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**Involving 3R Technologies and Choices under the Resource
Recirculation Policy of Republic Of Korea**

(Short Background Paper for Plenary Session 4 of the Programme)

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**Short Background Paper
on**

**Involving 3R Technologies and Choices under the Resource
Recirculation Policy of Republic Of Korea**

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Summary/Abstract

The waste policy of Korea is based on the principle of resource circulation, is aimed at minimizing untreated wastes in landfill and maximizing recycling by refraining from the single use and disposal of energy and resources to create a resource circulation society. Korean government has enacted many policies to establish an effective waste management system. For reducing waste generation Korean government implemented policies such as Volume based waste fee system, waste charging system, and industrial waste reduction program. The volume based waste disposal system is a policy to reduce waste generation and facilitate separation and discharge of recyclable materials by imposing waste fees in proportion to the amount of residential wastes one generates. The waste charging system is aimed at curbing waste generation by imposing charges on products that are hard to recycle or that contain hazardous chemicals and the reduction of industrial waste program is concerned with reducing environmental hazards by minimizing the amount of waste disposed of through the control of their generation and expansion. For the reuse of waste, policies such as deposit refund system for glass bottles, restriction on the use of disposable products, packaging container reuse system were made. For waste recycling government has enacted many policies, such as “food waste recycling policy” to actively promote the recycling of food waste, “construction waste recycling promotion” to recycle the waste generated from construction industry, “eco assurance system” for recycling electrical and electronic waste, automobile waste. Most importantly, extended producer responsibility system to promote the reduction, reuse and recycling of waste by encouraging manufacturers to consider the environment through the whole process of product design, manufacturing, distribution, consumption and disposal. Beside this Korean government also give high importance to energy recovery from waste. Republic of Korea has succeeded in achieving a socio-economic structure in which waste reduction and recycling are prevailed. People of Republic of Korea are well aware of the significance of waste management and played a vital role by reducing, reusing and recycling the waste. Now Korean government is targeting a zero waste landfill with the maximum recycling by establishing and enforcing the Resource Circulation Fundamental Law.

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1. Introduction

The waste policy of Korea is based on the principle of resource circulation, is aimed at minimizing untreated wastes in landfill and maximizing recycling by refraining from the single use and disposal of energy and resources to create a resource circulation society in which natural resources and energy are recirculated within the economic activity areas for as long as possible.

Under this policy, the first fundamental plan of resource circulation (2011-2015) was established in 2011 with the goal of realizing a zero-waste society by going beyond the quantitative level of resource circulation and shifting towards “upcycling” that upgrades the value of waste resources.

In addition, the ministry announced measures to promote the transition to a resource circulation society in September 2013, which include free pickup services for large-scale waste home appliances, securement of the collection, transportation and classification of recycling resources, expansion of waste to energy facilities, creation of a recycling market, etc. To that end, it plans to establish the “Act on Promotion of Transition toward a Resource Circulation Society. Recently the law has been enacted so called Resource Recirculation Fundamental Law which will be effective from January of 2018.

2. Policies for Waste Reduction

2.1 Volume-Based Waste Fee System: The Volume-Based Waste Disposal system is a policy, in accordance with the polluter pays principle, to fundamentally reduce waste generation and facilitate separation and discharge of recyclable materials by imposing waste fees in proportion to the amount of residential wastes one generates (except recyclable wastes). Under this program, wastes are required to be discharged by using designated standard plastic garbage bags or putting on labels marking wastes as bulky waste, and the charges are collected by selling volume-rate garbage bags and labels marking wastes. In the case of discharging recyclable materials, they are collected free of charge regardless of the amount. The Volume-based Waste Disposal System applies to residential waste discharged from households and business operations, and was recently expanded to cover food waste. This program, launched in January 1995, is considered to have significantly decreased the amount of residential waste. With this, the daily generated amount of residential waste per person decreased from 1.3kg in 1994 to 1.0kg since 1995 after the implementation of the program. Fig. 1 is showing volume-based waste fee bags

2.2 Waste Charging System: The Waste Charging System is aimed at curbing waste generation by imposing charges on products that are hard to recycle or that contain hazardous chemicals. This law was enacted in 1993 and the following seven product categories are subject to waste charge: containers of pesticides, hazardous chemicals and cosmetics, anti-freezing liquid, chewing gum, disposable diapers, cigarettes, and plastic products. The collected waste charges revert to the Environmental Improvement Special Account and are used to fund studies on waste reduction and reuse, as well as the development of related technology, supporting projects for installing waste disposal facilities and reusing waste, funding local governments for retrieving and reusing waste, and purchasing and stocking up on reusable resources.



Figure 1: Volume-based Waste Fee Bags

2.3 Business Waste Reduction Program: The reduction of industrial waste program is concerned with reducing environmental hazards by minimizing the amount of waste disposed of through the control of their generation and expansion of recycling in order to encourage the voluntary efforts of businesses to reduce harmful waste. This program was introduced in December 1996, and four types of business operations were added to target businesses subject to mandatory waste reduction in 2014. Currently, 2312 businesses from 18 types of business operations that are considered to generate large amounts of waste are designated for the reduction program and encouraged to voluntarily make improvements on waste reduction.

3. Policies for Reuse of Waste

3.1 Deposit Refund System for Glass Bottles: The 'Deposit Refund System' was adopted to promote collection and reuse of used containers by levying a refundable container deposit on consumers. At present, liquor or soft drink glass bottles are subject to the system. Producers and importers of alcoholic beverages and soft drinks can include a deposit fee separate from the retail price in order to promote collection of reusable glass- containers. Producers and importers must refund deposit to consumers via retailers or wholesalers when consumers return used beverage con

3.2 Restriction on the Use of Disposable Products: Due to the enactment of the restrictions on disposable products use law since March 1994, the generation of plastic waste material is decreasing in many areas including the reduction in use of plastic shopping bags by distribution companies, the replacement of plastic containers and cups with paper products by fast food businesses to facilitate recycling, and the use of carry-out food containers that use paper materials instead of plastic.

3.3 Packaging Container Reuse System: The Packaging Container Reuse system was enacted in 1993, under the Packaging Container Reuse system companies should voluntarily keep the proportion of refillable containers. The items and standard proportion are set by the Ministry of Environment. The items and the proportion are as following. (in Figure 2)



Figure 2: Packaging Container Reuse System

4. Policies for Waste Recycling

4.1 Extended Producer Responsibility (EPR): Extended Producer Responsibility was introduced to promote the reduction, reuse and recycling of waste by encouraging manufacturers to consider the environment through the whole process of product design, manufacturing, distribution, consumption and disposal. Table 1 is showing the targeted items for EPR. Prior to introducing the EPR, the Wastes Deposit Program had been implemented since 1992 as a way to strengthen the role of manufacturers regarding recycling. The Wastes Deposit Program allowed manufacturers to deposit a cost in proportion to their production output and retrieve it in the amount in proportion to their records in reuse. It was designed to encourage businesses to make effort to recycle by offering financial incentives, but the system faced criticism because companies simply paid the charge and did not make actual reuse efforts. Under these circumstances, the Waste Deposit Program was abolished and EPR was introduced to ensure the practical efforts of businesses. After a preparatory period that began with seven items, including electronic products, between 2000 and 2002 with a voluntary agreement between the government and industry, the full-fledged Extended Producer Responsibility system was introduced in 2003. The total amount of recycling has grown from 938,000 tons in 2002 to 1,519,000 tons in 2012, an increase of about 62%, which implies quantitative growth in the recycling sector.

Table 1. EPR Target Items

Products	Tires, Lubricants, Batteries (six types including mercury batteries), Fluorescent lamps, Electronics and Electric Products (27 types, including TVs and computers), Aquaculture Styrofoam buoys.
Packaging containers	Metal cans, Glass bottles, Paper pack, Synthetic resin packaging, Agriculture, Fisheries, and Livestock products, Detergents, Medicines and Cosmetics.

4.2 Food Waste Recycling: Although the Ministry of Environment put a priority on reducing the generation of food waste as its basic direction of food waste management policy, it is also actively promoting recycling of food waste inevitably generated as organic resources despite

the reduction efforts. Food waste can be turned into valuable resources such as feed and fertilizer since they contain organic substances and nutritive components. To that end, the developer of a housing and tourist complex was made to mandatorily install a facility to convert food wastes into resources in December 1997. According to the “Fundamental Plan on Food Waste Recycling” established in 1998, the reduction target and implementation measures are to reduce the total amount of generated food waste by more than 10% and recycle the total amount of food waste by more than 60% by 2002. In 2004, Comprehensive Measure for Reducing Food Wastes was established. As a result, 96% of the total amount of generated food waste (13,209 tons/day) is used as recycling materials, such as feed and compost, as of 2012. Table 2 depicts food waste recycling scenario in Korea.

Table 2. Food Waste Generation and Treatment (Unit: ton/day)

Year	2004	2005	2006	2007	2008	2009	2010	2011	2012
Generation	11,464	12,977	13,372	14,452	15,142	14,118	13,671	13,537	13,209
Generation rate (kg/person/day)	0.24	0.27	0.28	0.29	0.30	0.28	0.27	0.26	0.26
Landfill	1607 (14%)	356 (2.7%)	261 (2%)	451 (3.1%)	565 (3.7%)	281 (2%)	194 (1.4%)	167 (1.2%)	153 (1.1%)
Incineration	541 (4.7%)	516 (4%)	507 (3.8%)	674 (4.7%)	867 (5.7%)	459 (3.3%)	422 (3.1%)	465 (3.4%)	381 (2.9%)
Recycling	9,316 (81.3%)	12,104 (93.3%)	12,603 (94.2%)	13,327 (92.2%)	13,710 (90.5%)	13,378 (94.7%)	13,055 (95.5%)	12,905 (95.3%)	12,675 (96%)

4.3 Construction Waste Recycling Promotion: Construction waste has increased consistently, from around 53 million tons in 2003 to around 68 million tons in 2012, due to the requirements of the domestic construction industry, and it makes up more than half of the total amount of business waste. The recycling rate of construction waste has increased continuously, to 97.3% in 2012, thanks to the government’s recycling policy, and thus the landfill rate has been gradually decreasing. Table 3 is showing construction waste treatment status.

Table 3. Construction Waste Treatment Status (till 2012)

Classification	Total	Landfill	Incineration	Recycling
Treated amount (ton/day)	186,627	4,1118	1,016	181,493
Percentage	100%	2.2%	0.5%	97.3%

As for the proper treatment and recycling of construction waste, Ministry of Environment and Ministry of Land, Infrastructure and Transport has divided their roles and implemented them. The Ministry of Environment established the Construction Waste Recycling Promotion Act,

which was put into effect in January 2005, to provide the legal ground to treat construction waste in an eco-friendly manner and recycle waste to create high-value resources. According to the law, recycled aggregates should be mandatorily used for the construction of roads, industrial complexes and environmental infrastructure. In 2013, the revision of the enforcement ordinance and regulations specified the treatment methods for construction waste. Based on the revision, the asphalt concrete waste used for simple mounding and backfill should be separately discharged and stored away from other construction waste, and the recycling of asphalt concrete waste was restricted to road construction.

4.4 Eco-Assurance System (ECOAS): Eco-Assurance System for Electrical & Electronic Products and Automobiles is concerned with creating a resource circulation system encompassing the whole process from design and production to disuse in order to control the use of harmful substances and thus facilitate recycling. To support this program, Korea implemented the Act on the Resource Circulation of Electrical and Electronic Products and Vehicles in April 2007. Prior to the enactment of the law, the government implemented a guideline on examination of preliminary recycling of electrical and electronic products and vehicles and restriction of their use of harmful substances.

5. Energy Recovery from Waste

The 3R policy also gives high importance to energy recovery from waste. Currently in Korea, about 24% household waste, 6% industrial waste, 18% hazardous waste, 0.5% construction waste are being used for energy recovery. The technologies that are currently being used for energy production from waste are thermochemical conversion process like incineration, gasification, pyrolysis; mechanical conversion process like SRF manufacturing; biological conversion process like anaerobic digestion for biogas production. Bio-gas is made by livestock manure, food waste, sewage sludge, organic MSW, and organic industrial waste using anaerobic processes. Many biogas plants are being successfully operated in Korea, all the biogas are being used for producing heat, electricity or as a fuel in thermal power plant. Currently more than 200 combustion (incineration) plants for MSW, which have been installed in 1990s, are in commercial operation for producing energy from waste. The existing incineration plants place mostly for stable disposal of waste. However, their energy efficiencies are very low, sometimes just to get heat only not electricity. Due to emission of air pollutants it has received bad images by publics, so gasification and melting technology has been introduced in the beginning of 2000s. Around 10 plants are in operation. Korean government has planned to promote energy conversion efficiencies of WtE plants with segregating waste to produce higher calorific SRF(RDF) and to increase recycle rate as well since the expansion plan of renewable energy in 2008 has been established. Currently many SRF plants are being operated all over Korea, many are also still under construction and design process. The plants which are being operated their capacity varies from 25 tons/day to 200 tons/day.

6. Resource Recirculation Fundamental Law

Recently Korean government enacted a new law called resource recirculation fundamental law in May, 2016 and will be entered into force from January, 2018. Main objectives of this law are efficient use of resources, minimize waste generation, maximize the use of generated waste, conserving the environment and making sustainable society. Main contents of resource

recirculation fundamental law are establishing a foundation for resource recirculation through resource recirculation ground rules, developing master plan and international cooperation; accelerating resource recirculation through effective management system, implementing disposal fee and evaluating harmfulness and circulation usability; supporting resource recirculation business circles through implementing recognition system, by providing financial and technical supports. It is expected that effective implementation of this law will lead to resource circulating society by maximizing recycling of waste to resources and achieving a zero waste landfill.

7. Conclusion

Republic of Korea has succeeded in achieving a socio-economic structure in which waste reduction and recycling are prevailed. People of Republic of Korea are well aware of the significance of waste management and played a vital role by reducing, reusing and recycling the waste. Also, thanks goes to the Korean government for establishing effective waste management regulations. Now Korean government is targeting a zero waste landfill with the maximum recycling by establishing and enforcing the Resource Recirculation Fundamental Law. This may include some integrated structural efforts to improve recycling industries and markets, to set a tax system on the waste landfilled, and to utilize all the features to create zero landfill in Korea.

8. The Way Forward Section:

The republic of Korea has achieved a dramatic shift from landfill dependent waste management to 3R oriented waste management last three decades (~90% landfill in 1980 to ~60% recycling in 2015) by implementing many 3R related policies such as integrated waste management, polluter (discharger) payment strategies such as volume based tipping fee using priced bags and EPR system for many consuming products, plans of waste to energy, and promoting plans for waste to become resource.

There should be further movements to achieve SDGs, in which two most policy relevant questions would be followings. 1) How are we properly practicing the waste to energy policy? 2) How can we establish a resource circulation society by achieving zero waste country (less than 3% landfill)? As noticed in previous discussion, even though around 20% of waste is converting to energy, the efficiency is low and soon the period of replacement will be coming. And many RDF plants and biogas plants have been constructed and in operation, but many problems have been faced. So the appropriate technologies with supporting by engineers are needed. Then the recovery of energy from waste will be in right place to contribute a resource circulation society with SDGs. For responding to achieve the resource circulation society, the government just enacted the Resource Circulation Fundamental Law in 2016, this year, and will be effective from 2018. This law includes many schemes to accomplish a zero waste society with maximizing recycling by implementing several policies in coming decades as follows; promotion of utilization of recycled products, reduction of landfill by implementing tax system for landfill and incineration, and support the recycling business and landfill site surroundings. By effective practices by the newly established law, the government is being attempted to achieve resource circulation society for SDGs.

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Policies for Sustainable Resources Management in Korea.

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