

# Simple and Advanced Technology on Waste Tracking of Food Waste using RFiD

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A Volume-Rate Food Waste Disposal System**

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# Background to Introducing A Volume-Rate Food Waste Disposal System

# Current Status of Food Waste



Make up to **28%** of total garbage

**15,100 tons/day** ('08)  
→ 17,000 tons/day ('12)

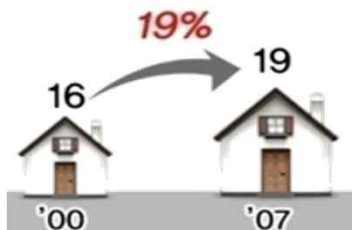
Increases by  
an average  
of 3% every  
year

Daily amount per person  
0.24kg ('00) → **0.3kg** ('08)

What is causing the increase in food waste ?

## Increased population and number of households

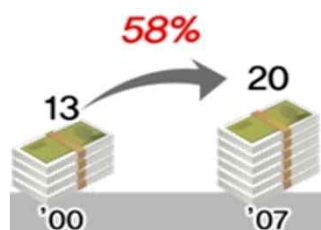
Increase in population by 3% every year  
43.1% of households have 1~2 members



Number of Households  
(units: million)

## Changes in eating habits

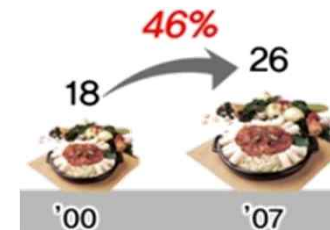
Increased eating out due to  
increased income



Income  
(units: million won/year)

## A culture that prefers hearty meals

Restaurants providing  
excessive side dishes



Eating out expenses  
(units: 10,000 won/month)

# Problems Caused by Food Waste



## Environmental Damage

- Waste of energy • Greenhouse gas emissions
- Offensive odor during collection and processing
- Water and soil pollution from high concentration waste water



## Economic Waste

- Food worth 18 billion dollar is wasted every year
- It costs more than 700 million dollar to process food waste



## Social Issues

- Excessive side dishes prevent global acceptance of Korean cuisine
  - Low self-sufficiency rate in food means increased imports of agricultural/fisheries products
- Self-sufficiency rate for food 50%, self-sufficiency rate for grain 27%



# If Food Waste Were Decreased by 20%

## Greenhouse Gas Emissions

145kgCO<sub>2</sub>e decrease yearly



Travel back and forth  
Seoul ↔ Tongyeong



30 trees

If decreased by 20% in  
**a household** (family of 4)



## Energy Consumption

Save 144kwh yearly



That's like 1,080  
laundry loads



Or 3.4 months of  
refrigerator use  
(2,440 hours)

If decreased by 20% in  
**the whole country**



## Greenhouse Gas Emissions

177 million CO<sub>2</sub>e decrease yearly



That's like 470,000  
fewer cars



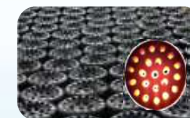
Or 3.6 billion trees

## Energy Consumption

Save 1.8 billion kwh yearly



Like the electricity from  
2.26 million drums (200 L)  
of kerosene

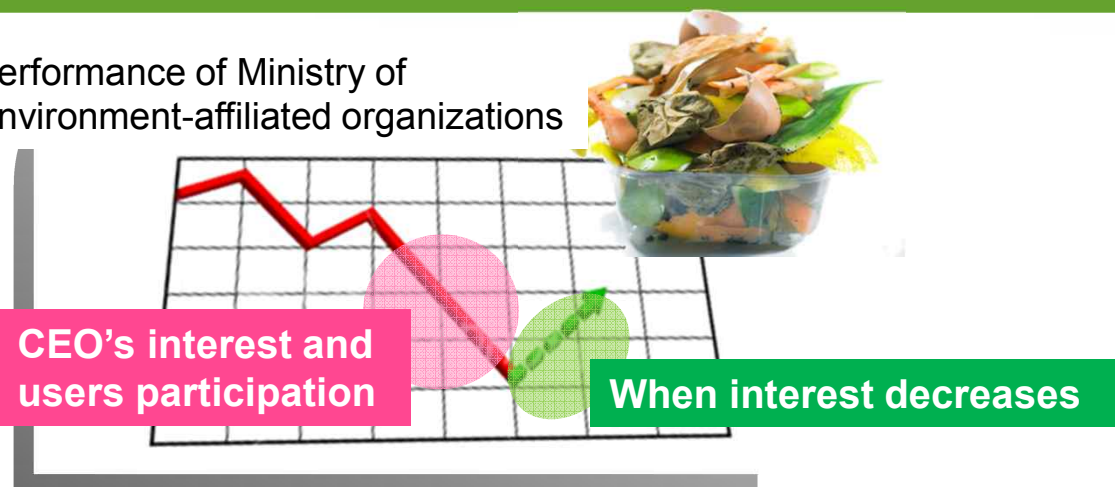


Or 1.86 million  
coal briquettes  
(enough to heat  
390,000 households for a winter)

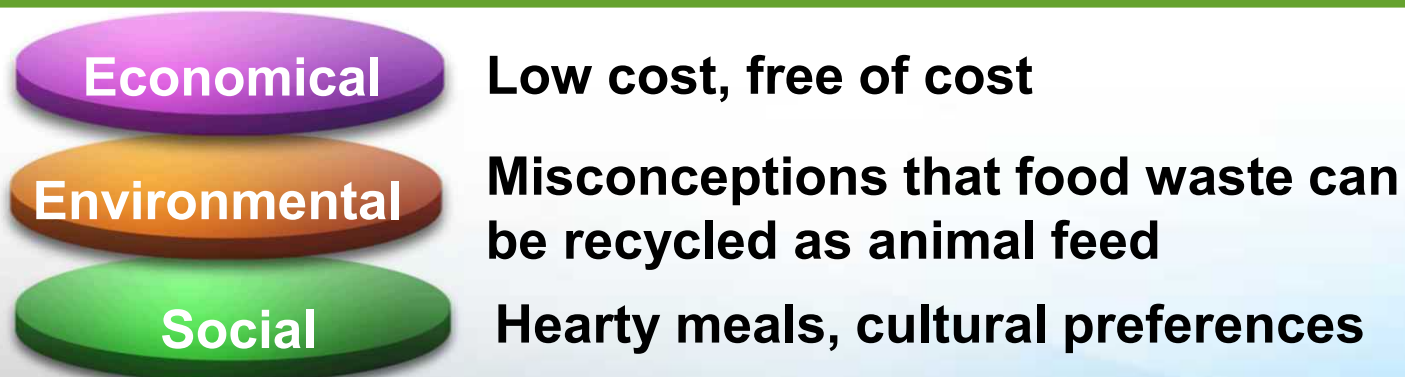
# Difficulties in Maintaining Low Food Waste Levels

## Yo-yo syndrome when people's interest and will decrease

Performance of Ministry of Environment-affiliated organizations



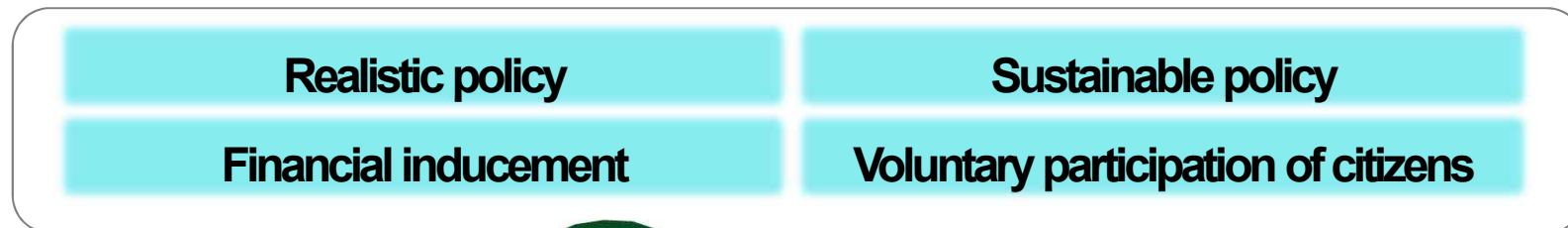
## Social Structure that Creates Food Waste



# Limits of Current Food Culture Improvement Policy

- ✓ Lacks sustainability due to limited content focusing only on public guidance
- ✓ Unrealistic systems
- ✓ Lack of financial inducement

## Direction of Food Waste Policy



[Directional Changes in Policy]

**Follow up Management → Reduced Food Waste**

[Action Plan for Stable Results]

**Volume-rate System Implementation**



# (Major Measure) Volume-Rate System for Food Waste

**Full Enforcement of Volume-Rate System in Local Governments targeted for separate disposal by 2012**

Overall Plan to Reduce Food Waste with Concerned Ministries(Feb 3, 2010)

**Make a surcharge for food waste according to disposal amount**

**Equal charge regardless of amount**



**Current Method**

**Rational charge according to amount**



**New Method**

**Choose between RFID, payment chip, stickers etc. considering characteristics of local governments**



**RFID System**



**Payment Chip, Sticker**



**Food Waste Bags**

# Application Methods of Volume-Rate System for Food Waste

## RFID

- ◆ Read RFID tag (for disposal source) on device → Dispose
- Transmit disposal information such as weight to central system
- **Surcharge information setup (advance/deferred payment)**
- **Surcharge management utilizing central system**

## Chip

- ◆ Purchase chip → Attach chip to individual container or insert chip in designated container → Dispose
- **Surcharge levied according to quantity / volume (advance payment, chip sales price)**

## Bag

- ◆ Purchase volume-rate system bag → Insert garbage in the bag
- Leave at the door or at designated container
- **Surcharge levied according to quantity / volume (advance payment, bag sales price)**



**Volume-rate system with RFID-based weight measurement method that levies surcharge according to the disposal amount on a 'disposer pays' basis is most efficient and recommended**

# Role of Government

<b>Government Support for Purchasing RFID Reading Devices</b>	<ul style="list-style-type: none"><li>✓ <b>47 billion won 2012~2014(3 yrs) (30% of total amount)</b></li></ul>
<b>Quarterly Assessment of Volume-Rate System Settling in · Reduction Effect for Each Local Government</b>	<ul style="list-style-type: none"><li>✓ <b>Joint assessment with NGOs</b></li><li>✓ <b>Media promotion of successful cases</b></li></ul>
<b>System Development, Implementation group organization</b>	<ul style="list-style-type: none"><li>✓ <b>Establish scheme, legal basis, notifications and etc.</b></li><li>✓ <b>Organize committees in relevant organizations</b></li><li>✓ <b>Set up and operate specialized institution (Korea Environment Corporation)</b></li></ul>

# RFID-based Food Waste Management System

# Goals and Systems

## Purpose

## Expand Reduction of Food Waste through RFID-based Food Waste Management System

### Demo Project ('10~'11)

- Joint project between KECO in local governments under MOSPA
- Cost sharing between MOE-NIA-local governments

MOSPA(NIA) MOE(KECO)  
u-service support system

Environmental  
Changes

### Expansion of Base Facilities ('12~'14)

- Enforcement and management with national treasury support, local government projects by MOE
- National treasury and local governments expenses matching

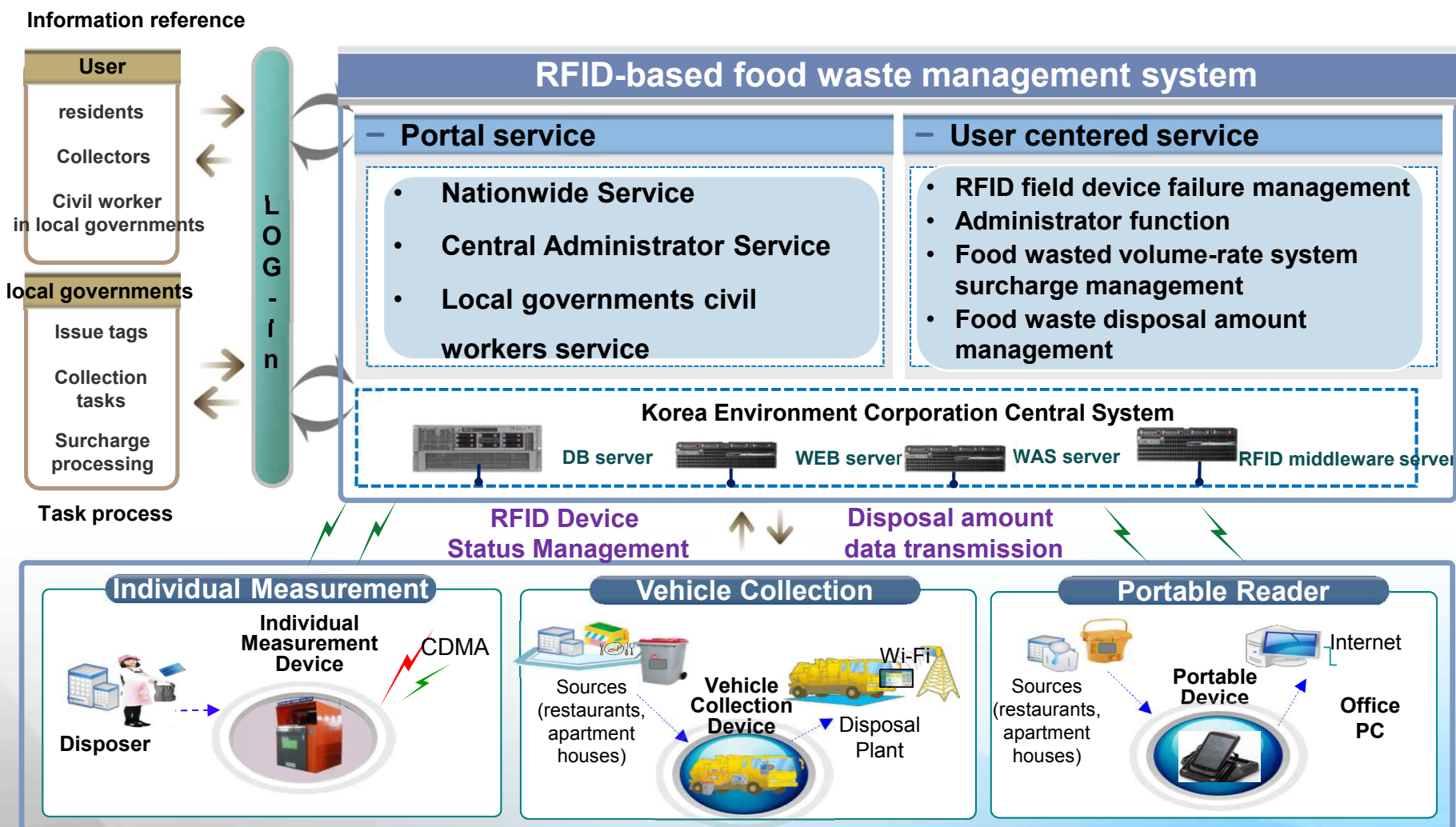
KECO support → Local government  
project implementation system

- ✓ Early establishment of volume-rate system process by setting up and operating a specialized institution (Korea Environment Corporation)
- ✓ Secure stability and procedure validity of project by establishing legal basis



# Introduction of RFID-based Management System

- Local governments conduct installation and operation of field equipment, utilize a central system installed at Korea Environment Corporation for IT operations and DB management.



# RFID-based Volume-Rate System Application

## Individual Measurement Method



## Vehicle Collection Method

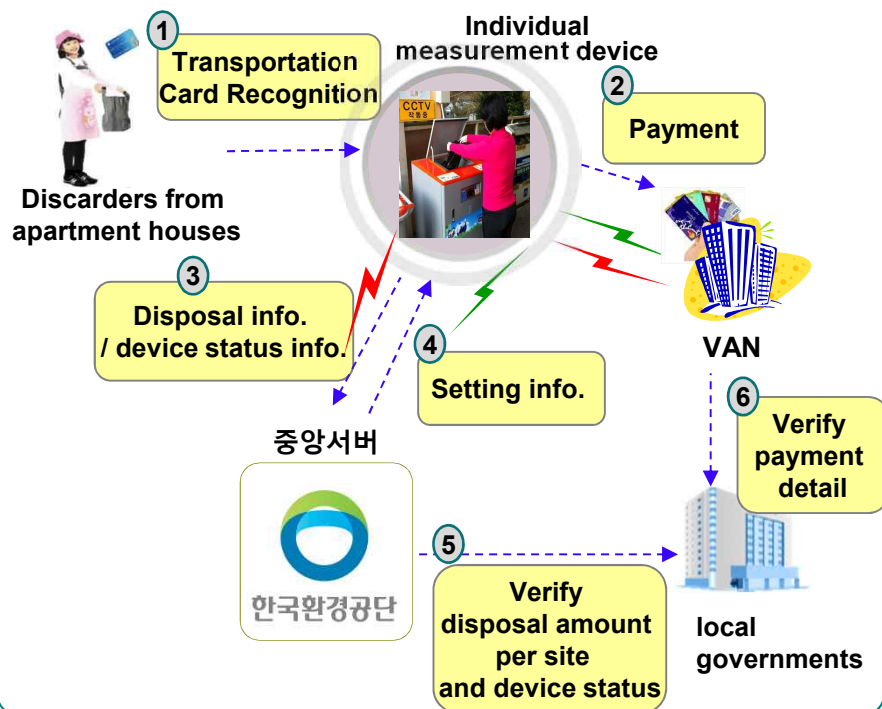


## Portable Reader Method



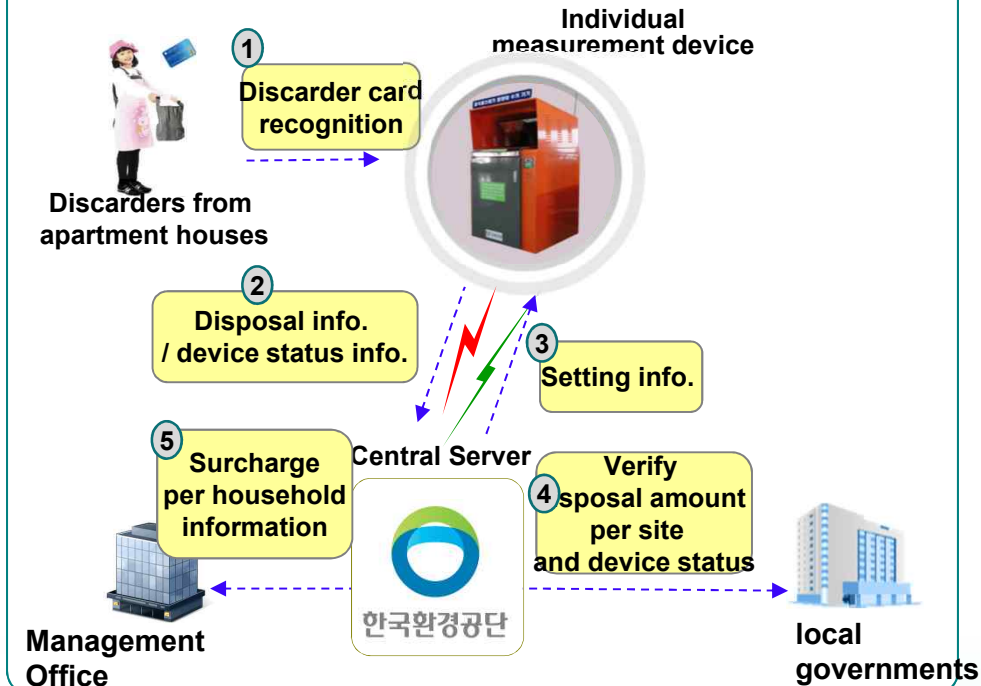
# Types of RFID Field Equipment (1/2)

## Individual measurement device (advance payment)



- ✓ Pay at the time of disposal, no nonpayment issue
- ✓ Difficult to verify disposal amount or surcharge per household
- ✓ Transportation cards need to be recharged, VAN surcharge issue

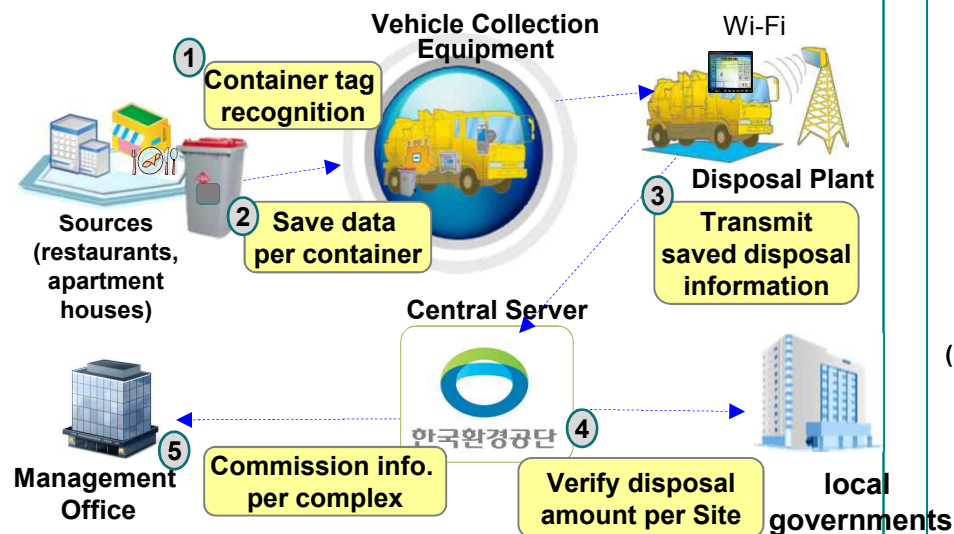
## Individual measurement device (deferred payment)



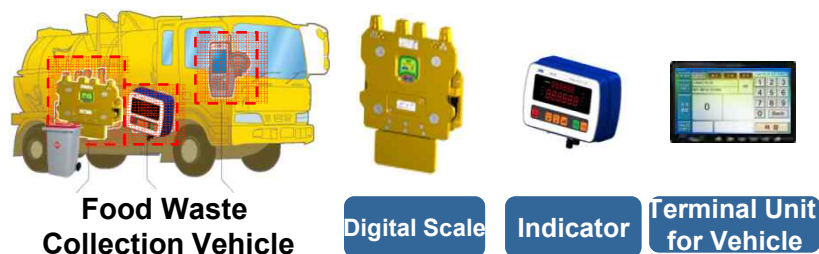
- ✓ Verify disposal amount and commission per household using system
- ✓ Can be charged monthly / quarterly
- ✓ Possible nonpayment issue

# Types of RFID Field Equipment (2/2)

## Vehicle Collection Method

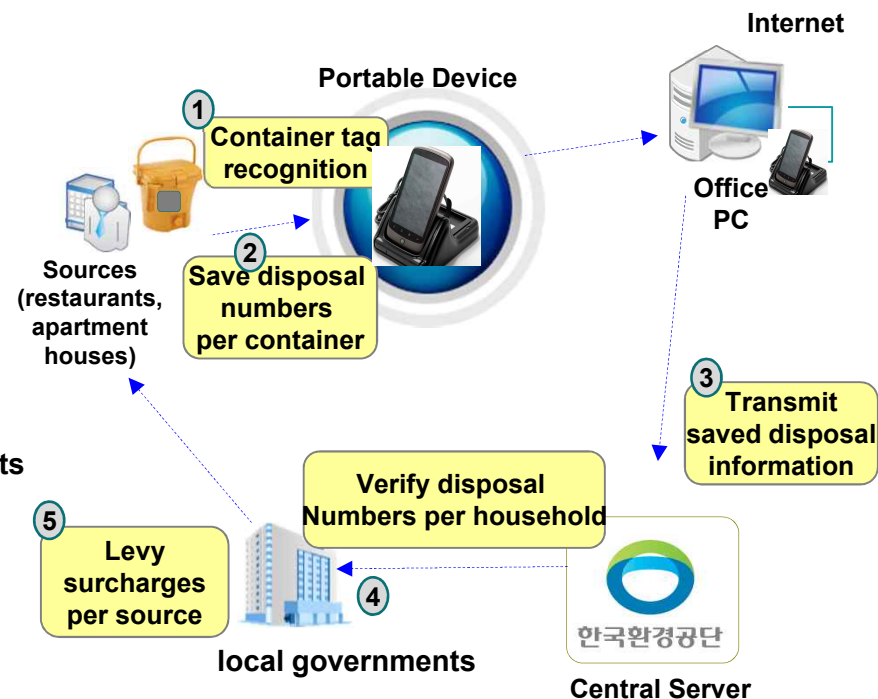


### Major Components



- ✓ Reduction effects when applied to restaurants etc.
- ✓ Difficulties in charging per household, additional reduction inducement needed

## Portable Reader Method



- ✓ Applicable to houses where vehicles cannot approach or communal use is inefficient
- ✓ Indirect volume-rate system based on disposal numbers rather than amount



# RFID Project and Operations Management Procedure

## Project Launch Stage

- Condition analysis and pre-investigations
- User education / promotion and securing residents' consent
- Establish project plan, select suppliers and enter into contracts

## Implementation / Completion Stage

- Field investigation / verification, field equipment installation (demo operation, installation verification, tests etc.)
- Produce / register / verify / issue/ distribute RFID tags
- Link to central system and input data

## Operation/ Management State

- Enter / confirm / modify required information to calculate surcharges
- Maintenance of equipment and handling user complaints (failure control, regular and frequent inspections)
- Performance management of RFID volume-rate system (reduction rate, operation rate, residents usage, resident satisfaction rate etc.)



# (Reference) Locality Application Example

- ✓ Implementation: **June 1, 2013 ~**
- ✓ Surcharge: Households (**80 won/ℓ, 100 won/kg**), Small restaurants (**100won/ℓ**)
- ✓ Implementation Methods

## Houses



Payment Receipt  
(Individual Container)

## Apartment Houses



Container per Complex  
/ RFID per Household

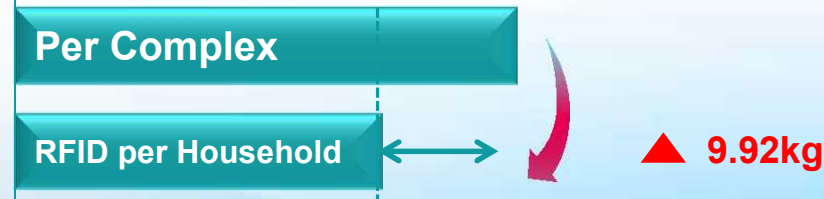
## Small Restaurants



Payment Receipt  
(Individual Container)

- ✓ Disposal Amounts in Apartment Houses (units : kg/household/month)

Classification	Per Complex	RFID per Household	Difference (Reduction amount)
Average amount per household per month	25.74kg	15.82kg	9.92kg



# (Reference) Locality Application Example

Gumi, Gyeongbuk

## Before

- ◆ Apartment House: 270 communities, 83,512 households
- ◆ Surcharge Type: Flat rate (1,200 per month for each household)
- ◆ Disposal Method: Direct disposal into containers within the communities
- ◆ Disposal Amount: 44 t/day



## After

- ◆ Period: 2013~2014
- ◆ Subjects: Apartment houses within the area (83,512 households)
- ◆ Budget: 2.58 billion won (national 5, state 3.5, city 17.3)
- ◆ Project Scale: 1,059 volume-rate system devices
- ◆ Methods: Fewer than 60 households - payment receipt method  
More than 60 households - individual RFID measurement method
- ◆ Charge Rate: 40 won/kg
- ◆ Disposal Amount: 29 t/day ( $\Delta 15$  t/day, 34.1% change)



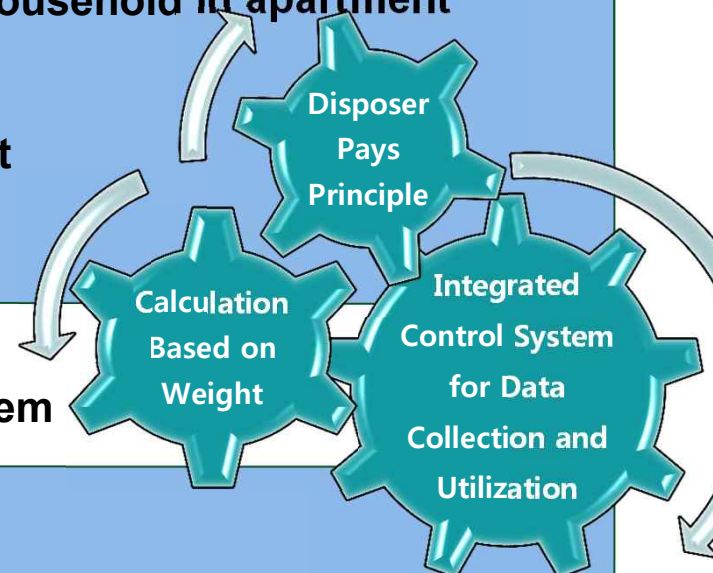
# High Suitability Advanced Management

## → Principles for Selecting Volume-Rate System Method (MOE, Guidelines for Food Waste Volume-Rate System Surcharge)

- ✓ Apply 'Disposer Pays' Principle and charge per household in apartment communities
- ✓ Disposal amounts are calculated based on weight
- ✓ Restrict the use of bags where possible

## → Characteristics of RFID Method Volume-Rate System

- ✓ In accordance with 'disposer pays' principle, and possible resolution of fairness issue around joint imposition of surcharge (complaints from those who dispose of less such as single person households or working couples)
- ✓ Surcharge based on weight of disposal
- ✓ Advanced method based on data provides baseline data for establishment of scientific policy



# Additional Reduction Policy Utilizing Data

## → Reduction Competitions in Apartment Blocks (example)

Disposal Reduction Rate per Complex Household Successful Cases

Objective and Reliable Assessment based on RFID Data

Inducement of Reduction Improvements of Resident Awareness System Stabilization in Early Stages

## → Application of Progressive Stage System (example)

Years Implemented	Charge Rate for Residents	Graded Charge Based on Disposal Amount (Month/Household) (Deferred Payment)		
		Less than 20kg	20kg ~ 30kg	More than 30kg
2013	30%	80	120	140
2014	40%	107	160	187
2015	50%	133	199	232
2016	60%	160	240	280
2017	70%	187	280	327

※ W Local Government Case (Unit: KRW)

- ✓ Collect and monitor disposal amount effectively using IT technologies  
→ Assessment and Analysis → Establish and implement flexible policies to induce more reduction at appropriate times

# Improvement in Residents' Awareness

**87.9%** 87.9% of the total population responded that they think food waste is a serious issue

**73.8%** are making efforts to reduce food waste after implementation of the volume-rate system

**87%** prefer to pay a surcharge based on the amount they disposed

**88%** Prefer the RFID method over bag or container method

**72.4%** are comfortable using an RFID device

<Based on 2 different research projects>

※ May 13~ June 2 '13 (2 weeks), directed at residents in 22 local governments implementing RFID, an online survey

※ Aug 30~Sep 2 '13 (4 days), directed at 1000 male and female adults nationwide, an online survey

✓ **Good level of understanding and acceptance of the purpose of the policy → Continuous education, promotion and management based on mature civic awareness to induce greater reductions**



# Improvement in the Urban Environment



# (Future Plan) Organization of the Basis of Data Utilization for Advanced Reduction Policy

- ➔ Create a big data based service value by advancing platform for data analysis · utilization and structuring interior/exterior link infrastructure.

**System Establishment for Data Collection (2012~2013)**

- ✓ Establish and utilize interface
- ✓ DB management streamlining

**Data Analysis and Efficient Utilization (2014~2015)**

- ✓ Provide policy services
- ✓ Establish and optimize platforms

**Value Creation Based on Big Data (2016~)**

- ✓ Structure interior / exterior link infrastructure
- ✓ Advance Platform and service

# Thank You!



**KECO Dept. of Waste Management  
Waste Business Team**