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MUNICIPAL SOLID WASTE COSTS: A COMPARATIVE ANALYSIS OF LOCAL AUTHORITY POLICIES IN ATTICA

Katia Lasaridi[1], Margarita Kehagioglou[1], Dimitris Komilis[2] and Antonis Rovolis[1]*
1. Department of Geography, Harokopio University, 70 El. Venizelou, 176 71, Athens, Greece
2. Department of Environmental Engineering, Dimokritio University of Thrace, Greece

Abstract

This paper presents the results from a comparative study of municipal solid waste (MSW) costs and respective management practices of the municipal authorities in Attica, Greece. Data on MSW collection, transport and disposal as well as their costs, from 33 municipalities of the largest region of the country were collected through a questionnaire survey. The annual waste production of the municipalities examined ranged from 50 (Antikithira) to 511,000 tn/yr (municipality of Athens), while the total waste management cost ranged from 41 (Helioupolis) to 184 €/tn (Amarousio). The MSW management costs are determined by a number of factors, including their quantity and composition, collection and transportation systems, treatment and final disposal methods, etc. A number of efficiency indicators are also estimated for each municipality in terms of solid waste disposal policy. Finally, an attempt to identify the causal factors for the differentiation of municipal costs is made, without underestimating the restrictions of the current analysis originating from the lack of reliable waste production data and full cost accounting systems.

Key words: Municipal solid waste (MSW), waste management, cost analysis, urban economics, economic geography

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[*] To whom correspondence should be addressed, tel.: +30 210 9549164, fax: +30 210 9514759, E-mail: klasaridi@hua.gr

1. Introduction

Waste management is rapidly becoming a major social and political issue all over the world, involving both developed and developing countries. Especially within the EU, solid waste management issues have been regulated since 1975, with the Waste Framework Directive (75/442/EEC) which constitutes one of the first pieces of environmental legislation in the Community. Since the '90s however, the EU waste policy and legislation is becoming increasingly demanding, setting high standards for the waste treatment and disposal facilities and specific quantitative targets for recycling, recovery and diversion from landfilling of a series of waste streams (COM, 2005a). This legislation stems from the need to protect the environment, though the development of sustainable waste management systems, based at large on the so-called "waste hierarchy" (Figure 1) which promotes waste prevention, re-use, recycling and energy recovery and requires safe final disposal of whatever residual waste is left, as the last option (COM, 2005a; Panagiotakopoulos, 2002).

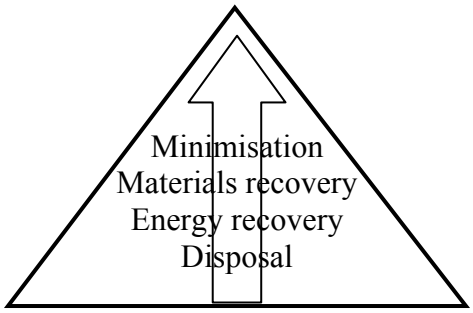

Figure 1. Schematic representation of the Waste Management Hierarchy.

Successful design and implementation of waste management policies requires reliable waste statistics, including cost data. Waste data should cover a sufficiently long time period, of over a decade, with relatively high measurement frequencies and their collection should follow standard and statistically valid methods. However, this type of data is not available in Greece, especially at the level of local authorities, where the largest part of waste management activities and costs occur.

The MSW management costs at the local level are determined by a number of factors, including the geographical location of the municipality, its population, economic, social and cultural characteristics, as well as the waste quantity and composition, the structure and efficiency of the collection and transportation systems, the treatment and final disposal methods, e.t.c. (Kreith 1994; Panagiotakopoulos, 2002; Tchobanoglous *et al.,* 1993). In Table 1 a brief review of the literature, illustrating the variability of the cost of the different components of a MSW management system, is presented (Koushki *et al.,* 2004).

The higher ranking of sustainable development in the waste management policy is driving waste management costs to substantially higher levels. This is particularly true for those Member-States with less developed waste management systems, which will need to introduce large changes to their waste management practices in order to comply with the EU requirements (COM, 2005b; EUNOMIA, 2002; Wilson *et al.*, 2001). Most Mediterranean countries and new Member-States, as well as some of the most developed EU countries (the UK and to some extend Italy and France), fall under this category, facing great challenges to transform their waste management systems, while keeping cost increases to a minimum (COM, 2005b; Read, 1999; Price, 2001). As there is a number of local factors influencing costs, data from the literature can not be globally used and specific case data are needed for proper planning. In this context, it is particularly important to study the cost components of the existing waste management systems of Greek local authorities, to

derive efficiency indicators and identify the factors affecting cost variations, in order to improve the economic efficiency of those systems and provide savings that will partially cover the expected cost increases. It is well established that solid waste management constitutes one of the major Municipal expenditures, globally. Moreover, little work has been carried out to investigate in which ways local authorities are responding to the new waste management agenda, being set by the EU and the corresponding national strategies (Read, 1999).

Table 1: Geographical variation of typical costs of MSW management components (Koushki *et al.,* 2004).

City / State / Country	***MSW management component cost (US$)***			
	Landfilling	***Collection & transport***	***Incineration***	***Total MSW management***
USA	10–80/ton	3.5/ton mile	-	-
Thailand	-	2.9–10.4/ton	-	-
Canada	80–120/ton	-	-	-
Kuwait	-	24.0/ton	-	-
Hong Kong	11.3/ton	-	-	-
Florida	55.1/ton	16.6/ton	-	-
New York City	-	-	-	143/ton
Philadelfia	55.2/ton	48.5/ton	52.5/ton	-
Fairbanks, Alaska	-	11.60/month/HH	-	$1.0x10^6$/year
Munster, Indiana	-	120.4/ton	-	174/ton

The aim of this paper was to collect data on waste management practices and costs, calculate and analyse the different cost components (i.e. capital vs operational, collection and transport vs treatment and disposal) and identify possible causal factors of cost differentiation for different municipalities of the largest region of the country, Attica, where the capital is located. Attica was selected as it is often considered the leading region of the country in the implementation of waste management plans and has relatively well organized local authorities, while it still provides a large variation in municipalities' population.

2. Brief overview of MSW management in Greece

MSW production in Greece has been increasing at about 3% annually during the last decade, closely following the GDP (Table 2). The national average waste composition according to the official data is: putrescibles, 47.0%; paper and cardboard, 20.0%; glass, 4.5%; plastics, 8.5%; metals, 4.5%; and various, 15.5% (Anon, 2003). However, the waste composition may vary widely both geographically and temporally and this type of available data is very limited (Figure 1). Individual municipalities and whole cities do not have any data on the composition of their waste, severely limiting the ability of reliable planning for more complex waste management activities, such as recycling or even energy recovery. MSW produced in Greece are mainly disposed of in landfills (91.2%; of it, about 40% is disposed of to uncontrolled dumps or licensed sites with insufficient environmental protection measures, which need to be phased out and restored by the end of 2007, according to the commitments of Greece to the European Commission. Severe fines are expected if the country fails to fulfil its commitment, while the possibility of earlier fines for specific cases, e.g. Kouroupitos, can not be exluded). The rest 8.8% is recycled through both the formal and informal sectors (Anon, 2003), while the Kalamata composting plant was temporarily closed, as it did not comply with the environmental terms of its licence and the large Ano Liosia MBT (Mechanical-Biological Treatment) plant in Athens is still under pilot operation.

Table 2: MSW production in Greece (Anon, 2003; EUROSTAT)

Year	*Annual production (tones)*	*Waste Generation Rate (kg/ca/day)*
1985	3,000,000	0.82
1990	3,000,000	0.82
1991	3,105,000	0.83
1992	3,200,000	0.86
1997	3,900,000	1.02
1998	4,082,000	1.06
1999	4,264,000	1.11
2000	4,447,000	1.15
2001	4,559,000	1.17

Note: Data for 1985 and 1990 are not considered particularly reliable.

3. Data collection and analysis

3.1. Primary data collection

Primary data were collected through a questionnaire survey of the Municipalities of the Attica region, carried out in the period 2/5/2005-31/12/2005. An open type questionnaire was sent via fax to 120 municipalities and communities out of a total of 125 local authorities of the Attica Region, following an initial telephone communication with the person responsible for the waste management service of the authority (either the waste management vice-mayor or the director of the service) who would address the questionnaire to the most relevant person(s) to answer it. The five authorities that were not sent questionnaires were very small communities, which it has not been possible to contact. A repeated telephone follow up was made and in many cases it was followed by a visit to the local authority. 33 questionnaires (27.5% of the local authorities approached) were completed, corresponding to a population of approximately 2,200,000 people or 758,000 households (NSSG, 2001). The population covered is over 50% of the Attica population, as some of the largest municipalities, including Athens, have replied.

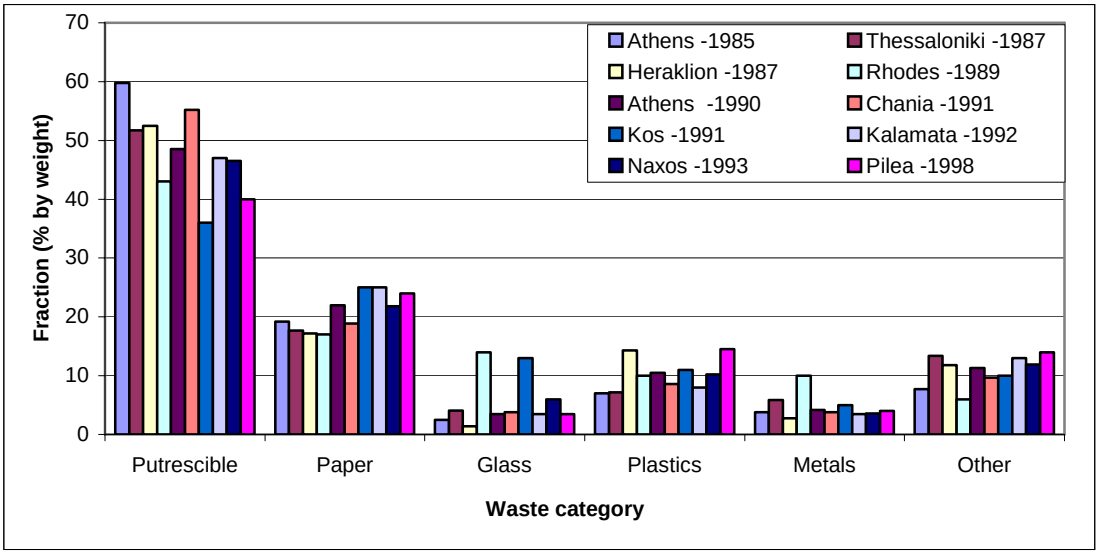

Figure 1. Regional and time variation of MSW composition in Greece (various sources, adapted from: Koufodimos and Samaras, 2002; Lasaridi *et al.*, 2006).

The questionnaire used contained questions regarding:
a) general data about the municipality, including demographic information
b) waste production, collection, transport, disposal and recycling,
c) available waste management infrastructure to the local authority (bins, vehicles, waste transfer stations etc),
e) number and categories of personnel involved in waste management, and
f) direct financial data (income from waste charges and estimates of waste management cost).

As most Local Authorities (LA) in Greece do not keep reliable waste management data and the organisational level of their waste management services may vary, some data collected from certain municipalities, and therefore the respective derived cost estimates, should be treated with care, as discussed in section 4.

3.2. Calculation of the waste generation rates

An individual question on the waste quantities generated in and collected by the local authority (these two quantities considered identical) was included in the questionnaire, noting whether this was an estimate or a measured value through vehicle weighing at the landfill. If the value came from weighing data, this was used as given. Otherwise, the quantity of waste generated annually was calculated on the basis of the weekly collection trips of each collection vehicle. As most local authorities do not posses regular weighing sheet data (although they should, according to the legislation – Ministerial decree 29407/3508/2002, FEK 1572B) in most cases waste quantities were indirectly calculated, using the following data which were recorded:

- Number, types and capacity of the collection vehicles.
- Number of weekly trips of each vehicle, in the winter and summer season (although for the local authorities of our sample there was no seasonal differentiation).

The waste quantity calculated in this manner was verified though a second calculation, according to the capacity of the temporary storage means (various types of bins) of the LA examined, and both values were compared to the estimate given by the authority in the questionnaire. If a variation of more than 15% was observed, the municipality was contacted for additional information and clarifications, which usually resolved the conflict. In the absence of weighing data, the values calculated through the capacity and trips of the collection vehicles are reported. In one case (Peristeri) the vehicle trips were not reliably recorded and the estimate of the waste management service on the quantities produced was used.

On the basis of the capacity of the collection vehicles, the density of the waste in the vehicles (and the bins) and their degree of fullness – as estimated in most cases by the drivers – the annual quantity of waste managed by the LA was calculated. The waste density in the vehicles was taken as 400 kg/m^3 while in the bins the value of 100 kg/m^3 was used (Panagiotakopoulos, 2002; Tchobanoglous *et al.,* 1993).

3.3. Cost classes and analysis

For the cost analysis of the waste management systems of the LAs examined, costs were classified to capital cost and operational cost. Each of these two cost categories were in turn classified into collection and transport cost (CTC) and disposal cost (DC). The cost data that were included in the questionnaire are presented in Table 3 (Panagiotakopoulos, 2002; USEPA, 1997).

The requested information regarding the capital cost components included the date of their purchase / acquisition. The transformation of the capital cost into the Equivalent Annual Cost (EAC) was made taking into account a depreciation rate (r) of 8% and the depreciation life span of each component of the system, as follows (Ossenbruggen, 1994; Panagiotakopoulos, 2002):

- n=8 years for vehicles, other machinery (tow tracks, tractors etc.) and bins,
- n=15 years for disposal site machinery, and
- n=30 years for the civil engineering works at the disposal site (excavations, lining, fencing etc.).

Table 3: Cost classes and components included in the questionnaire.

	Capital costs	***Operational costs***
Collection and transport cost	-Bins -Waste collection vehicles -Bin washing vehicles -Sweepers -Other vehicles (tow tracks, tractors, open tracks etc) -Other collection and transport equipment	-Gross salaries including employer insurance costs (drivers, workers, street sweepers, scientific and administrative personnel, etc.) -Fuels -Vehicle maintenance, lubricants, spares etc. -Vehicle insurance -Bin maintenance and repair -Collection and transport outsourcing / contracts
Disposal cost	-Access roads -Site configuration -Site infrastructure works -Civil engineering works (buildings, fencing, etc.) -Waste disposal machinery (font-end loaders, compactors, etc.)	-Gate fees -Salaries (workers, guards, etc.) -Utilities -Fuel, lubricants and maintenance of waste compaction vehicles -Daily waste coverage -Contracts for waste coverage, waste front configuration

For example, a waste collection vehicle, with 8 years life span, that was purchased in 1997 or earlier is considered to have an Equivalent Annual Cost equal to zero in 2005, the year of data collection and analysis. A collection vehicle that was purchased after 1997 at a cost of C euros will have an Equivalent Annual Cost in 2005 given by equation 1 (Panagiotakopoulos, 2002).

$$EAQ = C \times \left[\frac{r \times (1+r)^n}{(1+r)^n - 1} \right] \qquad \text{Eq. 1}$$

It should be mentioned that the last two components of the capital costs (other machinery and disposal site works) did not appear in any questionnaire, as most LAs of Attica are members of the Association of Municipalities and Communities of the Attica Region (AMCAR), which owns the landfill of Ano Liosia and therefore do not entail relevant capital costs. The two LAs of the sample not belonging to AMCAR also did not entail disposal capital costs as they use uncontrolled dumps (Oropos and Antikithira). The members of AMCAR pay gate fees, which are calculated as a percentage (currently 6%) of their annual state subsidy, two years before the year of charging. Their waste disposal cost is therefore independent of the quantity of waste produced. However, an index of "disposal cost per ton" was calculated for comparison among local authorities and with the estimated real landfill costs (Mavropoulos *et al.*, 2006).

As expected, in most questionnaires many cost components of Table 3 were not filled in detail, either because they were not relevant to the local authority (e.g. disposal components for AMCAR members) or were unknown. Where necessary, typical literature and market data were used for the relevant cost components (Table 4).

Table 4: Typical costs for equipment and personnel used in the absence of questionnaire data.

Item	***Typical cost value used (in €)***
Collection vehicle, 4-6 m^3	60,000
Collection vehicle, 8-12 m^3	85,000
Collection vehicle, 13-16 m^3	110,000
Collection vehicle, 18-20 m^3	140,000
Bin washing vehicle, small	72,000
Bin washing vehicle, medium	115,000
Bin washing vehicle, large	160,000
Street sweeper, small	56,000
Street sweeper, medium	101,000
Street sweeper, large	146,000
Truck, small	35,000
Truck, medium	65,000
Truck, large	96,000
Open truck	74,000
Front-end loader	100,000
Tow track	100,000
Bin, 1.1 m^3	340
Bin, 0.7 m^3	300
Bin, 0.66 m^3	250
Bin, 0.12 m^3	100
Drivers – collection workers (per person)	20,000
Street sweepers (per person)	19,000
Scientific personnel - engineers	24,000

3.4. Waste charges

The questionnaire contained also questions regarding the rates of the waste charges for homes and stores/offices, as well as the total revenue of the LA from the waste charges, in order to access to what extent it covers the calculated waste management cost. In Greece waste charges are calculated on the basis of the surface area of the property, and are collected through the electricity bill, having no connection with the actual amount of waste produced by the household or the business charged. Waste charges form the major part of the municipal charges, which also include street lighting. In this study waste charges were considered to cover 90% of the total municipal charges.

The local authorities may classify the property in their area into different classes (residences, offices, stores, etc) and define a different coefficient for each class. The product of this coefficient with the area of the property gives the annual municipal charge, which, according to the law, should result to a revenue for the LAs covering their costs for the waste management and lighting services provided. In Karagiannidis *et al.* (2006) an interesting analysis of the waste charging policy of Greek municipalities can be found.

4. Some empirical results

The characteristics and costs for MSW management vary among municipalities, not only due to geographic, demographic and organisational efficiency factors, but also due to differences in how cost and solid waste terms are defined (Metin *et al.,* 2003).

Table 5 shows that the annual waste production varies significantly between the different municipalities of the Attica region. Those with larger population tend to have higher waste production, as would be expected. Thus, the economic and social composition of the sample's municipalities does not determine waste production in absolute terms. The waste generation rate (i.e. the annual waste production per capita) shows a different pattern, in the sense that different municipalities are now in top of the list. The municipalities that produce the highest annual waste production per capita are Metamorphosi, Antikithira (Antikithira is a small island south of the Peloponesse peninsula but is considered as part of the Attica region due to historical-administrative reasons), and Moshato. The municipalities of this classification up to sixth place are working class. However, Hekali and Lykovrisi, municipalities with more affluent population can be found at the seventh and eighth place.

The same mixed picture appears if we look into the bottom of this classification: the last five places are taken up by three working class municipalities, a middle class one, and Amarousion, an upper class area, which has become one of the main business centers in Attica. The actual size of the municipality does not seem to play a critical role in annual waste production. For instance, the top twenty five municipalities have rather small size (below the average municipal area size). Aspropyrgos municipality, which is both densely populated and covers a large territory, does not have either per capita or per area high waste production. Again, it seems that the economic-social composition of the municipalities does not determine waste production per capita.

<<Insert table 5 here>>

There is also significant differentiation between municipalities in the cost management of solid waste. Total cost and its subcategories are presented in table 6. There are two subcategories of total cost: the first one (presented in the third and fourth columns) breaks down total cost to capital and operational cost. The last two columns present the second breakdown- of collection and transportation cost, and the final disposal cost. Again, Athens municipality has the highest total cost, as well as the highest in each subcategory.

There are some significant differences regarding the components of total cost across the different municipalities. Some municipalities appear to have high capital costs, in itself an indication that there was significant investment in recent years. In any case, the most important component of waste cost in capital and operational cost appears to be the latter. More interesting findings seems to be those from the second breakdown of total waste cost, in collection and transport cost on the one hand and final disposal cost on the other. One municipality, that of Oropos, appears to have only collection and transport costs.

<<Insert table 6 here>>

The last table offers the different categories of costs in per ton, capita, and household terms. The highest total and disposal costs per ton occur in Amarousion municipality. Metamorthoshi, a working class municipality, has the highest total cost per capita (and per household), as well as the highest collection and transport costs per capita (and per household). The highest collection and

transport cost per ton can be found at a central municipality of Attica, Kallithea. The lowest values for all costs categories, with the exception of disposal costs, occur in Helioupoli, municipality in the south of the metropolitan area of Athens.

<<Insert table 7 here>>

5. Conclusions

One of the main drawbacks of any waste management cost estimate at the local authority level in Greece is that it is not always clear how many of the personnel officially belonging to the waste management service of the authority actually work there. This problem stems from the practice of many local authorities to hire people for the waste management services in order to cover various personnel needs. This means that many of these employees will eventually end up working in a different department within the local administration while they will be classified as being employed in waste management. Furthermore, this also represents a long established clientelistic approach practiced across the range of local government in Greece, whereby people are recruited by the municipality in return for their vote.

Several policy issues arise in the light of the paucity of data and the empirical findings that show significant discrepancies between different municipalities in the Attica region. A current trend in the waste management services worldwide is the evaluation of the performance either of each waste service component separately or of the overall system. Benchmarking is widely spread in the evaluation of business performance and recently appears to be promoted also in the evaluation of public/municipal services (Anon, 2003; Bolli and Tarcq, 2001; Defra, 2000; Smeets and Weterings, 1999). Benchmarking of waste services is a tool for evaluating and comparing waste services of a specific municipality over time, as well as comparing different municipalities for the same reference year. Of course, benchmarking does not refer only to cost indicators, as different levels of service entail different costs. A municipality, for example, supporting an extensive source separation system is expected to have higher collection costs compared to another system which is offering only the standard commingled waste collection and disposal to an uncontrolled dump. The latter is cheaper (in short term monetary costs) compared to a well operated landfill and even more, compared to an integrated MSW system offering biological or thermal treatment of the waste. Therefore, differences in cost indicators such as cost per ton, per person or per household do not necessary reflect differences in the efficiency of service provision. However, all local authorities examined in this study offer the “standard” for Greece package of waste management services, which consists of waste collection, transport and disposal to a landfill (the Ano Liosia landfill for all the LAs examined except for Oropos and Antikithira). In this respect, cost differences may reflect to some extend a variation in service efficiency.

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Table 5: Annual and daily waste production.

Municipality	Annual waste production (tn/yr)	Waste generation rate (kg/ca/yr) or annual waste production per capita	(Daily) Waste generation rate (kg/ca/day)	Annual household waste production (kg/household/yr)	Annual production per area
Afidnai	1.775	444	1,22	1.532	58
Amarousion	34.706	289	0,79	843	2.651
Antikithira	50	1.111	3,04	2.000	2
Argyroupoli	14.990	468	1,28	1.399	1.822
Aspropyrgos	19.956	499	1,37	1.994	196
Athens	511.000	648	1,77	1.694	13.115
Daphne	14.600	605	1,66	1.668	10.618
Dionysos	3.650	664	1,82	2.340	170
Egina	8.500	669	1,83	1.926	97
Galatsi	36.879	461	1,26	1.342	9.160
Haidari	17.029	351	0,96	1.095	752
Hekali	5.000	769	2,11	2.643	1.154
Helioupoli	61.579	474	1,30	1.171	4.840
Kallithea	51.696	453	1,24	1.235	10.885
Keratsini	46.800	596	1,63	1.741	6.157
Kessariani	16.425	411	1,13	1.070	2.095
Korydallos	34.632	346	0,95	1.078	8.009
Lykovrisi	8.500	708	1,94	2.193	4.359
Mandra	7.486	588	1,61	1.984	36
Metamorphosi	32.850	1.194	3,27	3.875	5.971
Moschato	25.550	1.104	3,02	3.184	10.989
Nea Erythrea	14.901	596	1,63	1.806	3.084
Nea Smyrni	43.800	572	1,57	1.516	12.429
Nikaia	45.625	517	1,42	1.486	6.862
Oropos	7.300	1.022	2,80	3.357	610
Palaio Faliro	51.750	518	1,42	1.369	11.314
Papagou	11.680	649	1,78	1.773	3.461
Peristeri	146.000	995	2,73	2.975	14.527
Petroupoli	24.460	326	0,89	1.015	3.597
Rodopoli	1.296	624	1,71	2.189	136
Voula	13.520	386	1,06	1.148	1.469
Xalandri	51.830	432	1,18	1.259	5.383
Zographou	43.800	538	1,47	1.378	5.143
Average	**42.716**	**607**	**2**	**1.796**	**4.883**
Minimum	50	289	1	843	2
Maximum	511.000	1.194	3	3.875	14.527

Table 6: Total solid waste cost and its breakdown

Municipality	Total cost	Total cost		Total cost	
		Capital cost	Operational cost	Collection and transport cost	Final disposal cost
Afidnai	166.000	33.000	133.000	116.000	50.000
Amarousion	6.369.247	291.252	6.077.995	4.690.671	1.678.576
Antikithira	2.180	0	2.180	2.000	180
Argyroupoli	1.863.947	173.922	1.690.026	1.469.177	344.770
Aspropyrgos	2.222.126	311.573	1.910.553	1.876.982	345.144
Athens	59.440.402	3.220.317	56.220.085	47.822.414	11.617.988
Daphne	2.102.345	102.025	2.000.320	1.812.125	290.220
Dionysos	379.413	75.696	303.717	277.413	102.000
Egina	1.235.857	36.978	1.198.879	986.096	249.762
Galatsi	2.339.524	308.024	2.031.500	1.669.524	670.000
Haidari	1.662.604	0	1.662.604	1.206.840	455.765
Hekali	561.513	80.613	480.900	441.513	120.000
Helioupoli	2.496.914	507.427	1.989.487	1.782.587	714.328
Kallithea	9.054.230	327.137	8.727.092	7.721.137	1.333.092
Keratsini	3.790.335	237.182	3.553.153	2.713.935	1.076.400
Kessariani	2.088.089	268.398	1.819.691	1.679.089	409.000
Korydallos	2.609.833	224.781	238.502	2.069.781	540.052
Lykovrisi	1.086.704	66.204	1.020.500	891.204	195.500
Mandra	1.042.613	76.304	966.310	764.370	278.243
Metamorphosi	4.193.484	217.710	3.975.774	3.697.710	495.774
Moschato	1.862.217	133.121	1.729.096	1.515.121	347.096
Nea Erythrea	1.662.152	175.055	1.487.097	1.408.574	253.578
Nea Smyrni	3.899.582	219.641	3.679.941	3.312.641	586.941
Nikaia	4.704.810	366.186	4.338.624	3.646.650	1.058.160
Oropos	831.271	170.534	660.737	831.271	0
Palaio Faliro	3.613.547	314.662	3.298.884	2.914.546	699.001
Papagou	1.172.970	170.970	1.002.000	907.970	265.000
Peristeri	6.822.258	87.216	6.735.042	5.350.216	1.472.042
Petroupoli	2.403.475	339.475	2.064.000	1.880.475	523.000
Rodopoli	193.610	4.350	189.260	155.850	37.760
Voula	2.015.661	146.239	1.869.422	1.636.331	379.330
Xalandri	2.893.118	351.118	2.542.000	1.793.118	1.100.000
Zographou	3.368.427	415.721	2.952.706	2.453.888	914.539
Average	**4.246.984**	**286.449**	**3.895.487**	**3.378.704**	**866.765**
Minimum	2.180	0	2.180	2.000	0
Maximum	59.440.402	3.220.317	56.220.085	47.822.414	11.617.988

Table 7: Categories of total solid waste costs per ton, capita, and household.

Municipality	Total cost per ton	Total cost per capita	Total cost per household	Coll. & transport cost per ton	Coll. & transport cost per capita	Coll. & transport cost per household	Disposal cost per ton	Disposal cost per capita	Disposal cost per household
Afidnai	94	42	125	65	29	88	28	13	38
Amarousion	184	53	155	135	39	114	48	14	41
Antikithira	44	48	87	40	44	80	4	4	7
Argyroupoli	124	58	174	98	46	137	23	11	32
Aspropyrgos	111	56	222	94	47	188	17	9	34
Athens	116	75	197	94	61	159	23	15	39
Daphne	144	87	240	124	75	207	20	12	33
Dionysos	104	69	243	76	50	178	28	19	65
Egina	145	97	280	116	78	223	29	20	57
Galatsi	63	29	85	45	21	61	18	8	24
Haidari	98	34	107	71	25	78	27	9	29
Hekali	112	86	297	88	68	233	24	18	63
Helioupoli	41	19	47	29	14	34	12	5	14
Kallithea	175	79	216	149	68	184	26	12	32
Keratsini	81	48	141	58	35	101	23	14	40
Kessariani	127	52	136	102	42	109	25	10	27
Korydallos	75	26	81	60	21	64	16	5	17
Lykovrisi	128	91	280	105	74	230	23	16	50
Mandra	139	82	276	102	60	203	37	22	74
Metamorph.	128	152	495	113	134	436	15	18	58
Moschato	73	80	232	59	65	189	14	15	43
Nea Erythrea	112	66	201	95	56	171	17	10	31
Nea Smyrni	89	51	135	76	43	115	13	8	20
Nikaia	103	53	153	80	41	119	23	12	34
Oropos	114	116	382	114	116	382	0	0	0
Palaio Faliro	70	36	96	56	29	77	14	7	18
Papagou	100	65	178	78	50	138	23	15	40
Peristeri	47	46	139	37	36	109	10	10	30
Petroupoli	98	32	100	77	25	78	21	7	22
Rodopoli	149	93	327	120	75	263	29	18	64
Voula	149	58	171	121	47	139	28	11	32
Xalandri	56	24	70	35	15	44	21	9	27
Zographou	77	41	106	56	30	77	21	11	29
Average	**105**	**62**	**187**	**84**	**50**	**152**	**21**	**12**	**35**
Minimum	41	19	47	29	14	34	0	0	0
Maximum	184	152	495	149	134	436	48	22	74