantity of MSW

In REMTH the existing data based on weighbridge data logger are very scarce, not accurate and unreliable. For this reason, the waste quantities are estimated according to the Regional Waste Management Plan of the Region of Eastern Macedonia – Thrace (RWMP, 2009).

The estimation is based on the daily production rate of Municipal Solid Waste (MSW) per inhabitant. This rate is estimated as 1,40 kg per inhabitant per day (365 days/year) for the main municipalities of REMTH (e.g. Drama, Kavala, Xanthi, Komotini, Alexandroupoli) and as 1,14 kg per inhabitant per day (365 days/year) for the rest municipalities of REMTH. The number of inhabitants is the one of the

2001 Greek population census. Also an annual increase of 1,5% in the waste amounts of 2001 is assumed. The estimation is a fair enough approximation of the real waste quantities produced. This is verified by sample weighing of the MSW collection vehicles.

Based on the above-mentioned estimations total MSW waste produced is about 320.000 tonnes for year 2010.

2.2.2 Composition of MSW

The MSW has many fractions that include organics (putrescibles), recyclable materials, such as: paper/cardboard, plastics, metal and glass, as well other materials such as textile, wood, rubber, leather, rocks, hazardous materials and other. The waste composition according to RWMP is presented in Table 2.

Table 2: Composition of MSW (%w/w) in REMTH according to RWMP 2009.

Waste Fraction/ Regional Unit	Drama (%)	Evros (%)	Kavala (%)	Xanthi (%)	Rodopi (%)	Average (%)
Putrescibles < 40mm	23,8	18,7	21,3	23,7	28,6	23,2
Putrescibles >40 mm	25,2	24,8	24,6	23,7	14,7	22,6
<i>Putrescibles total</i>	<i>49,0</i>	<i>43,5</i>	<i>45,9</i>	<i>47,4</i>	<i>43,3</i>	<i>45,8</i>
Paper/Cardboard	15,2	19,0	12,8	11,2	18,3	15,3
Plastics	15,2	19,2	17,0	13,4	17,8	16,5
Metal	1,9	1,7	2,5	7,6	3,7	3,4
Glass	3,9	3,7	7,6	2,8	3,5	4,3
Diapers	5,4	6,7	4,7	7,0	7,4	6,2
Textile-Wood-Rubber-Leather	3,9	3,6	6,2	7,5	5,0	5,2
Rocks-Gravel	2,9	1,6	2,6	2,3	0,5	2,0
Hazardous Material	1,9	0,5	0,4	0,3	0,3	0,7
Miscellaneous	0,9	0,7	0,5	0,5	0,2	0,5
<i>Total</i>	<i>14,9</i>	<i>13,1</i>	<i>14,3</i>	<i>17,6</i>	<i>13,4</i>	<i>14,7</i>
Total	100,0	100,0	100,0	100,0	100,0	100,0

2.3 Present waste management system

In this paragraph the current waste management system and practices in REMTH is presented. REMTH has an officially approved local waste management plan (RWMP 2009). RWMP sets goals and provisions for the number and type of facilities for waste management. Nonetheless, not all of the planned facilities have been constructed. For example, RWMP sets the goal of constructing and using fifteen (15) Transfer Stations for MSW so as to facilitate the transferring of MSW from municipalities towards two (2) central Integrated Waste Management Units (IWMU) for MSW treatment. Currently

the use of two (2) Transfer Stations has been initiated. That is the TS in the island of Samothrace and the TS of Ferres since of the year of 2011. This was feasible with the close cooperation of DIAAMATH and the respective municipalities of Samothrace and Alexandroupolis. Also currently the two IWMU have not been constructed and are in the planning phase.

Another example is the goal of RWMP to enhance the recycling of packaging material and processing the MSW in waste treatment facilities. So there is provision of six (6) Material Recycling Facilities (MRF) but only one (1) of them is currently in operation. That is the MRF of Alexandroupolis which is in operation since the summer of 2010. The MRF of Alexandroupolis serves the three municipalities of Alexandroupoli, Komotini and Samothrace. As a result, today in REMTH the recycling of waste packaging material (“rest recyclables bin”) is practised only in three (3) municipalities from the twenty two (22) municipalities of REMTH.

Consequently, the management of the rest of the MSW in REMTH is mainly based in the practice of landfill. For this purpose, the three (3) already existing sanitary landfills (SL) are utilized. These are the SL of Kavala, the SL of Xanthi and the SL of Komotini. Thus, the currently utilized infrastructure of MSW management is depicted in Figure 1.

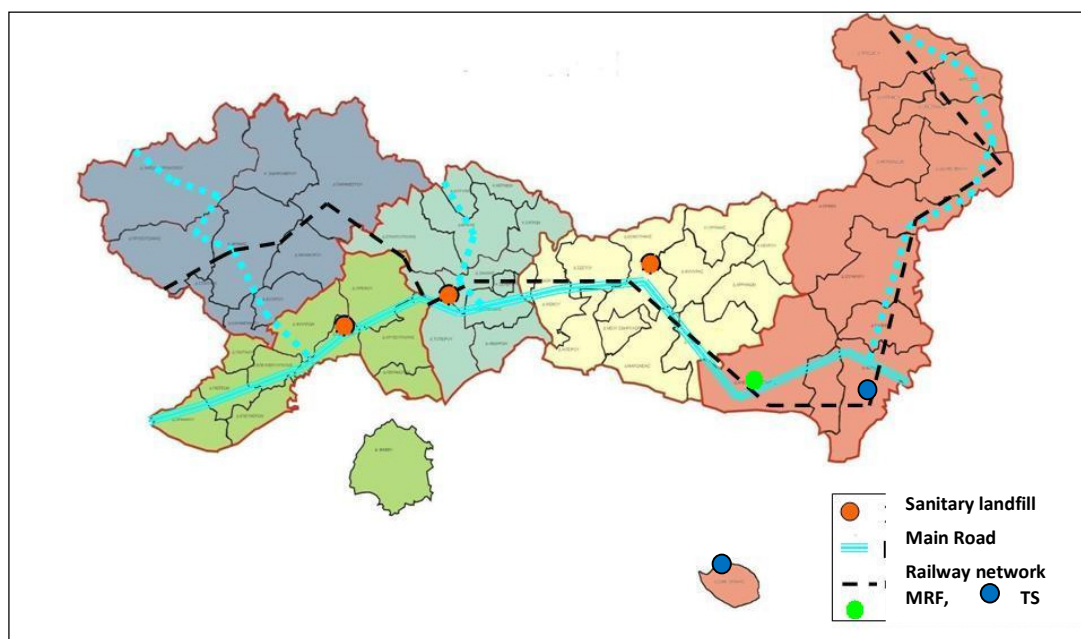


Figure 1: Currently utilized infrastructure of MSW management in REMTH.

It should be mentioned that the recycling of special types of solid wastes, such as end of life vehicles, tyres, waste of electrical and electronic equipment (WEEE), batteries etc, is practiced extensively in the whole Region of EMTH.

2.3.1 Current Recycling levels

Current recycling levels of MSW refer mainly to recycled packaging material. In REMTH packaging material is recycled since June 2010 in the cities of Komotini and Alexandroupolis through the “blue bin” for all recyclable materials of MSW (paper, glass, metal, plastic). Since 2011 the municipality of Samothrace is also participating in the blue bin system. The collected materials are headed towards the Material Recycling Facility (MRF) of Alexandroupolis. For the year of 2010 a total amount of 1.407 tonnes of recyclable materials were recovered. Projected annual results, if the MRF was in operation from January 2010, are in the order of 2.800 tonnes of recyclable materials. In correspondence with the estimated produced quantities of recyclable materials of MSW (paper/cardboard, plastics, metal, glass) this reflects to a recycling level of ~14%.¹

Regarding the organic fraction of Municipal Solid Waste (OFMSW) it should be mentioned that currently in REMTH there is no treatment of it. Thus, there is no recycling of the OFMSW or “Green” waste, for example through a composting process (aerobic treatment).

Appropriate systems for the collection and management of other special wastes (batteries, end of life vehicles, tyres, electrical and electronic equipment, etc) are operational and cover every municipality in REMTH. Recycling levels of special wastes (2010) are shown in Table 4.

Table 3 Quantities of special wastes recycled in 2010 in REMTH

	Evros	Drama	Kavala	Xanthi	Rodopi
End of Life Vehicles (tn)	1.460	702	278	362	-
Tyres (tn)	480	519	507	349	215
WEEE - Waste of Electrical & Electronic Equipment (tn)	253	240	347	589	95
Batteries (tn)	7	4	7	37	3
Motor-Oil waste (tn)	230	198	358	176	468

¹ =2800 tonnes/((100.273inh*1,4kg/inh/d*365d/year/1000kg/tn)*(15,3%+16,5%+3,4%+4,3%)=(2800/((51240)*39,5%))

3 Reference Case

3.1 Waste quantity and composition used in the Tool

3.1.1 Waste Quantity and Composition, future projections

In REMTH the majority of municipalities are rural based. Also the consumption patterns are influenced by the financial crisis and austerity measures in the Greek economy since 2009. Taking in consideration this context, it is assumed that the evolution of the waste quantity per material is going to be steady and uniform with an increase of 1,5% every year.

Table 4: Foreseen evolution of waste quantity.

Regional Unit / Year	2011	2016	2021	2026
Drama	54.999	59.250	63.829	68.762
Kavala	76.743	82.674	89.063	95.947
Evros	77.092	83.050	89.469	96.383
Xanthi	54.155	58.341	62.850	67.707
Rodopi	58.650	63.183	68.066	73.326
REMTH - Total	321.640	346.498	373.277	402.125

The composition that has been used for the 1st period is the one presented in Table 2. Due to the fact that the change in waste composition is rather difficult to foresee, an assumption was made that for the rest of the 5-year periods (totally the Tool requests data for for periods of five years each), a steady annual increase of waste production is reaches 1,5%, equal for all the different “ingredients” (organics, paper, etc), of the waste.

3.1.2 Rest of data

The reference case depicts the current situation in terms of MSW management in REMTH. Therefore, landfilling of MSW the dominant activity. In this reference or blank scenario, recycling activities are considered too as limited to be considered.

The Software is “free” to decide only upon the selection of transfer stations. So, the software initiates the operation of transfer stations in the period that is considered mostly appropriate and with a capacity also chosen by the Tool.

Approximate cost figures inserted in the model to depict the economies of scale applying in REMTH, with regards to Transfer Stations, are shown in Table 5.

With regards to sanitary landfills the default parameters for investment and operational cost were used.

Table 5: Approximate capital cost figures of the Transfer Stations

MSW management infrastructure	Capital Cost (buildings)	Capital Cost of machinery	Capital Cost (sum)
TS	€	€	€
Drama	233.700,00 €	424.592,00 €	658.292,00 €
K. Neurokopi	509.086,03 €	424.592,00 €	933.678,03 €
Eleftheroupoli	389.347,95 €	424.592,00 €	813.939,95 €
Thassos	416.407,24 €	424.592,00 €	840.999,24 €
Kavala	440.824,34 €	424.592,00 €	865.416,34 €
Chrysoupolis	463.632,77 €	424.592,00 €	888.224,77 €
Xanthi	198.474,00 €	424.592,00 €	623.066,00 €
Myki		424.592,00 €	424.592,00 €
Komotini	248.600,00 €	424.592,00 €	673.192,00 €
Sapes	424.182,98 €	424.592,00 €	848.774,98 €
Samothrace	484.249,59 €	424.592,00 €	908.841,59 €
Feres	447.125,65 €	424.592,00 €	871.717,65 €
Didymoteicho	251.300,00 €	424.592,00 €	675.892,00 €
Byssa	441.447,88 €	424.592,00 €	866.039,88 €
Soufli	326.707,57 €	424.592,00 €	751.299,57 €

The estimation of the operating cost is based on cost-benefit analysis of all TS of Regional Units of Drama, Kavala and Xanthi. It is noted that the estimation of the operation of the TS is without the cost of transportation (Table C7).

Table 6: Approximate operational cost figures of the Transfer Stations

	Operating Cost €/year
TS	
Drama	2.087.323,95 €
K. Neurokopi	158.215,74 €
Eleftheroupoli	664.153,54 €
Thassos	271.368,64 €
Kavala	1.734.754,05 €

Chrysoupolis	428.262,24 €
Xanthi	1.855.509,24 €
Myki	355.544,70 €
Komotini	2.061.982,99 €
Sapes	332.958,19 €
Samothrace	21.484,73 €
Feres	274.894,34 €
Didymoteicho	874.373,34 €
Byssa	350.145,98 €
Soufli	269.495,61 €

3.1.3 Results

The model, has resulted into 11 solutions for this “reference case” scenario, that are presented in the “Pareto front”, below. Solution 1, is the least costly but results in the highest emissions. When one moves from solution 1 to solution 11, less emissions are produced but the cost increases as a result for the construction and operation of more transfer stations.

