

Eco-town as a means to promote urban green business opportunities in 3R – case of Korean cities



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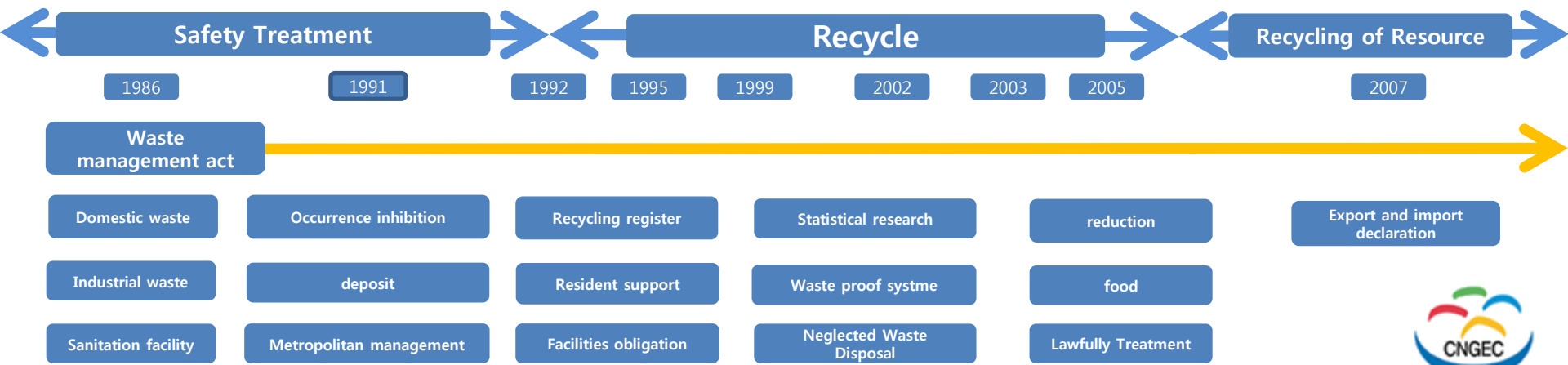
Reference



Korea's waste management and waste recycling system

Resource recycling policy and waste management system

- Before 1986, management of domestic waste and business waste was dualised according to [Filtch cleaning Act] and [Environment Conservation Act]
- Through the enactment of [Waste Management Act] in 1986 the management system was unified.
- From 1986 to 1992, occurrence inhibition, deposit system, metropolitan management and post management concept was applied in the [Waste Management Act]
- After 1992 [Recycling Promotion Act] came into effect and systems and policies related to packing material occurrence inhibition, disposable product regulation, waste deposit and waste share system and recycling industry development were implemented.
- Starting 2003, the waste deposit system changed to EPR(Extended Producer Responsibility) and [Construction Waste Recycling Promotion Act] was implemented and provided a demand base for recycling and recycled products.



Domestic waste related act process of transition



EPR(Extended Producer Responsibility) system

1. Outline

- A system for promoting the reduction, reuse and recycling of waste and planning 'resource cycle economic and social system' by inducing manufacturers to take environmental responsibility in the planning, manufacturing, distribution, consumption and discard of the product.
- The recycling rate of EPR products increased by 64% in 2013 by 1,540,000 tons compared to 938,000 tons in 2002 recording a qualitative growth in the recycling industry.
- Domestic packing materials which have the same route for excretion and recovery consolidated the benefit society which was founded based on the quality of the material. In consequence, strengthened the efficiency and public functions of the benefit society.

2. Procedure-2002



Korea's urban waste management policy case



Seoul

- population : 10,103,233
- area : 605.25km²



Daegu

- population : 2,493,264
- area : 884.46km²



Daejeon

- population : 1,531,809
- area : 539.84km²



Busan

- population : 3,519,401
- area : 765.94km²



Ulsan

- population : 1,166,377
- area : 1,057.1km²



Jeju

- population : 607,346
- area : 1,848.4km²



Seoul

Metropolitan

1. Resource collection facility

- 1) Resource collection facility construct
- 2) Resource collection facility operation
- 3) Resource collection facility operation status

2. Sharing-marketplace operation

3. Exaggerated packaging and practice of reduction of disposable products

- 1) Curb violation of packaging standard (ex. exaggerated packaging, etc.)
- 2) Reduction of disposable products



Korea's urban waste management policy case



Seoul

1. Resource collection facility

1) Resource collection facility construction

- Seoul is the main area for population·economy·culture·industry and waste is increasing due to rapid industrialization, mass production, mass consumption and use of disposable products.
- Seoul is planning to build a “resource cycle city” where it does not waste resources and recycles.
- Aims to build a resource cycle system which considers the resource cycle including the reduction of the generation of waste by extending the life of the product which is facilitated by the advanced source reduction of reuse, recycle and resource.

2) Resource collection facility operation

- Mapo-gu Samam-dong Nanjido was used as a landfill since 1978 but starting March 1993 it has been banned. Therefore in urgent need of finding a new landfill.
- Collect the total waste heat generated from the incinerator during management of incineration and distribute to nearby cogeneration plant and district heating cooperation and replace mass import of LNG by recycling waste heat and recovering energy from domestic waste.
- Distribute high efficient heating to nearby residents at low price.



Korea's urban waste management policy case



Seoul

1. Resource collection facility

3) Resource collection facility operation status

Resource collection facility operation status

classification		Yangcheon	Nowon	Gangnam	Mapo
Size of facility		400 ton/day (200 ton/day X 2ea)	800 ton/day (400 ton/day X 2ea)	900 ton/day (300 ton/day X 3ea)	750 ton/day (250 ton/day X 3ea)
Size of site		14,627m	46,307	63,813	58,435
throughput (2013)	Incineration amount	339 ton/day	638 ton/day	826 ton/day	643 ton/day
	Rate of operation	84.7%	79.7%	91.8%	85.7%

Resource collection facility operation status

year	Yangcheon			Nowon		Gangnam		Mapo		
	Waste incineration amount	Heat supply amount (Gcal)	power sales volume	Waste incineration amount	Heat supply amount (Gcal)	Waste incineration amount	Heat supply amount (Gcal)	Waste incineration amount	Heat supply amount (Gcal)	Power sales volume
2013	106,628	157,875	3,808	199,254	310,601	266,073	485,331	207,247	314,969	10,822
2012	109,927	172,381	3,280	191,851	254,424	262,233	499,607	207,009	322,749	12,114
2011	109,782	179,889	2,368	166,368	237,408	248,718	467,220	201,264	328,269	13,615
2010	109,392	83,953	1,273	160,189	230,017	268,422	511,726	202,284	385,740	

Korea's urban waste management policy case



Seoul

2. Sharing-marketplace operation

- Seoul and local governments are implementing a 'sharing-marketplace' to contribute to building a resource cycle society by selling and trading reusable household items and conserving resources and promoting reuse for the economy and environment.



Ttukseom island sharing-marketplace



Gwanghwamun gate sharing-marketplace

Ttukseom island sharing-marketplace management performance

Host year	Host number	Visitor (thousand People)	Recycle product cycle (thousand ea)	Donation (Million Won)
2009	24	250	520	₩ 29
2010	27	280	470	₩ 36
2011	29	320	520	₩ 37
2012	29	360	540	₩ 44
2013	48	480	750	₩ 47

Korea's urban waste management policy case



Seoul

3. Exaggerated packaging and practice of restriction of disposable products

1. Curb violation of packaging standard (ex. exaggerated packaging, etc.)

- Reduce exaggerated packaging, change to reusable packaging or replace packaging material with eco friendly material for recycling to inhibit packaging waste.
- Prohibition of joint PVC and PVC packaging material or coated packaging material since January 2001.
- Annual reduction of five synthetic resins packaging material for products such as egg prop ·pack, apple ·pear prop plate, noodle container, agricultural · livestock · marine products prop plate, electronic products packaging, buffer material

2. Reduction of disposable products

- The amendment content emphasizes stronger responsibility of the business operator and imposes a penalty in case of violation.
- Seoul, local governments and civil organizations will inspect and guide the practice of inhibition of use in the distribution and sales phase in Seoul.
- Due to the weak administrative power compared to object of regulation, it is difficult to gain effectiveness.
- Strengthen publicity and reward citizens for reporting.





Daejeon

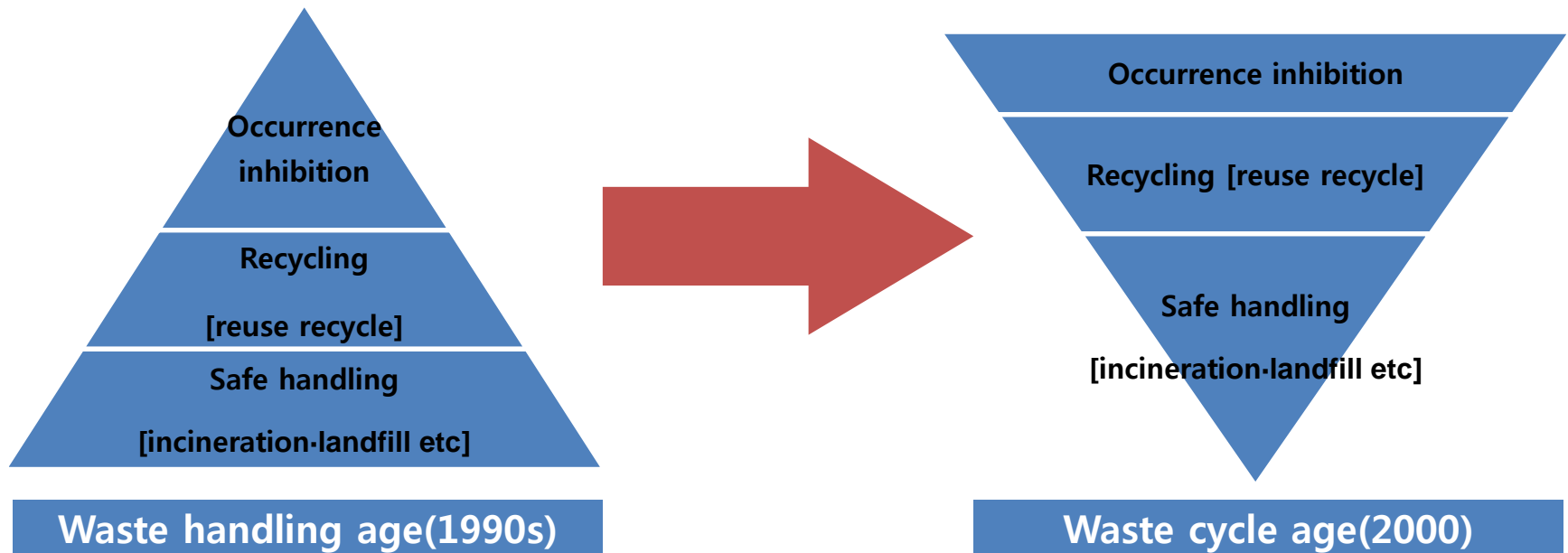
Metropolitan

- 1. Resource recycling**
- 2. Food waste reduction and recycling promotion**

Korea's urban waste management policy case

1. Resource recycling

- According to the fourth recycling general plan (2008~2012) resource cycle evaluation is held during the use of a product or waste resource and resource cycle consciousness is spread.
- Using resources efficiently and focus on fulfilling a sustainable resource cycle society.



Korea's urban waste management policy case

2. Food waste reduction and recycling promotion

- Since October 2004, Daejeon conducted recycling including general house and small restaurants
- At the end of 2013 439 ton, which is produced per day, is recycled 100% and used as feed and compost.
- March 2005 70 ton of waste per day is recycled as compost in the newly built food waste management facility and the remainder is recycled in a nearby private management facility on consignment.

Food recycling handling status (2013)

(unit : ton/day)

Emission source	Generation amount	Handling status	Handling amount	note
total	439	public/private handling	439	
General housing/ small restaurants	352	Public handling facility	73	
		Private handling facility	279	
Reduction obligated business	87	Private handling facility, etc.	87	



Ulsan Metropolitan

1. Waste recycling

- 1) Waste reduction and recycling
- 2) Food waste reduction and recycling

2. Domestic waste handling facility operation and recycling business

- 1) Domestic waste incineration facility
- 2) Seongam landfill landfill gas recycling business

Korea's urban waste management policy case



1. Waste recycling

1) Waste reduction and recycling

I. Reduction and recycling in the manufacturing and distribution phase

- February 2004 the amendment of 'waste management act' has changed the assigned waste from 200 ton per year to 1,000 ton during the past three years according to the annual waste average.

II. Reduction and recycling in the consumption phase

- Recycling infrastructure implementation and operation (ex. recycling center and recycled products trade market)
- Uljoo county operates its own recycling center, Joong-gu, Nam-gu and Dong-gu has a contracted service facility.
- Each borough and county holds a share marketplace to increase interest in recycled product use.



Korea's urban waste management policy case



1. Waste recycling

2) Food waste reduction and recycling

- Occurrence inhibition by food reduction T/F team formation, voluntary food waste reduction act determination, promotion campaign and managing environment class, etc.
- Policy for reduction of food waste through 'Supply of small side dish container', 'foodbank and food market revitalization' in restaurants.
- Construction of 'Onsan organic waste biogasification facility' which can handle 150 ton per day. Starting from 2014, food waste and livestock feed was biogasified and sold to nearby industrial facilities.



Korea's urban waste management policy case



2. Domestic waste management facility operation and recycling business

1) Domestic waste incineration facility

- Hygienic handling of combustible waste and domestic waste incineration facility (400 ton/day) construction and operation for the extension of the use of landfill.
- Collection of energy generated during incineration and distributing to nearby production facilities.
- Sold 320,009 ton of steam for one year in 2013 generating 10.5 billion won.

2) Seongam landfill landfill gas(LFG) recycling business

- Capturing the gas generated from organic matters from the landfill and recycling for business.
- According to the end of 2013, a total of $4,246,000m^2$ domestic waste was buried, captured amount in 2013 was $1,393,000Nm^2$ approximately $4,635 Nm^2$ LFG per day was captured.





Daegu Metropolitan

1. Waste incineration plant operation
2. SRF facility installation
3. LFG recycling business plan

Korea's urban waste management policy case



Waste handling facility management

1. Waste incineration facility operation

- The incineration facility in Daegu handles 480 tons/day (160 ton/day X 3ea)
- Heat generated during the incineration process distributed to nearby residents' heating and cooling and to Korea district heating cooperation with a profit of 3 billion won in 2013.
- The remaining heat is used for power generation and the incineration facility itself, recycling the energy produced from waste.

2. Solid Refuse Fuel (SRF) facility installation

- Constructing a SRF production facility and SRF exclusive boiler which can distinguish domestic waste and generate energy and promote waste-to-energy business.
- Subordinate effect of CER profit and landfill usage period extension



Korea's urban waste management policy case



Waste handling facility management

3. LFG resource recycling business

- Install medium quality gasification facility and power facility in order to recycle LFG generated from landfill and use as alternative energy which can prevent stench in nearby areas and create added value.
- Produced LFG is used as fuel for Korea district heating cooperation's Daegu branch heat distribution facility.

LFG recycling facility operation status

classification	Type of LFG Sampling (Thousand Nm ³)	LFG sales volume (Thousand Nm ³)	Electricity generation (MW)	Incinerated amount (Thousand Nm ³)	LNG usage amount (Thousand Nm ³)
2007	52,739	51,243	1,368.70	51	112
2008	49,670	49,270	282	-	-
2009	47,462	47,767	102	-	314
2010	45,194	45,475	-	-	357
2011	48,229	48,441	-	-	265
2012	44,306	44,248	-	-	57
2013	45,839	44,524	-	1,530	162



부산광역시
BUSAN METROPOLITAN CITY

Busan

Metropolitan

1. Waste minimization

- 1) Input waste reduction
- 2) Disposable product usage inhibition and package waste reduction
- 3) Food waste reduction

2. Waste recycling

- 1) Waste recycling status
- 2) Waste recycling policy
- 3) Food waste recycling promotion
- 4) Recycling facility expansion plan

3. Energy collection and usage expansion

- 1) LFG power facility operation
- 2) Plastic waste handling Eulsification business
- 3) Incineration facility heat recycling promotion



Korea's urban waste management policy case



1. Waste minimization

1) Input waste reduction

- Continuous promotion of domestic waste reduction since 1996 in order to minimize waste brought inside facilities and promote recycling.
- Frequently curb recycled material brought inside handling facilities (landfill-incineration facility)
- Incentive and penalty policy was implemented for the increase and decrease of waste in municipal handling facilities for the waste reduction will of head of borough-governor since 1998.

2) Prohibition of use of disposable products and reduction and expansion of packaging waste

- Strengthen the usage regulation and spot check for violation of exaggerated packaging.

2013 disposable product usage regulation business and administrative measure status

Inspection performance			Administrative measure	
Subject business	Inspection business	percentage(%)	penalty(number/1000 won)	percentage(%)
70,433	8,272	11.70%	7/930	0.7

Korea's urban waste management policy case



1. Waste minimization

3) Food waste reduction

- Since 2005, landfill for food waste has been banned and exclusive container emission has been implemented, therefore food waste meter rate system has been demonstrated.
- August 2008, waste meter rate system has been implemented in Busan. In 2012, it has been implemented in apartment houses.
- In 2013, daily average of 760 ton of waste was generated, decreasing by 7.6% compared to 2008.
- RFID based apartment house meter rate system was implemented in 2012, and food waste decreased by 30%.
- The system will be implemented to over 200 households and 520,000 households by 2015.



Korea's urban waste management policy case



2. Waste recycling

1) Waste recycling status

- Return recycled products' sale price to citizens, recycled products collection promotion incentives (In 2013, 17,243 ton, 1,257 organizations 368,000,000 won paid), continuous finding of new policies, prohibition of disposable products and prohibition of exaggerated packaging mainly for distribution business.
- For the proper use of collected recycled goods, Busan is making efforts for the automation and modernization of the recycling process by installing more than one collection facility in each borough and county.
- In 2013, Busan collected 1,411 ton of recycled products and accomplished recycle percentage of 44.45% out of 3,173,9 ton of total generated waste (increase of 0.01% compared to former year)

Recycled products collection and handling (unit : ton/day, %)

classification	2010	2011	2012	2013
Paper	706	704	698.4	700.8
Bottle	188	185	184.2	185.1
tin	67	67	67.1	66.3
plastic	184	180	180.2	179.6



Korea's urban waste management policy case

2. Waste recycling

2) Waste recycling policy

I. Recycling policy

- Starting from 2008, the difference in collection items according to borough and county has been unified to 15 items (paper, milk carton, scrap iron, glass, tin, plastic and clothing)
- In apartment houses, recycling bins have been placed and collection days have been assigned by residents.
- In detached houses collection dates have been assigned for each borough and county.
- Since the implementation of the recycling system in 1995, it has started to gradually settle down.
- Recycling rate of domestic waste was 44.4% in 2010, 2011 44.42%, 2012 44.44% 2013 44.45%, recording a steady increase.

Korea's urban waste management policy case



2. Waste recycling

3) Waste recycling policy

II. Recycling foundation formation and vitalization policy

- Continuously promoting building recycle centers for a recycling environment, securing recycling vehicles and recycling equipment by annual plans funded by the city(70%) and borough's budget(30%)
- Service improvement and promote recycled product use for the vitalization of recycling centers and provide collection incentives to NGOs for vitalization of recycled products collection from November 1991.

Recycled products collection incentive payment standard in 2012 (unit : won/kg)

Paper cup paper package	Glass bottle	plastic	PET	Rubber gloves	Disposable bags	Styrofoam	Used battery	Fluorescent light (kg)
130	20	30	20	80	10	40	150	150

Korea's urban waste management policy case



2. Waste recycling

4) Promotion of food waste recycling

- Funded 3.1 billion won to boroughs and counties for the improvement of paper bag to exclusive containers.
- Prevention of waste of resources by the use of 150,000,000 exclusive bag per year and the secure of recycling due to the decrease of food waste inside meter-rate system bag and secure handling of food waste due to decrease in operation failure of handling systems by alien substance.

Food waste recyclingz (unit : ton/day)

classification		2008	2009	2010	2011	2012	2013
recycling	total	823	814	774	774	778	759
	compost	433	241	237	275	232	232
	feed	243	385	288	253	309	278
	fuel	141	188	249	246	237	249
Landfill. incineration		6	0	0	0	0	0

Korea's urban waste management policy case



2. Waste recycling

5) Recycling facility expansion plan

- Shortage of food waste management facilities due to prohibition of dumping food waste in sea since 2013, Attain combining treatment facilities persisting period and private facility bankruptcy
- Streaming a 200 ton biogas facility for organic waste by 2017 to secure food waste handling and building recycling facility in Busan.

Food waste recycling facility status

classification		Facility capacity	area
total		7ea Facilities, 964ton/day	
Metropolitan facility		2eq Facilities, 320ton/day	Dongrae, Gangseogu
Private facility	In city	3ea, Facilities 480ton/day	Gangseogu, Gijanggu
	Own business (retail market)	2ea, Facilities 164ton/day	Haewoondaegu, Sasanggu

Korea's urban waste management policy case



3. Energy collection and usage expansion

1) LFG plan facility operation

- Prevent global warming and recycle by Capturing methane produced from Saenggok landfill and use as fuel in power facilities and generate electricity.
- Install 172 gas capture holl inside the landfill annually and generate 4MW/hr of electricity through the power facility.
- Based on the end of 2013, generated energy is 12,747MW and the profit is 2,010,000,000 won. Created a annual profit of ₩ 900,000,000 according to an agreement between Busan and private investor.

Energy production status

By year	2008	2009	2010	2011	2012	2013
Produced energy (MW)	21,310	20,178	20,647	14,814	12,364	12,747
Energy sales amount (1,000,000 won)	2,849	2,311	2,574	1,967	1,999	2,010
City profit (1000000 won)	128	104	116	89	89	90

Korea's urban waste management policy case



3. Energy collection and usage expansion

2) Plastic waste Emulsification business

- Recycle plastic waste generated from cities and reduce waste management cost and prevent pollution by landfill and incineration.
- Plastic waste of 9,500 ton/year was produced as renewable fuel in 2013 and sold to vinyl greenhouse and bathhouses for heating.
- The remaining sludge from pyrolysis was used as fuel.

3) Promotion of recycling of heat source from incineration plant

- Produce energy from operating cogeneration power plant with remaining steam from Myeongji incineration plant. Reduce operation cost by selling remaining electricity after use to KEPCO.
- Haewoondae incineration plant also reduces its operation cost by generating electricity from the remaining steam during the incineration process. Return 6.3 billion won to local society by providing 70,000Gcal of heat for heating to 38,500 households in Haewoondae-gu Jwa-dong Newtown.



Jeju

Special Self-Governing Province

1. Waste minimization direction

- 1) Waste reduction
- 2) Disposable products inhibition and packaging waste reduction

2. Waste recycling

- 1) Waste recycling policy
- 2) Food waste recycling promotion

Korea's urban waste management policy case



1. Waste minimization direction

1) Waste minimization

- Promote recycling and increase recycling and food waste recycling to minimize waste inside the facility.
- Curb dangerous waste in the metropolitan incineration plants by residents
- Constant promotion through TV public service and local news.

2) Inhibition of disposable products and reduction of packaging waste

- Law related to strengthening the regulation for disposable product use and inhibition of packaging waste was revised on December 2002.
- Out of 20,457 business selected for regulation in 2013, restaurants are 13,136. These restaurants are prohibited to use disposable products (cup, plates, containers, wooden chopsticks, toothpicks, spoons, forks, knives) and produce disposable advertisement products.
- Bathhouses (158) prohibited from providing disposable products (razors, toothbrush, toothpaste, shampoo, rinse) for free and large scale shops(7), food service establishments(623), retail and wholesale(5,043) prohibits providing disposable bags for free.



Korea's urban waste management policy case



2. Waste recycling

1) Waste recycling policy

I. Secure recycled products facility and equipment

- 5 Crushing facilities, 4 waste Styrofoam reduction facilities, 11 recycling sorting facilities, 11 compression facilities to secure recycled products quality.

Recycling facility status

Name of facility		Handling amount (ton/day)	Equipment status						
			sum	compressor	baler	conveyer	sorter	crusher	etc
Jeju (4)	Recycled products sorting facility	60	67	5	1	28	7	-	26
	Plastic waste plant	8	5	-	-	1	1	3	-
	Western farming and fishing village waste facility	16	6	2	1	2	1	-	-
	Eastern farming and fishing village waste facility	16	7	2	1	2	1	1	-
Seogwipo (3)	Recycling center	15	10	2	1	1	1	1	4
	Andeok farming and fishing village waste facility	8							
	Pyoseon farming and fishing village waste facility	8							

Korea's urban waste management policy case



2. Waste recycling

2) Waste recycling policy

II. Strengthening of district collection and transport responsibility

- Shorten current 4 stage collection and transport system to 2~3 stages and promote consciousness of recycling by returning profit to residents.

III. Incentive for residents' voluntary participation

- Evaluate residents' participation in domestic waste meter-rate system, food waste reduction and recycling performance and award successful areas.
- Promote residents participation by holding recycled products collection competition, incentives for collection of recycled goods and site visit to environmental treatment facilities.



Korea's urban waste management policy case



2. Waste recycling

3) Promote food waste recycling

I. Food waste recycling facility expansion

- In preparation of 300 ton/day organic waste recycling business in Jeju for stable management of food waste and recycling.

Food waste recycling facility status

classification	Name of facility	Facility capacity (ton/day)	Daily average operation time	Number of facility	2013 handling amount (ton)
Jeju	Composting facility	50	8	1	64
	Composting facility	60	8	1	77
	High speed food waste fermentor	0.03	8	2	4
	High speed food waste fermentor	0.9	8	1	200
	High speed food waste fermentor	1	8	1	77
Seogwipo	Food recycling	46	8	1	25

Korea's urban waste management policy case



2. Waste recycling

4) Food waste recycling promotion

II. Clean-House construction

- An initiative in Jeju for the first time in Korea which divides waste in a designated location by incineration, landfill, recycling and food from past system of dumping in front of the house.
- Flexible choice of area by 100~120 households or 1 per 100~150m according to the amount of waste generated from 100~120 houses, such as public facilities including wayside corner, free parking lot and Province-owned lands.
- In preparation of building 2,930 facilities in the whole are by 2014.

Clean-House installation status by year

classification	Total	2006	2007	2008	2009	2010	2011	2012	2013
Total	2,745	121	79	473	598	581	505	294	94
Jeju	2,290	121	61	429	544	457	394	211	73
Seogwipo	455	-	18	44	54	124	111	83	21

Result

Seoul

- Due to high population and as the capital, amount of domestic waste is bigger than industrial waste
- Most of domestic waste can be recycled. Most resource is easy to recycle.
- Has the most incineration facility which uses waste, providing waste heat to residents for daily use is highly preferred.

Daejeon

- Most active city in food waste reduction policy and using food waste to produce compost and feed.

Ulsan

- Has the largest industrial complex and most policies are about waste reduction and recycling
- Specialized in recycling LFG generated from landfill in cities.



Result

Daegu

- Most active in waste recycling and waste-to-energy. Most policies are about profits from the providing residents with waste energy generated from incineration plants.
- Fossil fuel consumption reduction from use of SRF facilities LFG through classification and sorting of domestic waste from landfills.

Busan

- 2nd largest population in Korea. Largest port in Korea.
- Relatively active in conducting 3R policy.
- Also uses waste heat from incineration, but is the only city which reduces fossil fuel consumption by producing recycled fuel through plastic waste.

Jeju

- Highly active in implementing domestic waste regulation policies. Highly interested in hygiene through the implementation of Clean-House policy.

Reference

1. 2014 White Paper of Environment – ME
2. 2013 Environment of Seoul– Seoul Metropolitan city
3. 2014 White Paper of Environment – Busan Metropolitan city
4. 2013 White Paper of Environment – Daejeon Metropolitan city
5. 2014 White Paper of Environment – Daegu Metropolitan city
6. 2014 White Paper of Environment – Ulsan Metropolitan city
7. 2014 White Paper of Environment – Jeju Special Self-Governing Province
8. Waste of Construction sites reduction and Recycle case – Choi., Samsung C&T
9. Waste Recycle performance and Company's Status(2013)– KECO
10. Extended Producer Responsibility – ME, KEREC
11. Nationwide Waste generation and treatment Status – KECO
12. Waste policy and local government waste administration estimation – Lee., Seoul Univ.
13. RDF of government Status and Problem(2008) – Yoon., Citizens Coalition for Economic Justice

**Thank you for
attention!**

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