

Korea waste management and WtE vision



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Table of Contents

I. KEITI Introduction

II. National R&D for Wastes to Energy

III. Domestic Waste Management Policy

I. KEITI Introduction

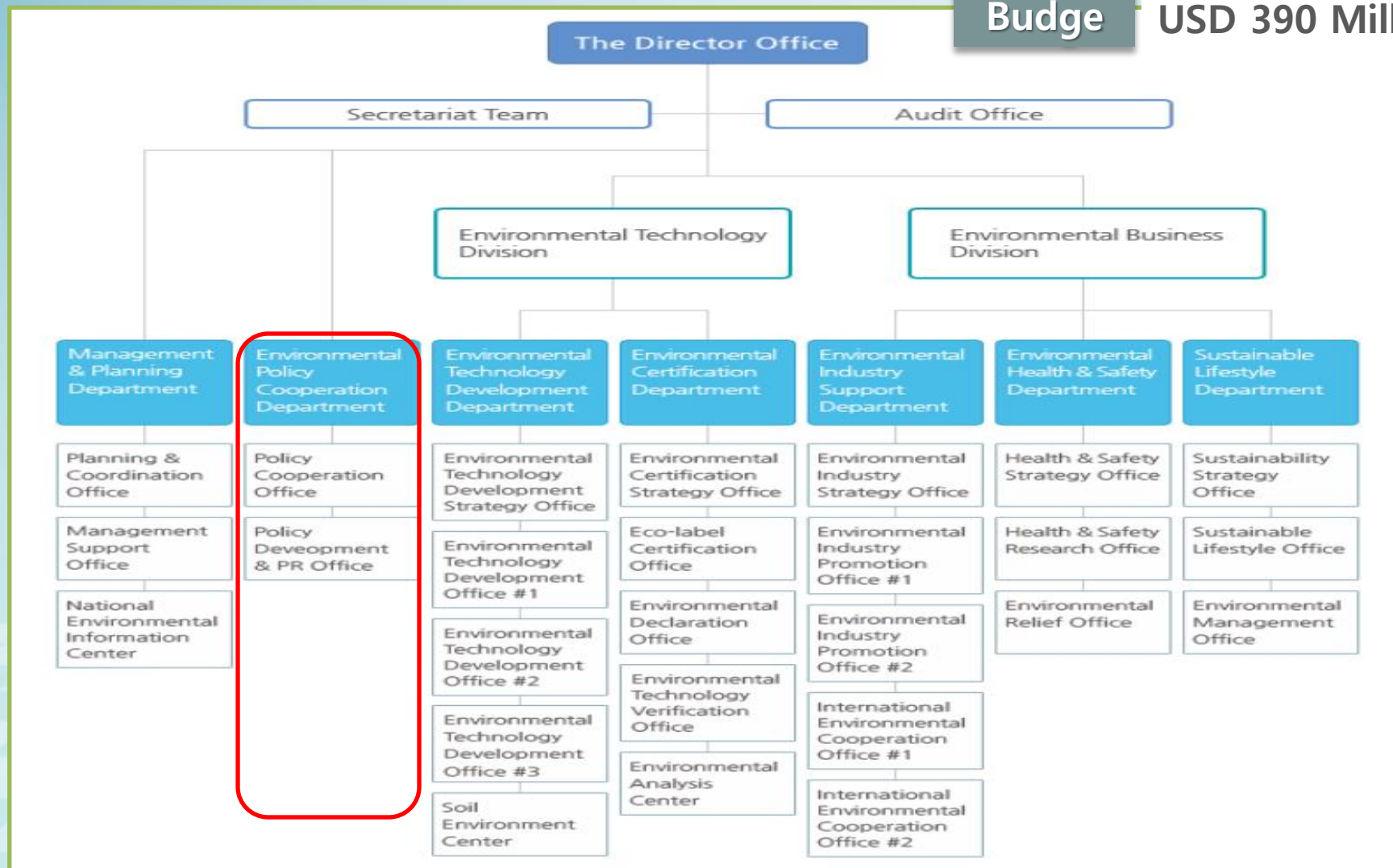
I. KEITI introduction

HR

430 employees

Budge

USD 390 Million



Key Functions and Programs



Environmental Technology R&D

- Environmental Technology (R&D)
- Planning, Evaluation, Management



Train professionals and provide information

- Train environmental Industry · Technical professional and Create Jobs
- Collect Environmental Industry, · Technical Information, Utilization and Education, PR



Certification Evaluation

- Operate Environmental Mark, Carbon Achievement Carbon score label
- Certification · verification environmental technology and certification of green technology



Develop environmental industry

- Develop environmental industry and support expansion to overseas market
- Environment loan, Eco-friendly creative economy center
- 5 overseas offices operation



Distribute eco-friendly business models

- Promote green product life
- Promote eco-friendly management and low carbon management by company



Support environmental health · safety management

- Relieve environmental damage and manage chemical materials
- Manage eco-friendly product, support environmental health · safety for the vulnerable social group

I. KEITI introduction

KEITI's overseas cooperation

414 environmental cooperation projects in 75 countries (2015)

- ▲ Master Plan: 20 countries, 19 projects
- ◆ Feasibility Study: 52 countries, 137 projects
- Joint International Localization: 23 countries, 245 projects
- ★ Market Pioneering: 13 countries

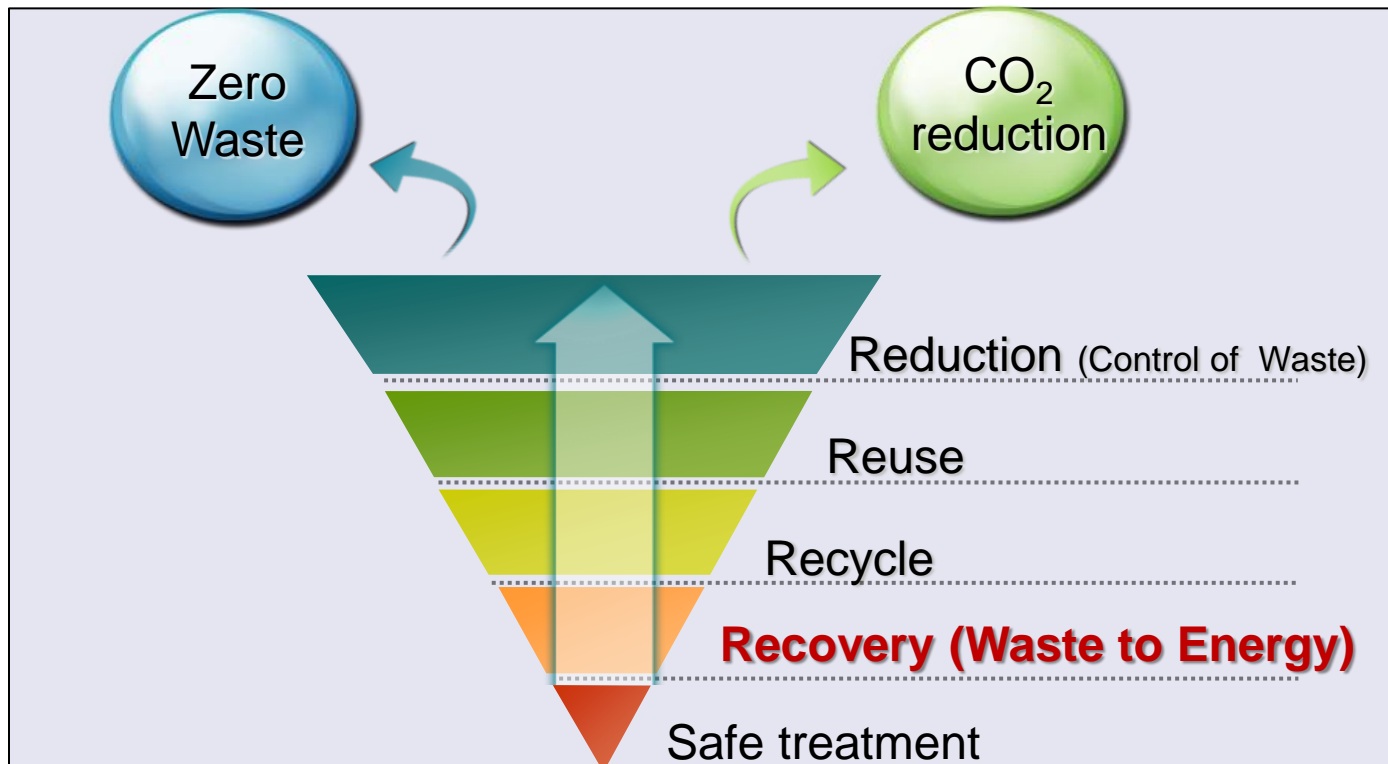


II. National R&D for Energy from Wastes

II. R&D for Energy from Wastes

Waste treatment policy in Korea

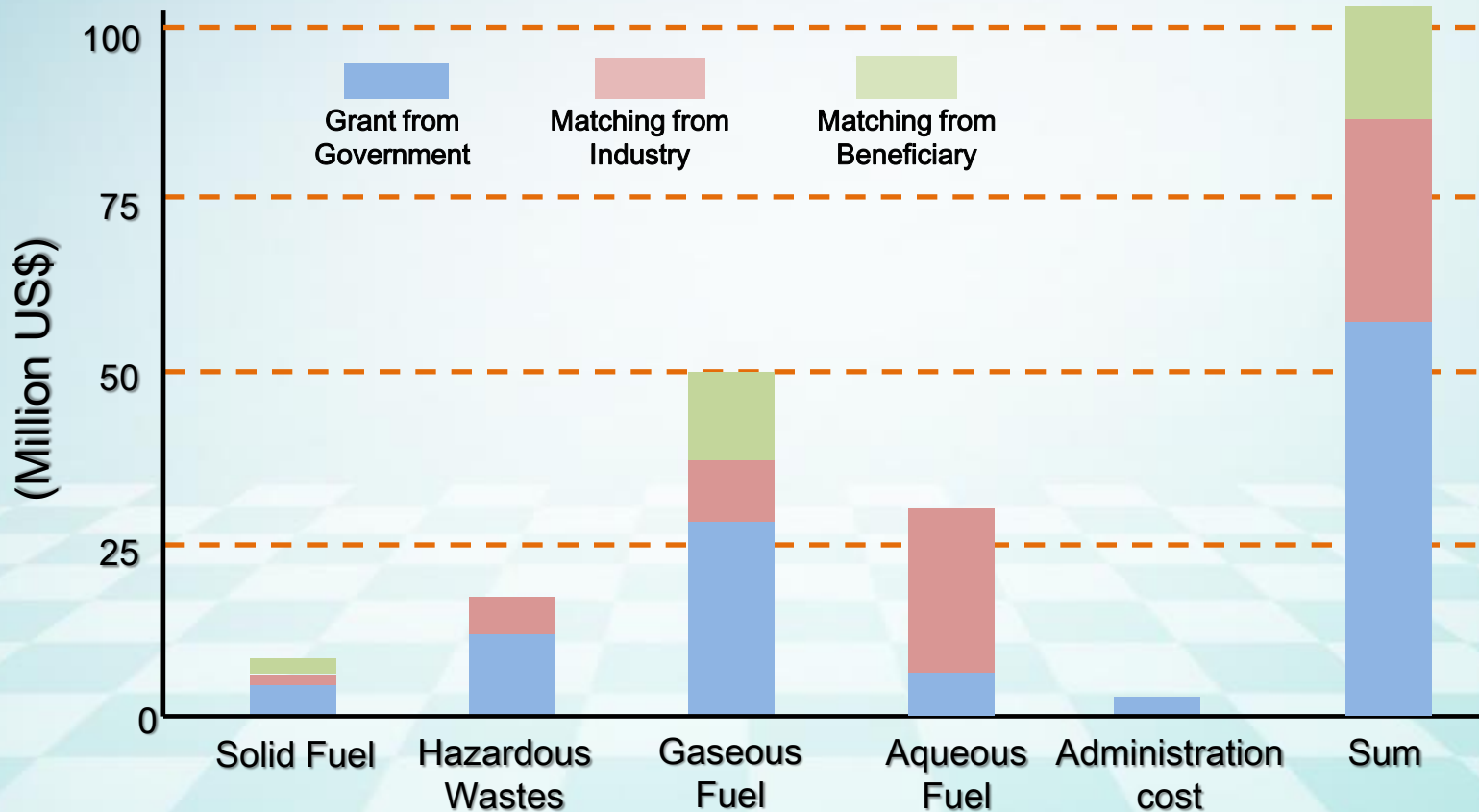
- Reduction(Control of waste) ⇒ Reuse and Recycle ⇒ **Recovery(Energy resources)** ⇒ Safe treatment : Promote to reduce CO₂ and zero waste by building a waste treatment system (4R)
- ➡ Resource Recirculation Society for climate change



II. R&D for Energy from Wastes

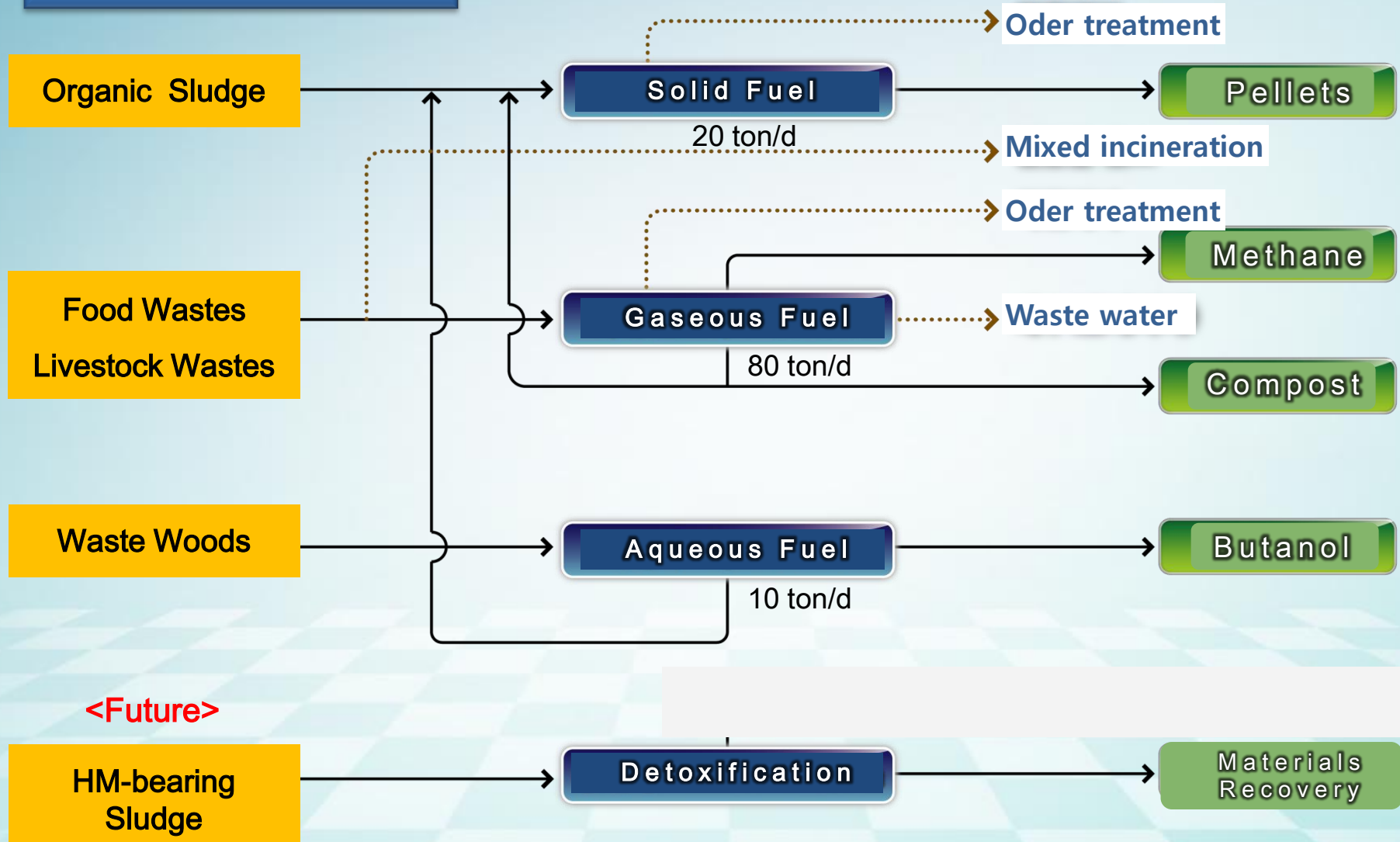
Waste to energy R&D Budget

- Total budget : 80 million USD
- Government grant : 50 million USD
- Private fund : 30 million USD(Industry 15 million USD, Beneficiary 15 million USD)



II. R&D for Energy from Wastes

Major Projects



II. R&D for Energy from Wastes

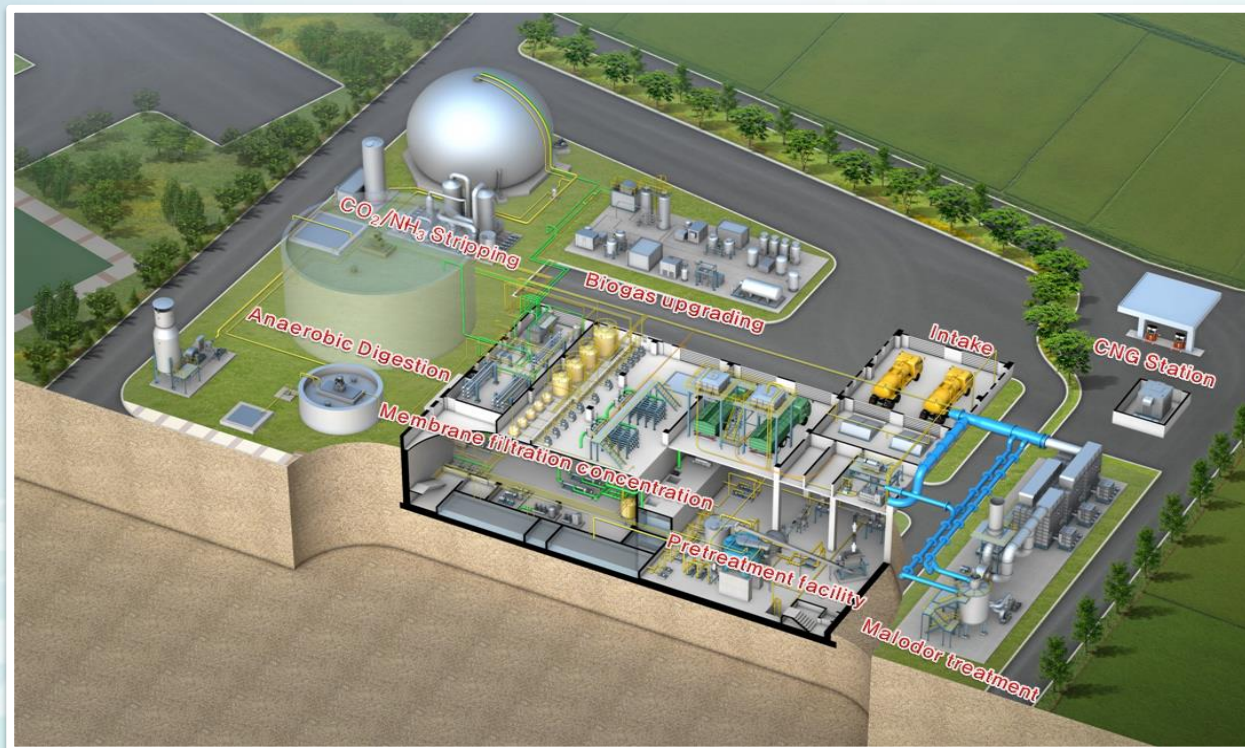
Step-wise Goals

	Phase I	Phase II	Phase III
	2013~2015 (3 yr)	2016~2018 (3 yr)	2019~2021 (2yr)
Solid Fuel	Integration of Best Available Technologies EPC-Commercial Scale	Improved O&M Technology Advancement Innovation of Key Technologies Accepting Orders from Domestic Market	Building Test Bed in developing country Completion of World-Class EPC-O&M Technology Accepting Orders from Overseas Market
Gaseous Fuel			
Aqueous Fuel			

II. R&D for Energy from Wastes

Construction of Test Beds

- KEITI is building 1.5 ha size of test beds for waste to energy R&D project and we will operate the facilities from this year
- KEITI would like to build a waste to energy test bed to overseas from 2019



III. Domestic Waste Management Policy

III. Domestic Waste Management Policy

Stepwise technologies for waste treatment in Korea

Waste Discharge & Collection

- Separate waste discharge & collection
- Automatic waste collection system
- Volume-based Waste Fee System



Waste Pre-treatment

- Waste Recycling
- Demolition waste Separation & Sorting



Middle processing of waste

- Incinerators
- MBT
- Pyrolysis



Waste to energy

- Combustible Waste to Energy
- Organic Waste to Gas Energy
- LFG Power
- Bioreactor



Final Disposal

- Sanitary Landfill
- Maintenance & Restoration of non-sanitary landfill
- Sustainable landfill



III. Domestic Waste Management Policy

Reduction of waste generation

- Reduced waste generation per capita
 - Municipal waste discarded daily in 2014 per capita was 47% less than that of 1981.
 - Germany 1.671kg/day, Japan 0.959kg/day, UK 1.342kg/day(2012)
- This is remarkable change of waste treatment method
 - (Landfill) 53.4%(1994) → 9.3%(2014)
 - (Recycle) 42.7%(1994) → 84.4%(2014)
 - (Incineration) 4.1%(1994) → 6.3%(2014)

199



Per capita
2.3kg/day

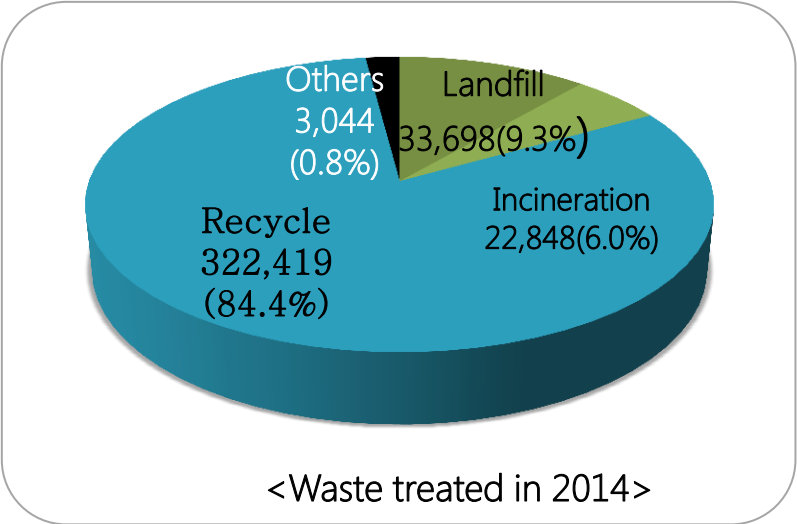


201

4



Per capita
0.95kg/day



Volume-based Waste Fee System

- Korean government had introduced the Volume-based Waste Fee System in 1995
- Based on the polluter pays principle, they should purchase discharger of non-recyclable garbage and pay waste treatment cost in proportion to its amount
- Polluter should be put in plastic bag purchased in advance, and discharged at the place and time designated by local governments
- The 10L cost of household plastic garbage bag is USD 20 cents and total payment of the garbage bag was USD 458 Million in 2013
- 99.9% of administrative districts had implemented the system in 2013
- Discarded bags, 21,413 ton/day, are collected by local government or its contractor, then mostly incinerated or land filled

III. Domestic Waste Management Policy

Volume-based Waste Fee System

● The discharge of recyclable waste is free



Paid



Free of charge



Volume-based Waste Fee System

- Since ban on direct landfill from 2005, most of food waste is recycled for feedstuffs, compost or biogas production at public or private facilities.
- Should be separated from other waste and discarded in accordance with local regulations. (free or charged)
- Volume-based charge system is applied at all area since 2013

Payment Chip



- Suncheon in Jeollanam-do -

RFID



- Guri in Gyeonggi-do -

Standard Bag



- Jongno in Seoul -

III. Domestic Waste Management Policy

Advantages and disadvantages of waste treatment technologies

● To build Resource Recirculation Society, Waste to Energy Activities have been under study and commercially utilized

Process	Advantage	Disadvantage
Incinerator (WTE)	<ul style="list-style-type: none"> ● Decrease of Final Waste ● Sanitary Treatment ● Energy Recovery (Heat + Power) 	<ul style="list-style-type: none"> ● High Construction and O&M Cost
Refuse Derived Fuel	<ul style="list-style-type: none"> ● Combustible Waste Recycling ● Energy Recovery 	<ul style="list-style-type: none"> ● Not economical (Low Yield & low sales cost) ● Difficult in Control
Organic Waste to Biogas	<ul style="list-style-type: none"> ● CH₄ Production (To be used as fuel) ● Sludge to Compost 	<ul style="list-style-type: none"> ● High Cost & Technology
Landfill Gas to Energy	<ul style="list-style-type: none"> ● GHGs Reduction (CH₄ Utilization) ● Energy Recovery (Heat + Power) 	<ul style="list-style-type: none"> ● Irregular LFG Production
Bioreactor + LFG Energy (Improved LFG Utilization)	<ul style="list-style-type: none"> ● More GHGs Reduction(CH₄ Utilization) ● More Energy Recovery(Heat + Power) ● Landfill Early Stabilization 	<ul style="list-style-type: none"> ● Added bioreactor system Cost

III. Domestic Waste Management Policy

Cost comparison in each technology

Comparison of Construction Cost in South Korea (Capacity of treatment : 1,000ton/day)

Process	Construction Cost(USD/30y)	Energy Recovery(%)	Endurance Period(year)	Total Operating Cost(USD)	Days of operation(day/year)
Incineration	600 million (Excl. Landfill construction)	20 ~ 30	30	450 million	330
RDF	200 million (Excl. Landfill construction)	10 ~ 15	30	300 million	265
Landfill Gas to Energy	120 million	5 ~ 10	30+20 (Depends on the site size)	60 + 10 million	365
Bioreactor + LFG Energy	130 million	7 ~ 15	30+10 (During +After operation)	75 + 5 million (During +After operation)	365

UNFCCC's CDM projects of LFG

Country	No.	Business item	Registration date	Reduction (tCO ₂ e/y)	IRR (%) Including CER
Peru	708	Huaycoloro landfill gas capture and combustion	2007.05	298,996	21.2
China	887	Shenzhen Xiaping Landfill Gas Collection and Utilization Project	2007.05	471,619	30.0
Mexico	1123	Ciudad Juarez Landfill Gas to Energy Project	2007.11	170,499	10.2
Korea	941	Sudokwon Landfill Gas Electricity Generation Project	2007.04	1,210,342	5.9



THANK YOU

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