

Pay as you throw system of Seoul

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Background and Implementation Status of Pay as you throw system

How to Implement the Pay as you throw system

The amount of daily waste¹ emitted from 10.3 million citizens, 4 million households and 780 thousand businesses in 2012 was 9,189 tons per day, 0.88kg per person. All daily wastes should be discarded according to the regulations of the 25 autonomous districts. To discard the general waste (to be sent to incineration facilities or landfills), you should buy and use the standard waste bags sold by the relevant autonomous districts. To discharge food waste, you should buy and use the standard waste bags or use the chip or RFID based system. In the case of large sized waste, you have to buy stickers from the relevant autonomous districts and attached them to the waste before discarding them, or you can hand such wastes over to specialized waste collection agents. (Ministry of Environment, Nov. 2012; Resource Recirculation Bureau, Ministry of Environment, Nov. 2012) The items that can be recycled to create resources or have value of resources like paper, scrap metal, large home appliances, small home appliances, fluorescent lamps, batteries, cooking oil, etc. should be separated and discarded according to the methods regulated by the government. (Minister of Environment, 2011)

In the case of the general waste and food waste, the discarders bear the whole or a part of expenses for waste collection and treatment and the cost depends on the amount of the discarded waste. That is why the waste fee in Seoul is called pay as you throw system. The measuring method for general waste and food waste is different. The measuring method for general waste is the standard bags which are made according to the quality standards² set by the government. The waste discarders can buy the bags in desired sizes at designated stores (such as convenience stores, laundries, etc.). The expenses for waste collection, treatment and production of bags and the commission for the stores are included in the price of the bags, granting the nature of marketable securities to the bags.

The measuring method for food waste are either an RFID based waste weighing system, chips (or stickers) or standard waste bags, more various than the method for general waste. RFID based waste weighing system is used to measure the weight of waste and impose consequential fees. An advantageous trait of this system is accurate weighing of the discarded waste. But the devices have disadvantages at the same time, because the system has a complicated configuration consisting of weighing devices, discarder recognition system and storing devices to save the discarders and results of weight measurement. Chips or stickers are used with the standard containers. Daily volume measuring and monthly volume measuring are all available with this solution.

Except for recycling products, large sized waste and used coal briquettes that are allowed to be discarded using other routes, all wastes discarded in Seoul must be made according to the volume-rate disposal system without exception and the corresponding fees must be paid. If you do not pay the fees when you discard your waste, it is a violation of the waste management law or ordinances of the local government, and is subject to the penalties of those laws or ordinances.

¹ Waste is divided into daily waste and industrial waste in Korea. Industrial waste refers to the large amount of waste, recycling items, intractable things or toxic substances discarded during business activities from the companies and are classified into massive daily waste (wastes over 300kg per day from business entities), wastes from waste disposal facilities (wastes discharged from the business site operating environmental pollution prevention facilities), construction wastes (over 1 ton per day from construction sites) and designated wastes (toxic wastes or infectious wastes). Discarders of industrial waste are responsible for the treatment of such waste. Any waste that is not industrial waste is considered daily waste which includes waste that is small in volume, non-hazardous nature, local governments' handling responsibilities, etc.

² Korean Plastic Standard, enacted on Dec. 17th, 1993, KPSM 1000

<Table 1> Measuring Methods of Pay as you throw system in Seoul

Classification	General Waste	Food Waste
Measuring Methods	<ul style="list-style-type: none"> • Standard Bags 	<ul style="list-style-type: none"> • RFID based Weighing System • Chips or Stickers • Standard Bags
Kinds of Standard Bags	<ul style="list-style-type: none"> • General: 3ℓ, 5ℓ, 10ℓ, 20ℓ, 30ℓ, 50ℓ, 75ℓ, 100ℓ • Reuse: 10ℓ, 20ℓ • Public: 30ℓ, 50ℓ, 100ℓ 	<ul style="list-style-type: none"> • General: 1ℓ, 2ℓ, 3ℓ, 5ℓ, 10ℓ * Over 20ℓ can be used when large amount of wastes is discharged in holidays, Kimchi-making season, etc.
Colors of Standard Bags	<ul style="list-style-type: none"> • General and Reuse: White • Public: Blue 	<ul style="list-style-type: none"> • General: Yellow
Materials of Standard Bags	<ul style="list-style-type: none"> • PE Bag • Biodegradable Bag 	<ul style="list-style-type: none"> • PE Bag • Biodegradable Bag
Examples	 <p>Standard Bags for General Waste</p>	 <p>RFID Based Waste Weighing System</p>

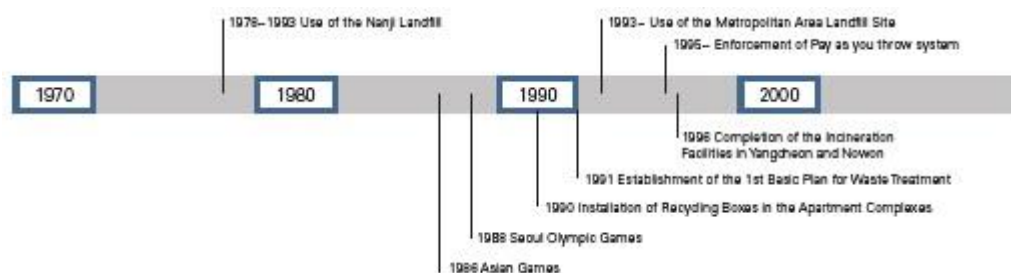
Background of Introduction of Pay as you throw system

In the late 1980s and early 1990s, the whole society of Korea was filled with high public esteem and vitality due to the successful hosting of Asian Games in 1986, Seoul Olympic Games in 1988 and continuous economic development. There were lots of products on the market and plastic products were produced in mass volume thanks to the development of production technologies. Lots of products led to increased amounts of waste. Meanwhile, Seoul, the capital city of Korea, could not secure the space for landfills to treat wastes any more while the space of Seoul was being expanded to the outskirts of the city.

As the capacity of Nanji Landfill (operated from 1978 to 1993) was reaching its limit, the central government led a project to establish new waste treatment facilities in the metropolitan area to treat the waste from Seoul, Incheon and Gyeonggi-do (province) in 1989. But it was very difficult to move forward because of the strong opposition from the residents living the areas near the expected sites for facilities. The Seoul Metropolitan Government also planned to build 11 incineration facilities to treat all daily waste from Seoul, but encountered opposition from neighboring citizens and strong voices of the civil societies concerned about excessive facility construction. In 1996, Seoul managed to complete the construction of incineration facilities in Yangcheon (400 tons per day) and Nowon (800 tons per day), and just 4 more facilities (2,850 tons per day) could be built after that. In order to address the issues of waste which had increased in quantity and had deteriorated in quality, the government started to have interest in waste recycling as an alternative mean.

Recycling boxes had appeared in the apartment complexes of Seoul in 1990, and began to be provided to detached house areas the next year. However, the citizens were not familiar with the separate discarding for recyclables. In the case of the detached house areas, half of the collected recyclables was general garbage. On the other hand, the changes in the waste management system costed a lot of money, using landfills a long distance away, constructing incineration facilities, separating the waste into general garbage and recyclables to be collected in different ways, etc. As shown in the data from 1991, the financial expense spent in the waste management was KRW 280 billion and the fee revenue was only KRW 25.4 billion, covering just 9% of the total costs. Most of the expenses for waste treatment were taken by the general account budget, and the part paid by the citizens, the waste generators, was very small. (The Seoul Metropolitan Government, 1992)

<Figure 1> Main Waste Management Projects before and after the Introduction of Pay as you throw system



In this situation, the government started seeking methods to reduce the amount of waste fundamentally (waste reduction), to lower the dependence on the incineration facilities or landfills by establishing the separate discarding of recyclables (promotion of recycling), and to charge the citizens who generate waste for the involved costs of the waste management (securing financial resources for waste management), and selected the pay as you throw system as an alternative. Entering the 1980s, the necessity of introducing the pay as you throw system had been raised in a corner of academic circles (Environmental Planning Institute, Graduate School of Environment of the Seoul National University, 1983; Jeong-jeon Lee, 1991). However, the fees for waste disposal in Seoul had been collected in a kind of tax form based on the building areas or property taxes which had nothing to do with the amount of waste produced before the pay as you throw system was introduced in 1995 (Ki-young Yu and Jae-cheon Jeong, 1995). The pay as you throw system taken as the waste disposal fee system through establishment of social atmosphere, creation of implementation conditions, pilot projects, etc. has gone through changes and development until it reached its current form.

<Table 2> Waste Disposal Fee Systems of Seoul When Introducing the Pay as you throw system

Period	Kinds of Waste	Fee Rates	Basis of Charging Fees
In the 1980s	General Waste (Small Amount)	7	Total Ground Area of Buildings
	General Waste (Large Amount)	-	Weight
	Business Site Waste	6	Total Ground Area of Buildings
In the Early 1990s	Household Waste	9	Total Ground Area of Buildings /Amount of Property Tax
	Business Site Waste (Large Amount)	2	Weight
	Business Site Waste (Small Amount)	6	Total Ground Area of Buildings
1994 (Just before the Introduction of Pay as you throw system)	Household Waste	9	Total Ground Area of Buildings
	Business Site Waste (Small Amount)	6	Total Ground Area of Buildings
	Business Site Waste (Normal Amount)	1	Volume
	Business Site Waste (Large Amount)	2	Volume
	Construction Waste	-	Volume
	Home Appliance	7	Kind, Volume
1995 (Enforcement of Pay as you throw system)	Furniture	7	Kind, Volume
	General Waste/Food	-	Size/Number of Standard Bags
	Large Waste	-	Kind/Size/Number
	Recyclable Items	-	Free

Process of Introduction and Settlement of Pay as you throw system

Preparation Stage (1992~1994)

The pay as you throw system was introduced in 1995, however the preparation started in the early 1990s and the practical arrangement began in 1992 with the government at its center. First, the survey and research to verify the validity of the introduction of pay as you throw system had been conducted by Korea Society of Waste Management from September 1992 to January 1993. The main contents of the survey and research were relevant amendment of legislations, enforcement measures, expected effects, ripple effects, etc. In 1993, the government began the process of opinion collection from all walks of life regarding the introduction of pay as you throw system. Public hearings and meetings with private organizations consisting of relevant experts, cleaning companies, etc. (Feb. ~ Jul. 1993), meetings with the consumer groups, groups of housewives and waste bag manufactures (Jul. 1993), meetings with the managers of the urban and provincial cleaning departments and opinion collection of the waste subcommittees (Jul. ~ Aug. 1993) were held during the process. Inquiry about the opinions of related organizations and institutes on the legal status of standard waste bags was also conducted (Sep. 1993). The result was that the waste bags could be regarded as official documents as long as the positions of mayor or district heads as well as the marks of the city hall or the autonomous district offices were on the bags, and that it would be considered forgery of official documents if anyone forges and sell the bags.

One year before the pay as you throw system was introduced in country-wide, pilot projects were conducted in 33 cities, counties and districts (Apr. ~ Dec. 1994). In Seoul, Jung-gu as a commercial area, Seongbuk-gu as a detached housing area and Songpa-gu as an apartment area participated in the pilot projects (The Seoul Metropolitan Government, 1994). Before that, the central government announced the implementation measures of the pay as you throw system, including the amounts of the waste fees, how to distribute the standard bags, how to treat the expected increase of recyclables, etc. (Nov. 1993). During the pilot projects, the government concentrated on finding the waste discarding status, standard waste bags, degree of citizens' participation, flow of the community opinions, etc. The government assembled a civil assessment team consisting of 7 civic groups including YWCA, YMCA, Green Korea United, the Korean Federation of Environmental Movement, etc. and 165 monitoring agents to provide the ability to assess and report the status of the projects. There were big concerns about negative factors, such as illegal waste dumping, however the positive assessment was dominant due to the 40% reduction of waste amount, 100% increase of recyclables collection, reduced cleaning cost, social expansion of awareness about waste reduction, inspiration of self-confidence of the officials, etc.

Based on the problems that appeared during the implementation of pilot projects, the government made "Guidelines of Pay as you throw system" (Sep. 8th, 1994) to enforce the system on a national scale. On November 7th, 1994, the government held a meeting with the related urban and provincial officials to conduct an interim evaluation on the project implementation of the local governments. On December 7th of the same year, the government issued guidelines of how to fix the problems that were discovered during the interim inspection such as the basic plans to handle the expected rapid increase of regional processing of recyclables, emergency transportation period setting against the emission of large amount of waste just before the enforcement of pay as you throw system at the end of the year, the reinforcement of manpower to facilitate the pay as you throw system, etc. In addition, the government processed the revision and amendment of related ordinances, management of waste bag manufacturing, designation of the stores to sell the bags, public relation activities, etc. in preparation for the introduction of pay as you throw system on January 1st, 1995. In particular, the government carried out a public relation campaign to ease the citizens' complaints of "why we should pay for waste disposal?" via media outlets such as TV commercial programs, advertisements in the daily press, TV talk shows, etc. and made and distributed promotion materials like VTR tapes, PR books, posters, etc. (Ministry of Environment and Korea Environment Institute, 2012)

<Figure 2> Main Projects in the Process of Introducing the Pay as you throw system

1991	1992	1993	1994	1995
	<ul style="list-style-type: none"> ■ Sep. 1992~Jan. 1993 Feasibility Study for the Introduction of Pay as you throw system 	<ul style="list-style-type: none"> ■ Feb. ~ Aug. 1993 Opinion Collection from all walks of life ■ Sep. 1993 Confirmation of the Official Status of Standard Bags ■ Nov. 1993 Preparation of Guidelines for the pilot projects 	<ul style="list-style-type: none"> ■ Apr. ~ Dec. 1994 Pilot Implementation: Jung-gu, Seongbuk-gu and Songpa-gu in Seoul ■ Monitoring of the pilot projects by the civic assessment team ■ Preparation for nationwide enforcement ■ PR for the nation 	<ul style="list-style-type: none"> ■ Jan. 1st, 1995. ~ Enforcement of the Pay as you throw system on a national scale

Introduction Stage (1995)

The pay as you throw system was implemented nationwide as of January 1st, 1995. As a result of the implementation of the system, the previous waste collection fee was replaced with the value of waste bags and the bags could be used in the region that was printed on the bag. General waste was to be placed in bags purchased from the designated stores up to the dotted line and discarded in the front of houses. The recyclables were separated into paper, bottles, cans and plastics and then discarded. The large waste like refrigerators and cabinets were collected after prior notification by phone call to the administrative organizations containing address, name, kind and size of the waste, the confirmation of the visiting officials and the issuance of the bill for disposal fees. In consideration of low-income people, the coal briquette ashes were allowed to be discharged without using the standard bags. For the protected groups under the livelihood protection law and other poor people authorized by the heads of local governments, around 60ℓ of standard bags were provided for free or the purchasing price was reduced (Ministry of Environment, May 1997). In the beginning stage of the system, the citizens seemed to not adapt to the implementation of the volume-rate waste disposal methods. There were many cases where the citizens could not distinguish recyclables from general household waste. Out of selfishness, citizens dumped household trash prior to the enforcement of pay as you throw system. They especially discarded large waste like cabinets, refrigerators, etc. at the same time to intensify the confusion. However, these things happened often only in the early stages, and became stabilized as time went by.

In April 1995, the government had an evaluation meeting 100 days after the implementation of pay as you throw system. During the period, a survey of 1,000 households was conducted and the results showed that the citizens appeared to almost fully adapt to the system in a month after the implementation. 98.6% of the respondents had evaluated that they practiced the system well, and the capacity of the most widely used standard bags was 10ℓ, 5ℓ and 20ℓ in order. The improvement and complement points proposed in the evaluation meeting were strength and convenience of the standard waste bags, application of the system to the wastes in public places, enhancement of convenience for separate collection of recyclables by showing the recycling mark, timely collection of recyclables, prohibition of collection of recyclables that were mixed with the waste, prohibition of excessive packaging of disposable products and preparation of its basis, initiative practice of the system in government organizations, preparation of the criteria for penalty enforcement, establishment and expansion of recycling networks, securing the appropriate price of standard bags, linkage of allotment/deposit for the pay as you throw system, supply and promotion of system related information, etc.

Development Stage (After 1996)

Many things that concerned the government and caused inconvenience to the citizens regarding the implementation of pay as you throw system. However, the system was recognized to have lots of positive effects, including the practical reduction of the amount of waste, facilitation of separate disposal of recyclables and expansion of social awareness on waste reduction from when it began in 1995 through its 20-year anniversary in 2015. In the meantime, the pay as you throw system has been developed and changed continuously.

First, the most troublesome problem in the beginning stage was how to handle the collected recyclables. It was resolved by enacting the producer responsibility regulation in 2003. The recyclables are divided into paper, plastic containers, scrap metal (including cans) and glass bottles. Under the pay as you throw system, the amount of collected recyclables increased but the demand for recyclables was the same. The producer responsibility regulation had been executed using the deposit system for a limited number of items including paper packs, PET bottles, iron cans, glass bottles, etc. However, the system did not work well enough to be of help to increase the demand for manufacturing, because many manufacturers gave up the deposit. Thus, the government decided to convert the deposit system to an expanded producer responsibility scheme, which required the producers to treat

the recyclables. Additionally, the relevant items were greatly expanded to include paper packs, plastic containers, scrap metal (including cans), glass bottles, large sized home appliances, small sized home appliances, fluorescent lamps and batteries. As a result, the supply and demand of recyclables were dramatically improved.

In 1997, the government started to make and provide waste bags exclusively for waste that was difficult for both discarders and collectors to handle. The special waste bags were used to hold broken glasses, small amounts of construction waste, etc. that are sharp and heavy enough to cause physical damage, especially in the process of collection. The special bags were made of tough and easy-to-handle materials (poly propylene) different from those used for the general waste bags.




The standard waste bag, as the core method for implementing the pay as you throw system, was a very convenient tool for measuring the amount of waste in a large city like Seoul, Korea where it is difficult to identify the discarders. But many people pointed out repeatedly that the waste bags were disposable products and became waste after a single use. In order to address the problem, the government recommended selling standard bags for goods transport at large supermarkets (E-mart, Homeplus, Lotte mart, National Agricultural Cooperative Federation or Nonghyup Hanaro Club and Mega Mart). The large supermarkets located in Seoul began to sell the standard bags in 2010. The bag was called the reusable bag, consumers could use it as a standard waste bag, and the price of the reusable bag was same as the standard bag selling at other stores.

The most innovative development was the introduction of the weight-rate waste disposal system to weigh food waste. Many autonomous districts could not apply the principle of pay per disposal system properly in the case of food waste. Most of the districts used the standard boxes for the food waste, and imposed the same fees to all households regardless of the amount of waste. Some districts collected food waste free of charge. There were reasons for their methods. The material of standard bag was polyethylene, which would become foreign material in the process of food waste treatment, lowered the quality of feed or compost made from the food waste, and made the feed or compost consumers reluctant to buy. The districts were confused because they were not sure of the validity of imposing fees for the collection of food waste that could be treated only using the garbage recycling methods, while they were collecting the recyclables free of charge. However, too much food waste was generated, and it was difficult to turn the food waste into recycled resources and to apply the expanded producer responsibility scheme while taking care of the food waste. Thus, the government decided to introduce the weight-rate waste disposal system in order to reduce the amount of food waste. The Seoul Metropolitan Government also enacted the system in 2003 (The Seoul Metropolitan Government, <https://seoulsolution.kr>).

The government recommended that the system should operate not on the basis of volume, but on the basis of weight when treating food waste because food waste is heavier than general waste. As a result of this change, it was reported that food waste was reduced by 10~30% (Korea Institute of Industrial Relations and Korea Environment Corporation, Dec. 2013). By using this system, the amount of food waste is recorded by each individual when the food waste is discarded. Based on the recorded information of each individual, the monthly fees are imposed. However, this system is currently only operated in a portion of apartment complexes, because the installation and operation of the weighing system costs a lot and requires space for the installation. For detached houses and restaurants, the standard bags or standard tanks with chip attached are generally used. (Resource Recirculation Bureau of the Ministry of Environment, Nov. 2012)

<Table 3> Methods and Features of Food Waste Disposal Systems

Item	RFID Weight Method	Chip Method	Standard Bag
Recognition of Discarder	Electronic Tag/Electronic Card	NA	NA
Measuring Unit	Weight	Volume	Volume
Storing Container	Individual Container	Individual Container	Bag + Base Container
Imposition of Fees	By Household/Restaurant	By Household	By Household
Payment of Fees	Deferred Payment	Advance Payment	Advance Payment
Waste Reduction Effect	9~31%	14%	13%

Item	RFID Weight Method	Chip Method	Standard Bag
Remarks	 <p data-bbox="395 533 647 591">RFID based Weighting System</p>	 <p data-bbox="794 533 1018 591">Chip Attached to the Standard Tank</p>	 <p data-bbox="1222 542 1369 568">Standard Bag</p>

Source: Resource Recirculation Bureau of the Ministry of Environment (Nov. 2012), Korea Institute of Industrial Relations and Korea Environment Corporation (Dec. 2013)

As described above, the meter-rate based waste fee system has been steadily developed. During the process, the government made big efforts to develop the system by implementing periodic status and problem monitoring. It found and evaluated the degree of system settlement, inconvenient factors when discarding the waste, items to improve in the system, things to improve in the related cleaning system and things to improve in the recycling market. In the beginning stage, the government evaluated the achievement of the system every year and held an evaluation meeting in 2005 to look back the achievement of the system over the first 10 years. In 2004, it started to investigate the results of standard bag sales by the local government, waste treatment facilities, how to secure the financial resources for cleaning, response performance against illegal waste dumping, etc. and to issue the results of the investigation as a government report. The guidelines for the waste disposal system established in the early stage have been amended many times in 1997, 2001, 2003, 2006, 2008, 2009, 2010 and 2012.

<Figure 3> Sourcebook Regarding the Achievement Monitoring of Waste Disposal System and Improvement of the Implementation Methods



Effects of Introduction of Pay as you throw system

Acceleration of Waste Reduction

According to the statistics of Seoul, in 1995 when the pay as you throw system was implemented, the amount of waste was reduced by 8% compared with the previous year and 11% in 1996 compared with two years before. In the beginning stage of the system, large waste was discarded in large quantities because it was free at that time. Therefore, the amount of waste discharged in the 2nd year, 1996, can be assumed to be more accurate. So the actual percent of waste reduction was about 11%, which equaled an amount of about 1,712 tons per day. The average capacity of the 4 incineration facilities in Seoul is 700 tons per day³. In other words, the amount of waste reduced was equal to the capacity of 2~3 incineration facilities.

Of course, there were different arguments for the reduced wastes. According to an opinion, other factors besides the pay as you throw system such as the rapidly reduced use of coal briquettes and the regulatory policy on disposable items and product packaging affected waste reduction (Yong-seon Oh, 2006). On the contrary, another study showed that even when the other factors are considered, it was the waste disposal system that clearly brought about the reduction in waste (Kwang-ho Jeong et al, 2007). The controversial evaluations above were not on the waste reduction itself, but on the size of the system's effect. The citizens became more sensitive to exaggerated packaging when choosing products, took only the products, leaving the packing materials, and requested to return the packing materials of delivered products. These reactions of the consumers influenced manufactures and were reflected in product design. After the introduction of pay as you throw system, it was obvious that there were changes in the consumption pattern and those changes were admitted by all.

<Table 4> Change of Waste Amount before and after the Enforcement of Pay as you throw system

Classification	1994 (Preparation)	1995 (Enforcement)	1996 (2 nd Year)
Generation Amount (tons/day)	15,397	14,102	13,685
Generation Amount (kg/day)	1.43	1.33	1.31

Facilitated Separation of Recyclables and Early Adaptation of Waste Separation

The outstanding results of the pay as you throw system included the facilitated separation of recyclables and early adaptation of waste separation habit in a short period of time. The amount of recyclables increased by 881 tons per day in 1996 compared to 1994. The proportion of recycled waste of the total amount of processed waste was 20.5% in 1994, 29.3% in 1995 (enforcement of the system) and 29.5% in 1996, showing a rapid increase of 9% in 1996 (2nd year) compared with that in 1994. There were different evaluations of the waste reduction effects, but everyone agreed on the adaptation of separate disposal of recyclables. The facilitated separation of recyclables led to the reduced demand for the waste treatment facilities. Because the average capacity of the incineration facilities in Seoul was 700 tons per day, the separation of recyclables contributed to the reduction of 1.3 incineration facilities worth of waste.

<Table 5> Change of Recycled Waste Amount before and after the Enforcement of Pay as you throw system

Classification	1993 (Fixed Ratio)	1994 (Preparation)	1995 (Enforcement)	1996 (2 nd Year)
Waste Amount (tons/day)	16,021	15,397	14,102	13,685
Recycled Amount (tons/day)	2,940	3,156	4,131	4,037
Recycling Rate (%)	18.4	20.5	29.3	29.5

³ Yangchoen Facility: 400 tons/day, Nowon Facility: 800 tons/day, Gangnam Facility: 900 tons/day and Mapo Facility: 750 tons/day

Securing the Waste Management Expenses with Fees

The financial independence rate (appropriation scale by the income from fees, etc. compared to the expenses for waste management) in 1991 was just 9%, meaning that the expense burden of the waste discarders was very low (The Seoul Metropolitan Government, 1992). It is for this reason that the pay as you throw system was introduced. With the pay as you throw system, the fees paid by the waste discarders increased from KRW 119.9 billion in 1993 to KRW 153.6 billion in 1995 (growth rate: 28%), and there was a more desirable aspect. The total income from the fees got bigger without increasing the burden per household while maintaining fairness in charging the burden of fees. In other words, the monthly fee per household before the introduction of the pay as you throw system was KRW 2,102, and KRW 2,288 after the system introduction, showing little difference except that the waste discarding sources who were paying the waste fees were expanded from 1,690 thousand households to 2,970 thousand households. In conclusion, the introduction of pay as you throw system was effective in improving the unreasonable fee structure and increasing the fee income.⁴

<Table 6> Change of Waste Fees according to the Enforcement of Pay as you throw system

Classification	1993 (Fixed Ratio)	1995 (Enforcement)	1995/1993
Fee Income (KRW Mil.)	119,912	153,638	1.28

Creation of Economic Benefit

In 2005, the government evaluated the 10-year performance of pay as you throw system that was introduced in 1995. According to the evaluation, 1 ton of waste reduction created a benefit of KRW 144,071 and 1 ton of waste recycling created a benefit of KRW 18,901. The benefits of waste reduction came from the reduced cost for waste collection and transportation, installation of treatment facilities and operation of such facilities. The benefits of recycled waste were the values earned after deducting the cost for collection and transportation, sorting, processing, etc. from the total value of the recyclable items (Korea Institute of Industrial Relations and Korea Environment Corporation, Dec. 2013). In the case of Seoul, it seemed that the cost for waste collection, transportation and processing was reduced by KRW 90 billion and the recycling created KRW 6.1 billion of economic benefits, KRW 96.1 billion in total per year if the government evaluations above were applied to the performance of pay as you throw system in Seoul.

<Table 7> Change of Fees According to the Enforcement of Pay as you throw system

Classification	Increase/Decrease Amount (1996-1994, ton/year)	Benefit per Unit (KRW/ton)	Scale of Benefit (KRW Bil./year)
Reduction	-624,880	144,071	90
Recycling Amount	+321,565	18,901	6.1
Total Benefits	-	-	96.1

⁴ Before the volume rate waste disposal system was introduced, the waste fee was imposed based on the scale of houses and the amount of property taxes. Therefore, the fees were the same regardless of the number of households in a building or housing.

Meaningful Experience of Seoul

Thorough Preparations

The volume-rate waste fee collection system is inconvenient to citizens as the waste discarders. Even the experts opposed the introduction of the system, saying that foreign countries hesitated its introduction out of concern for possible illegal waste dumping. In Korea, the introduction of pay as you throw system was made with the support of the government, cities and some scholars fearing the difficulties in securing the waste treatment facilities, not with the support of the majority of people. To cope with this negative atmosphere, it was necessary to remove the institutional obstacles in advance, to create an amicable social atmosphere for the system, to find the effects and the problems through implementing pilot projects and to persuade the people of the benefits. In particular, it was imperative to find the system implementation methods suitable to each city in during preparation stage. In the case of Seoul, it was not easy to identify the waste discarders because there were many high-rise buildings such as apartments and shopping centers and the city space was small and narrow. That was the reason why Seoul took the standard waste bag as the method to measure the amount of waste. However, it was desirable to use baskets only for the waste in regions with many detached houses and developed roads because it was possible to prevent the waste of disposable standard bags and illegal dumping by making an agreement with all dischargers on the size of waste baskets and to reduce the waste collection cost by introducing the automated basket loading vehicle system.

Cooperation with the Civil Society

The civil society in the environmental field played a large role in adapting the pay as you throw system in Korea. When the system introduction was in the middle of discussion, the civil society did not have a favorable opinion of the system. It expressed concerns about illegal waste dumping to avoid paying the waste fees and signs of uneasiness about the intention of government to shift the responsibilities for waste reduction and waste recycling to the people. However, the society started to see the positive sides of the system after participating in the site monitoring activities and ensuring the citizens' active participation during the periods of pilot project and the 1st year of project implementation.

The civil society has taken part in the evaluations for the pilot project and the first, second and tenth years of the system implementation persistently. Even now it is involved in the process of assessment for the implementation of the food waste disposal system. The positive evaluation from the civil society has contributed greatly to the change of the attitude of the mass media and the national consciousness.

Securing the Disposal Paths for the Increased Amount of Recyclables

The separate discarding of recyclables free of charge was implemented in a short time. How to process the collected recyclables became the task of the government. The biggest headache was how to handle plastic containers (PE, PP, PS and PVC materials) other than PET containers. While they were designated as recyclables, there were not enough infrastructures equipped to treat plastic products. In addition, the producers were not responsible for the treatment of waste plastics because the waste charges⁵ were imposed on most of the plastic containers. The issue was solved in 2003 when the government gave financial support to help the plastic recycling operators install and operate the relevant facilities, made the public sectors purchase recycled plastic products preferentially, and to impose the obligation to collect and process recyclables which had weak treatment basis in the market (including the plastic containers) to the manufacturers (Extended Producer Responsibilities Scheme).

With the introduction of pay as you throw system, an unplanned recycling item was added. Because of the serious bad smell from the landfills, lots of complaints were raised one year after the system's introduction. The same complaints were made about the roads to the waste treatment facilities. The cause of the problems was food waste. The large amounts of papers acted as buffers in standard bags, absorbing the leachate and blocking the smell of the food waste to some degree, but the papers were classified as one of the recyclable items. The main cause of the bad smell was the fact that papers were no longer discarded with general waste⁶. The problem was resolved by collecting the food waste separately and changing the treatment system on a large scale. Landfill of all food waste

⁵ A system to impose the cost for treatment (incineration or landfill) of the items with no recycling infrastructure on the manufacturers

⁶ The food waste content was 50~60% of the household wastes and around 30% of the city waste. The food waste in Korea generate the leachate and bad smell because there are lots of fermented products and surplus produce that are discarded in the process of preparation of food materials.

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was prohibited from 2005. The government started the construction of food waste treatment facilities in 1998. Seoul has 5 public facilities to treat food waste in five places now. The remaining food waste is processed using private facilities.

Prevention of Illegal Acts

When reviewing the system introduction, the most concerning side effect was illegal waste dumping to avoid paying fees. Actually, many people dumped household or business side trashes in public street wastebaskets or in secluded spots or desolate places and discarded the waste without using standard waste bags. In order to prevent illegal waste dumping, reflectors were installed and places used for illegal dumping were changed into flower gardens. Some districts removed the wastebaskets on downtown streets. The illegal dumping was reduced a lot, but not eliminated though. In the meantime, the systems to impose penalties for committing illegal acts and to supply standard bags to the low-income class free of charge were prepared.

<Figure 4> Cases of Illegal Dumping and Corresponding Measures



Illegal Waste Dumping in Suburbs (<http://waste21.or.kr>)



Disposal Using Non-standard Bags (<http://waste21.or.kr>)



Creation of Flower Beds (<http://dong.jungnang.seoul.kr>)



Installation of Reflectors (<http://www.cpdcr.re.kr>)

Revision of Legislation

The enforcement basis of pay as you throw system is the waste management act. The detailed implementation methods are authorized to the local governments by their ordinances. The waste management act also deals with the penalties for illegal dumping to avoid the fees.

Each district covers the specific regulations on how to enforce the system in its own ordinance. It regulates the kinds of waste under the application of the pay as you throw system, discharging methods, fees, kinds/colors/materials of the standard bags, supervision of standard bag manufacturing and safe management, designation of the stores to sell standard bags, guidelines for standard bag sellers, criteria on the cancellation appointment of standard bag sellers, etc.

The size, material, strength and kind are determined based on the Korean Standard on Plastic Products. All specifications of standard bags are subject to the standard and standard bags made against the standard cannot

pass the inspection. To prevent the counterfeiting of bags, the seals for printing on the surface of standard bags were kept by the autonomous districts and handed over to the manufacturers only when they produced standard bags. In the case that a person makes and distributes counterfeit bags, the person would be punished according to the regulation on the fabrication of official documents under criminal law.

<Table 8> Legal Systems Related to the Enforcement of Pay as you throw system of Seoul

Classification	Description
Waste Management Act	<ul style="list-style-type: none"> ♦ Recommendation on the Enforcement of Pay as you throw system ♦ Legislation of Ordinances Related to the Enforcement of Pay as you throw system ♦ Prohibition of Illegal Dumping and Imposition of Penalties on Illegal Dumping ♦ Revision of the Regulations Related to the Autonomous Districts: Ordinance and Regulations, Guidelines for the Enforcement of Pay as you throw system, Guidelines for Discarding Food Waste and Fees
Ordinance on the Waste Management of the Autonomous Districts	<ul style="list-style-type: none"> ♦ Contents: Waste Subject to the Pay as you throw system, How to Discard the Waste, Fees, Kind/Color/Material of the Standard Bags, Supervision of Standard Bag Manufacturing and Safe Management and Designation of the Stores to Sell the Standard Bags
Korea Standard on Plastic Products	<ul style="list-style-type: none"> ♦ Kinds: Standard Bags in PE Material, Standard Bags in LLDPE material and Standard Bags Containing Calcium Carbonate ♦ 9 Kinds of Standard Bags in Generation and Disintegration Natures
Reports on the Performance	<ul style="list-style-type: none"> ♦ Contents: Enforcement Status, Status of Standard Bag Manufacturing and Sales, Waste Collection Method and Collection Cycles, Financial Independence Rate in Cleaning and Rate of Burden, Discharge of Large Waste and Collection of Disposable Vinyl Bags, Illegal Dumping Regulation Performance, etc.
Criminal Law	<ul style="list-style-type: none"> ♦ Manufacturing and distribution of counterfeit standard bags correspond to the fabrication of the official documents

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