

*Full Length Research Paper*

# Evaluation of the current condition of packaging wastes throughout Istanbul

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**Environmental problems that have been faced recently are differentiated in terms of their source and progress. Household wastes have increased in amount and variety due to improvements in life standards and technological issues. Disposal of wastes before they damage the environment especially concerns the environment and public health as well as the economy. Priority in waste management is regarded as prevention, minimization in source, reuse, recovery/recycling, pretreatment and disposal. Landfill facilities, solid waste transfer stations, medical waste incineration facilities, plants of electricity production from landfill gas and composting and recycling facilities are operated in Istanbul in compliance with the related legislations. In this way, the waste amounts decrease, recycling activities are performed and energy sources are produced from the solid wastes. The first level in 'waste management hierarchy' is to manage the wastes at their source so that it is very important to recycle them as much as possible in order to extend the working life of the landfill sites and prevent the loss of the recyclable economical values. This paper covers the evaluation of the current condition in packaging wastes in Istanbul and looks at the studies to establish a healthy recycling system.**

**Key words:** Waste management, packaging wastes, recovery, recycling.

## INTRODUCTION

Household waste management is crucial for the local authorities in developing countries. Integrated waste recycling systems are an effective way to reduce the problem for current and future waste management. Discovering the factors that affect the recycling performance is the key to reach a sustainable waste management (Suttibak and Nitivattananon, 2008). Rapid increase in population along with industrialization and urbanization cause a remarkable rise and change in waste amounts or varieties. In parallel to that rise, especially in big cities like Istanbul, one of the most important environmental problems that have been faced is household solid wastes. In the frame of EU conformity period, the search for new solutions is continuing in order to bring an economical meaning to the disposal of waste and minimize the damages to the environment instead of disposing waste in landfills. Packaging wastes are accepted as one of the primary environmental problems because they have a big volume and it is easier to recover them from nature. Social and economical changes have increased the usage of packaging materials. Therefore, reuse and recycling of the

packaging wastes and also consider them as a source for producing energy is an important issue to protect the nature and reduce the waste amount in landfill sites (Akçay et al., 2010). The first level of 'waste management hierarchy' is to manage the wastes at their source and this covers minimizing waste generation and recovering as much waste as possible to the economy. Disposal in landfill sites of the tons of solid wastes that cannot be separated at the source both shortens the working life of the landfill sites and causes the loss of the recyclable economic values. Reducing the waste amount at source, recycling and reuse of any potential wastes taken from the consumers must be accepted as methods to be adopted instead of using landfill and incineration methods that are adopted by many countries (Rhyner et al., 1998). There are lots of environmental benefits of the recycling of the waste materials however this method is rarely realized due to various reasons.

For instance, the produced materials might not be designed as suitable for disassembling or might not comply with recycling methods. Improving short term designs including an environmental view instead of long

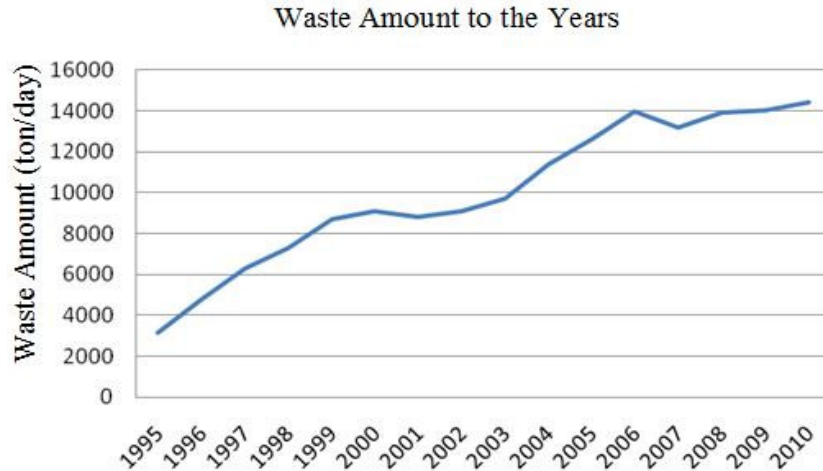


Figure 1. Yearly household waste amounts in Istanbul.

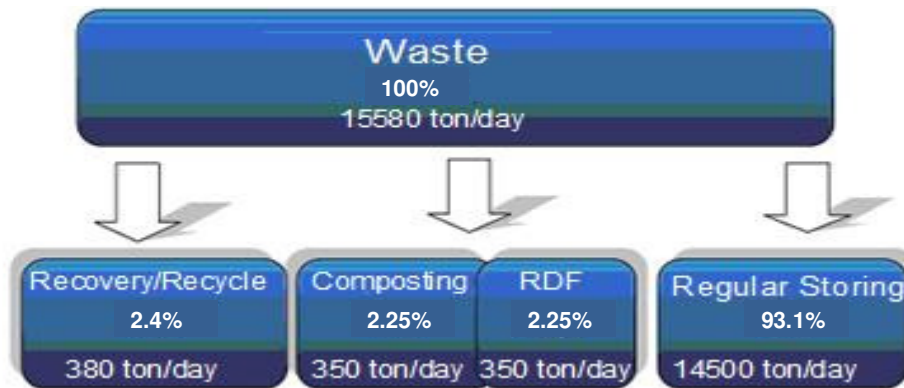


Figure 2. Current solid waste disposal methods.

term designs may help solve this issue. Simultaneously, prioritising systems like separation at source and generalization of the recycling centers is a must (Krook et al., 2010). More important than that is to demonstrate the steps which consumers should take after the separation of the waste materials. At this point, awareness raising activities are also needed (Eklund et al., 2010). Daily household solid waste amount in Istanbul reached 14.000 tons in 2009 while it was only 3.000 tons in 1995 (Figure 1). As of 2010, a daily average of 15.580 tons of household waste in Istanbul is disposed at the required standards in landfill sites in Gokturk – Odayeri of European Side and Sile-Komurcuoda of Asian Side via 7 transfer stations (Archives of Directorate of Waste Management, 2010). Some of the household wastes that have organically rich content are brought to the ‘composting and recovery facility’ located on the European side which has a processing capacity of 1.000 ton/day, to produce compost which is soil ameliorative, organically rich and highly capable in holding water. The unrecyclable wastes taken out from the separation unit of

the ‘composting and recovery facility’ are used to produce RDF material (refuse derived fuel) which can be used as an additional fuel in cement kilns (Figure 2).

**LEGISLATION**

European Union waste framework directive (2006/12/EC) declares that member countries should take measures to prevent or to reduce the generation and damage of waste and promote the recovery of them by recycling, reuse, amelioration, or by using as an energy source. The main legal tool of EU regarding packaging wastes is “packaging and packaging waste directive (1994/62/EC)” dated 20 December 1994. The directive contains the whole packaging and packaging wastes that the package manufacturers in EU market produce. This instruction assigns numerical targets for the recovery rates of different packaging materials. These targets are revised every five years. According to the directive, it is stated that 60% of the total packaging wastes have to be

**Table 1.** “Packaging wastes control regulations” recovery targets.

Years	Yearly recovery targets in terms of the material type			
	Glass	Plastics	Metal	Paper/carton
2005	32	32	30	20
2006	33	35	33	30
2007	35	35	35	35
2008	35	35	35	35
2009	36	36	36	36
2010	37	37	37	37
2011	38	38	38	38
2012	40	40	40	40
2013	42	42	42	42
2014	44	44	44	44
2015	48	48	48	48
2016	52	52	52	52
2017	54	54	54	54
2018	56	56	56	56
2019	58	58	58	58
2020	60	60	60	60

recovered up to the end of 2008 (Aarnio and Hamalainen, 2008). This directive aims to prevent and decrease the negative effects of packaging and packaging wastes and enable them to be used in public markets. It includes the prevention of wastes, recycling and reuse of the packages. On 11 February 2004, some amendments were made to the “Directive 94/62/C” and 2004/12/EC” was constituted. According to this directive, at least 55% and at most 80% of the wastes can be recycled. Until 31 December 2008, the least recycling rates in terms of waste kinds were 60% for glass, 60% for paper and Bristol, 50% for metals, 22.5% for plastics and 15% for wood (Council directive, 2004/12/EC). “The packaging wastes control regulations” which was prepared in compliance with EU packaging and packaging waste directive’ came into force on 24th June 2007. “The packaging wastes control regulations” determine the methods and principles to manage packaging wastes. This regulation aims to arrange the required technical, administrative and legal principles and establish standards for the generation of packages with specific features. It also aims to prevent damage that packaging wastes may cause, prevent the occurrence of packaging wastes, decrease the disposal amounts of packaging wastes that cannot be prevented to occur and cannot be disposed of by recycling, reuse or recovery methods and collect packaging wastes at the source along with the carrying and separating of them in a systematic fashion (Waste management plan, 2008).

Table 1 indicates the yearly recovery targets determined with respect to the “packaging wastes control regulations” dated 24th June 2007. It is crucial that all parties which are conferred the responsibilities in reference to the regulation perform the required practices

to protect the environment. With this purpose, the parties that generate packages, the parties that launch packaging products to the market, the parties that import packaging products, municipalities, sales points and consumers are all given some responsibilities and liabilities which include collection of the consumed packaging wastes starting from the generation of the packages to the recycling, recovery and disposal of them.

## PACKAGING WASTES MANAGEMENT

In order to constitute a healthy recycling system in Istanbul, it is required that corporations can only continue their operations after signing some protocols that specify these corporations’ assignments and responsibilities which result from “packaging wastes control regulations”. In this protocol, the entity authorized as coordinator and decision maker, Istanbul Metropolitan Municipality (IMM) or the unit it authorizes (ISTAC Inc. Co.), district municipalities that are assigned to provide the collection of packaging wastes within district borders, licensed companies that arrange the collection and separation operations of packaging wastes and all other authorized entities that implement the liabilities of the parties launching packaging wastes to the market must play a part. In summary, a detailed sample protocol for packaging waste management in districts is given in Figure 3. The municipalities are given a certain period of time in “solid waste control regulations” dated 1991 for the foundation of systems to collect separately the recyclable wastes at the source. In “Environmental Law” No. 2872 prevention or reduction of the generation of waste and their damage, recovery of them and separate

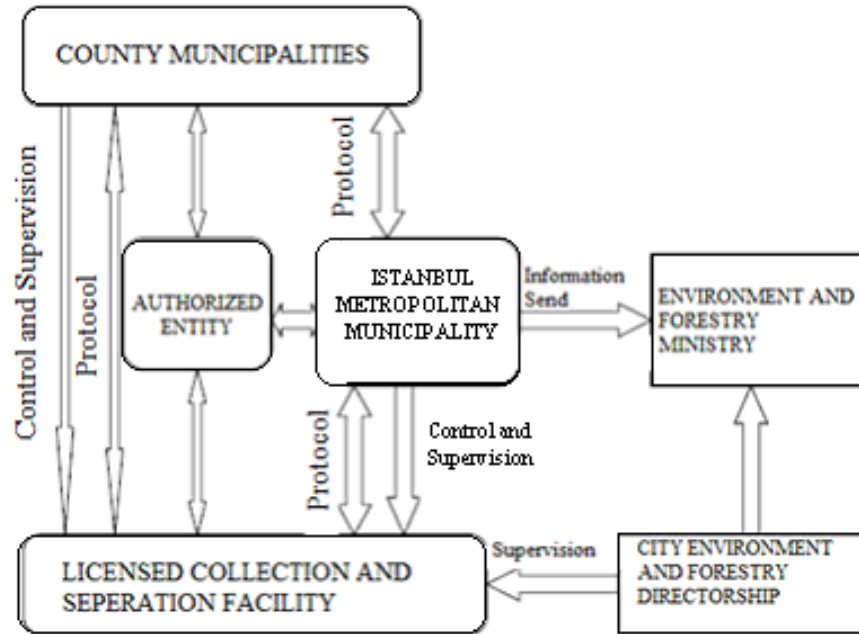


Figure 3. Detailed sample protocol (Istac Inc. Co.).

collection of recyclable wastes at the source are accepted as the main principle.

According to “The Metropolitan Municipality” Law No. 5216, district municipalities are responsible for the collection of packaging wastes separately at the source. According to “The Municipality Law” No. 5393, both the city and district municipalities are responsible for the collection of packaging wastes separately at the source.

**Existing implementations**

**Metropolitan municipality’s practices**

Within the scope of the regulation, ISTAC Inc. Co. was authorized to manage the organization of the collection of packaging wastes separately at the source within the borders of IMM. In this context, “the project of the separate collection of the packaging wastes at the source” is initiated by IMM and ISTAC Inc. Co. The project encompasses phases such as where, when, how and with what kind of tools packaging wastes will be collected, where they are separated, where the recycled products will be used, how to train the consumers, reviews and opinions of the consumers, training of the collectors and how the street collectors will be adapted to the system. Figure 4 shows the packaging waste collection system in Istanbul. Under this project, firstly the “packaging waste management plan” was prepared and it is aimed to extend the project to encompass the whole of Istanbul. Triple protocols were signed among ISTAC Inc. Co, district municipalities and their contractual licensed firms in order to carry out the project. Currently, the

number of districts who have signed the protocol has reached up to 26.

Practices carried out in compliance with these protocols are coordinated by IMM. The other districts carry out their activities by themselves or along with CEVKO (the Environment Protection and Package Waste Recycling Foundation) (Archives of Directorate of Waste Management, 2010).

**District municipalities’ implementations**

According to the regulation, district municipalities are responsible for collecting or getting packaging wastes collected separately at the source, preparation of the packaging waste management plan and preparation of practice plans belonging to the whole district and then sending them to the Ministry of Environment and Forestry (2007). District municipalities have to provide every kind of support for both the licensed firms that they work with and the authorized entities. At the same time, district municipalities are also responsible for arranging the educational activities about the collection of packaging wastes at the source, the recovery and recycling of them. District municipalities and the parties that signed the protocol gather together and compose detailed practice plans. In the practice plans, geographical and economical specifications of the area along with population data, the current condition of the chosen area, statistical information about the places where packaging wastes are taken out intensively and general specifications of the streets are compiled. In addition, primarily pilot areas along with general practice periods are determined. In the



Figure 4. Packaging waste collection system.

pilot areas identified in the practice plans, the tools, personnel, equipment, packaging waste boxes and other required materials are provided in accordance with the plan. Moreover, separate collection at the source activities are begun as well. In the practice context, the packaging waste bags that are collected separately at the source are carried to the separation centers on certain days and at certain hours.

The recycle chain is completed by dispatching the package wastes that have already sorted at the separation centers to the recycling centers (Demir et al., 2008). Recovery practices are coordinated by some units of the municipalities such as the Cleaning Services Department, Environmental Protection Department and Technical Services Department. Some municipalities carry out the separation activities by themselves at the small scale centers they founded for packaging waste collection and separation. The operating of these centers is the responsibility of the companies that collect the district's wastes. Some district municipalities only organize the separate waste collection system and pass the collection activities to licensed companies. Table 3 shows the list of district municipalities, whose implementation plans were approved by the Ministry. According to the list implementation plans of 8 district municipalities have not been approved yet.

#### **People and/or companies who put the packaging on the market and selling points**

According to legislation; people and/or companies who

put the packaging on the market is defined as natural people or corporations who package a product with packing within the legislation. In case it is not launched to the market directly by producers, people and/or companies who put the packaging on the market is defined as natural people or corporations who use his own name or trade on the packs. In case of producer is out of Turkey, agent and/or importer who is empowereed by producer. Selling points are defined as selling places which sell packaged products by wholesale or retail and have a closed are which is bigger than 200 m<sup>2</sup> such as store, market, supermarket, etc. Units which launch the package to the market are obligated to choose the packaging material which is economic, produces less waste and recycle easily. In addition to that, people and/or companies who put the packaging on the market should make a principle to reach the recycling rates. Packaging producers and business organisations that put the packaging on the market should recycle the packaging when they are chained.

Selling points are charged sorting the packaging waste which has to collect seperately, delivering these wastes to the units which have a protokol with the authorised body and sending the information to the Ministry.

#### **Private sector's practices**

The major service of the private sector in Istanbul within the solid waste management frame is the collection of solid wastes on behalf of the district municipalities. Another important service is the collection of recyclable

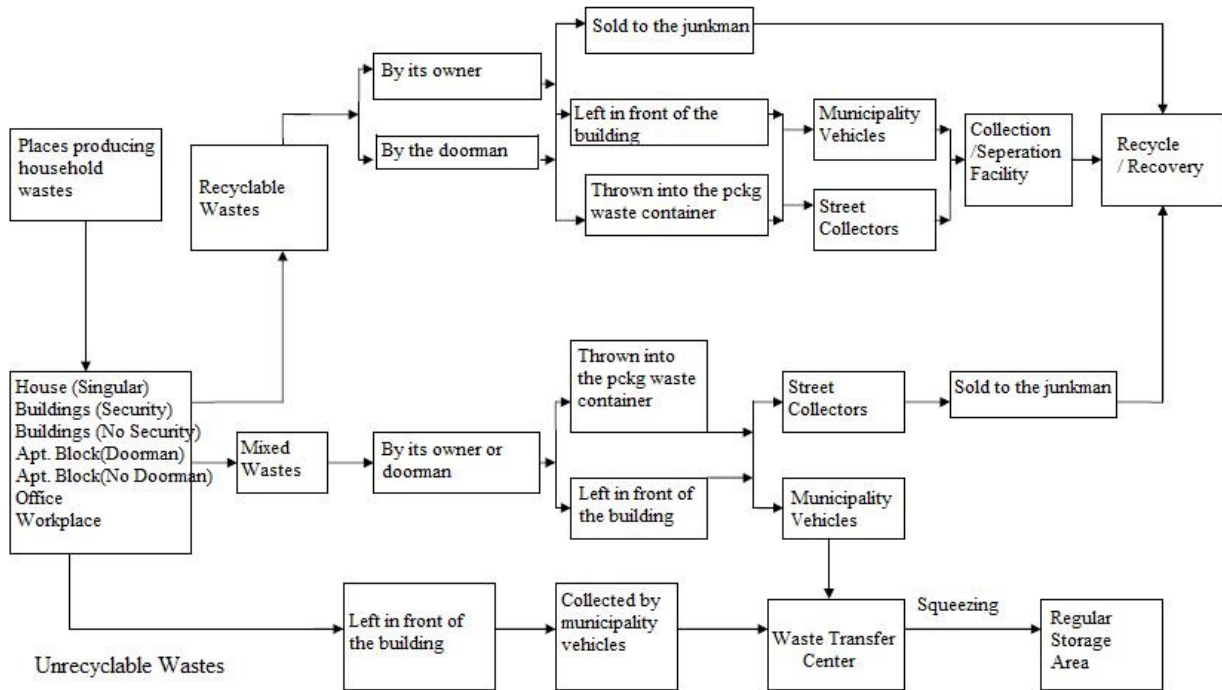


Figure 5. The general structure of solid waste collection and disposal system in Istanbul.

wastes and the utilization of them. The starting point of the collection chain of recyclable wastes is doormen, street collectors and refuses collectors. The doormen separate the clean, easily obtainable and valuable wastes (paper, carton, glass, bottles, etc.) taken out from the buildings, and sell them to mobile refuse collectors. However, these transactions are not carried out with the recycling awareness, but only for generating small revenue. The first and most important component of the recovery chain in our country is street collectors. Street collectors collect the valuable waste from the litter bins, containers, or the waste left on the streets in bags to be collected by dump trucks, and then sell them to the junkmen. Junkmen sell them to the bigger junk dealers, breaker-granulers or to the manufacturers that use junk materials. Scrap plastic processing mills convert the waste plastics they bought into granule and then sell them to the operating enterprises or people in the plastics industry. Granules produced from waste plastics are used in manufacturing of the shoe polish boxes, plastic water pipes, electric conduits, bags, plastic cans and toys etc. The scrap papers are sold to the paper and carton factories to be re-used in manufacturing of paper and carton. Some voluntary associations and foundations in Istanbul also collect and sell the recyclable wastes to generate revenue by aiming to contribute to their main activities with these revenues.

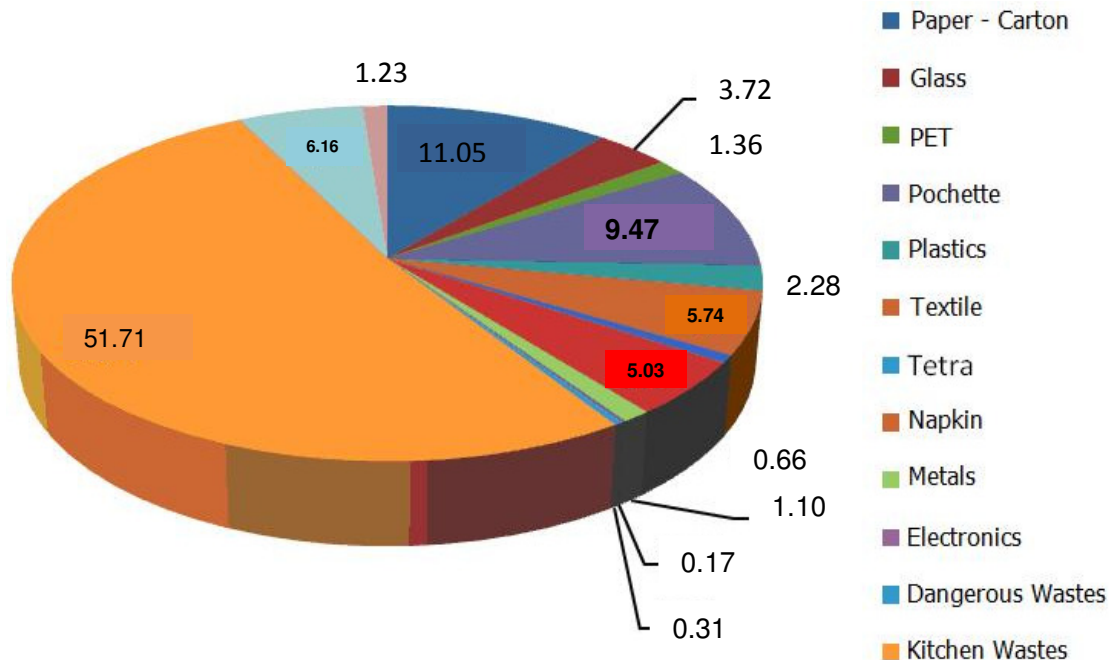
Figure 5 indicates the summary of the collection and utilization of the recyclable wastes throughout Istanbul. According to the findings of the reasearch conducted by

the Ministry of Environment and Forestry (2008), it is estimated that 10% of total urban waste and 25 to 30% of recyclable solid waste is collected by the street collectors. It is mentioned that there are 200.000 street collectors in Turkey and 100.000 in Istanbul who are generally from immigrant, minority or other radical groups. They belong to any age category, are generally male, start to work temporarily in seasonal periods and then keep working regularly, generally residing in slums located around economically high level areas where quality waste is thrown out.

**Recovery and utilization of the wastes**

**Characterization of solid and packaging waste**

Activities, including separate collection of the utilizable wastes by benefiting from their features, dividing them into different types, converting them into secondary raw material or agricultural input by physical, chemical and/or biological processes or subjecting them to the thermal processes to yield energy are all called recovery. It is economically and environmentally important to use the waste materials as raw materials. It is crucial in terms of waste management to know the characteristics of the waste. In the context of urban waste management throughout Istanbul, waste characteristics are followed in required periods. In the summer of 2010, waste characterization studies were carried out. As a result of



**Figure 6.** Solid waste characterization throughout Istanbul in 2010.

these periodical studies, the regional waste quality belonging to Istanbul and the calorific values of the wastes are determined. As it can be seen on Figure 6, 51% of the waste comprises of organic materials and 20% comprises of packaging wastes. Paper - carton with 11.05% has the biggest share among the characterized packaging wastes. In this ranking, plastic bags take second place with 9.47% and napkins take the third place with 5.03% (Figure 6) (Archives of ISTAC Inc. Co., 2010). In order to determine the composition of solid wastes generated in Istanbul, a characterization study was carried out in September 2010. Samples were taken from the solid waste collecting vehicles coming from 37 counties of which 25 were located on the European side and 12 were located on the Asian side and then they were characterized. No sample could be taken from the districts of Adalar and Sile.

In order to carry out the planning process more effectively, the 37 districts characterized were divided into three segments: 1) segment for the Asian side, and 2) segments for the European side. In the characterization study, the standards of the American ASTM D5231 "standard test method for determination of the composition of unprocessed municipal solid waste" and the methodology of "European Commission-Methodology for the Analysis of Solid Waste (SWA-Tool)" were adopted as the main principles. In total, 4 samples from each district were taken in the weekdays and at weekends. The process of solid wastes classification for characterization was carried out in the 'composting and recovery facility belonging to IMM (Archives of Directorate of Waste Management, 2010).

### **Recovery**

The recoverable materials rate in all solid wastes in Istanbul is around 20 to 25% and some parts of this are collected by the street collectors. In order to enable the selling of all generated recyclable wastes to the recycling facilities in a clean and proper condition, there is a need for separation facilities. Separation facilities are differentiated in terms of their capacity and working style, however, they function under two main groups: manual and automatic separation facilities. There are 28 packaging waste separation facilities and 21 recycling facilities in Istanbul. For the efficiency and sustainability of the system, new facilities need to be found by the Metropolitan Municipality, the related District Municipalities and mainly market launchers of the packaging wastes (indirectly authorized entities) or directly licensed entities. Besides, the suitable ones out of the existing facilities may be revised and then used temporarily until a healthy system is founded.

### **The amount of the packaging wastes collected separately at the source**

Since 2006, the packaging waste amount collected separately at the source in Istanbul has been increasing day by day (Figure 7) (Archives of ISTAC Inc. Co., 2010). The collected packaging waste amount reached up to 82.750 tons with a 74% increase in 2009 while it was only 47.485 tons in 2008 throughout Istanbul (Figure 8) (Archives of ISTAC Inc. Co., 2010). According to Table 2,

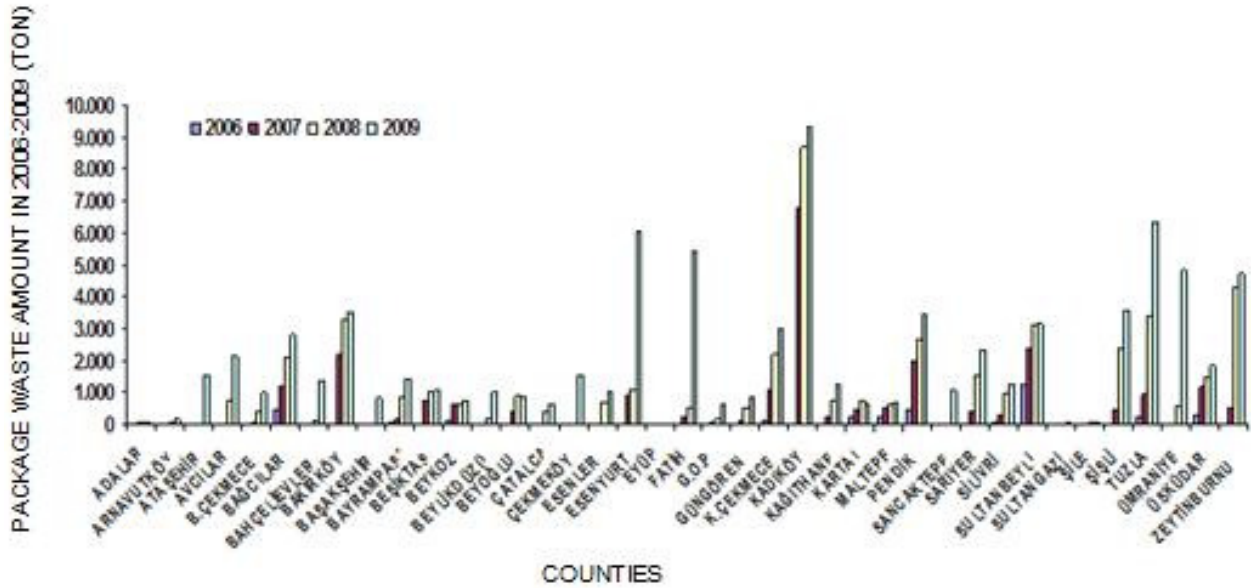


Figure 7. The packaging waste amount collected separately at the source in each district between 2006 to 2009

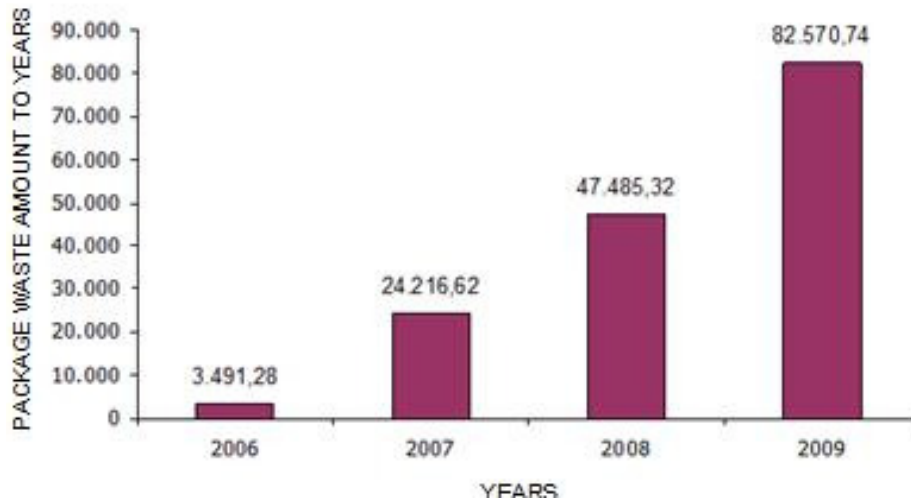


Figure 8. Packaging waste amount to the years.

Kadikoy had the biggest amount of packaging waste collected at source which equals 24.819. Tuzla and Sultanbeyli follow with 10.941 tons and 9.957, respectively. However, when the percentages of the potential packaging wastes are considered, Besiktas stands out with the highest percentage (Archives of Directorate of Waste Management, 2010).

**Recovery in the world and the European Union**

In the countries with the most developed waste management, the rate of waste reduction at the source and separation processes is very high. In Figure 9, the

recovery percentages of 27 European countries are shown. Recovery/recycling processes throughout Europe are around 23%. Some countries have a higher percentage than 23% however the other countries which pull the average percentage down are currently only at the beginning stage. In Figure 10, waste disposal and recycle percentages of 27 European countries are shown. The highest recycle percentages in sequence are belonged to Austria, Germany, Belgium and Holland.

**CONCLUSIONS**

In parallel to the increase in population, waste amounts in



**Table 2.** Potential packaging waste in districts

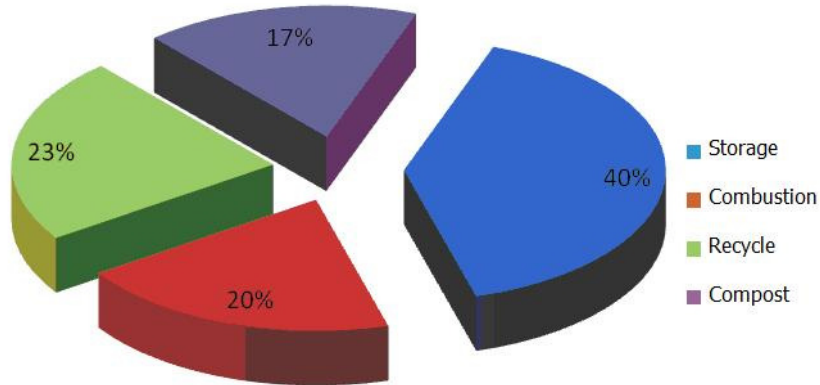
Districts	Collected packaging waste amounts (ton) (2006-2009)	Population (person)	Packaging waste amount per capita in 2009 (kg)	Packaging waste percentages according to the waste characterization in 2010 (%)
Adalar	107	10.460	3.47	-
Arnavutköy	202	141.634	1.18	18.65
Ataşehir	1.551	345.588	4.49	20.95
Avcılar	2.941	322.096	6.65	21.3
B.çekmece	1.524	152.106	6.79	24.53
Bağcılar	6.582	719.267	3.94	18.05
Bahçelievler	1.464	571.711	2.39	22.57
Bakırköy	9.050	214.821	16.41	21.52
Başakşehir	837	193.750	4.32	18.33
Bayrampaşa	2.517	272.196	5.18	16.21
Beşiktaş	2.876	191.513	5.76	30.14
Beykoz	2.206	241.833	3.33	25.28
Beylikdüzü	1.175	186.789	5.34	20.43
Beyoğlu	2.154	247.256	3.37	30.7
Çatalca	1.066	61.566	10.64	17.13
Çekmeköy	1.573	135.603	11.6	21.34
Esenler	1.753	468.448	2.18	14.69
Esenyurt	8.061	335.316	17.97	19.01
Eyüp	0	317.695	0	20.11
Fatih	6.201	455.498	11.98	26.18
G.o.p	874	464.109	1.39	21.69
Güngören	1.465	318.545	2.65	18.29
K.çekmece	6.405	662.566	4.53	18.71
Kadıköy	24.819	553.062	16.88	23.01
Kağıthane	2.265	418.229	3.02	20.76
Kartal	2.136	427.156	1.56	19.53
Maltepe	2.063	415.117	1.67	18.37
Pendik	8.534	520.486	6.62	19
Sancaktepe	1.096	223.755	4.9	23.15
Sarıyer	4.257	276.407	8.4	23.42
Silivri	2.536	118.304	10.43	19.73
Sultanbeyli	9.957	272.758	11.7	19.08
Sultangazi	62	436.935	0.14	15.83
Şile	144	25.169	2.34	-
Şişli	6.459	314.684	11.39	23.57
Tuzla	10.941	165.239	38.39	19.06
Ümraniye	5.466	551.091	8.78	23.64
Üsküdar	4.913	529.550	3.53	22.14
Zeytinburnu	9.533	288.743	16.3	18.94

Turkey have also increased depending on the rapid consumption of natural resources and the usage of the packaged products. Besides the prevention of the wastage of resources with the efforts to raise life standards and energy crisis occurred, the developed countries have recognized the importance of recovery and recycling of waste. They have researched and developed methods for this. An efficient and healthy

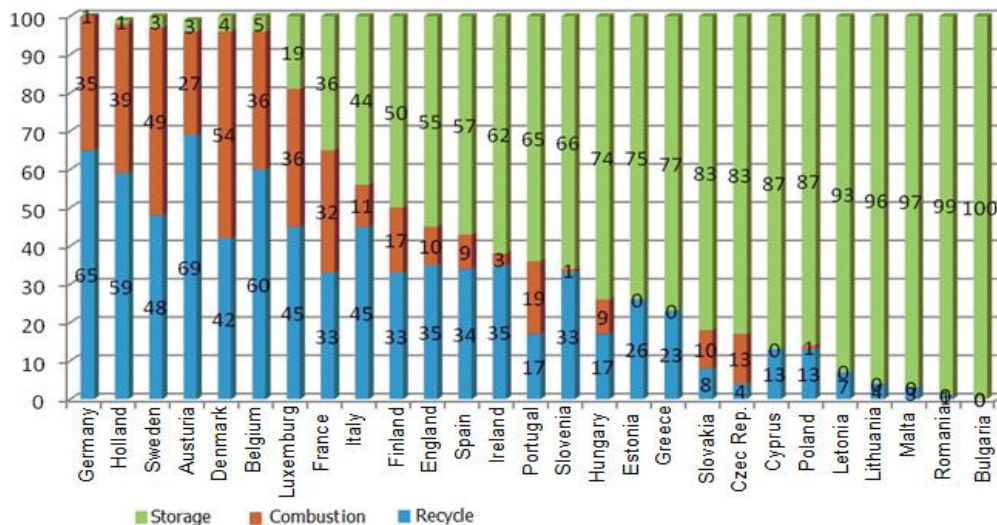
recovery study can only be possible with a system that will be advanced by the coordinative practices of each party. In order to operate packaging waste management systems effectively and satisfy the public, firstly the collection system has to be operated to an efficient degree as it was planned. That is why the collection system must be a system that takes into consideration the realities of the country; it also must conform to the

**Table 3.** List of packaging waste management implementation plan which is approved by Environment and Forestry Ministry.

List of district municipalities, whose implementation plans were approved by the ministry	List of district municipalities, whose implementation plans were not approved by the ministry	
Arnavutköy	Güngören	Sultangazi
Ataşehir	Kucukçekmece	Beykoz
Avcılar	Kadiköy	Üsküdar
Buyukçekmece	Kağıthane	Fatih
Bağcılar	Kartal	Adalar
Bahçelievler	Maltepe	Beşiktaş
Bakırköy	Pendik	Eyüp
Başakşehir	Sancaktepe	Şile
Beylikdüzü	Sarıyer	
Beyoğlu	Silivri	
Çatalca	Sultanbeyli	
Çekmeköy	Şişli	
Esenler	Tuzla	
Esenyurt	Ümraniye	
Gaziosmanpaşa	Zeytinburnu	
Bayrampaşa		



**Figure 9.** EU percentages of waste disposal.



**Figure 10.** Total household solid waste condition in 27 European countries.

socio-economic structure of the public and be quickly adaptable and applicable. The separation at the source is an important issue to provide a desirable and benefitable level of recovery. The required sensibility in this issue has to be shown by the waste producers and the Municipalities responsible for collecting the solid wastes have to provide the required support to the waste producers. The collection, carriage and separation of the packaging wastes have to be evaluated at the international norms and in the sectoral basis. The main theme of the legislation concerning packaging wastes is the reduction of the environmental effects that result from consumption, by a more efficient usage of the resources or the development of alternatives to these resources where needed, the consideration of the life cycle concept more and more, and to potentiate the waste management by decreasing the waste amounts.

In Istanbul the rate of the recoverable materials among the solid wastes is around 20 to 25%. The street collectors' role in the existing collection system is very important. In order to establish a healthy recovery system, the activity area of the street collectors should be restricted, the relations between the parties that are responsible for managing the packaging wastes should be enforced within the frame of the legislation and lastly, awareness raising for the consumers should be the focus, with respect to encouraging them to separate waste for collection.

## ACKNOWLEDGEMENT

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