

Towards a Circular Economy

- Sustainable Waste Management in Korea -

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Overview of the Presentation

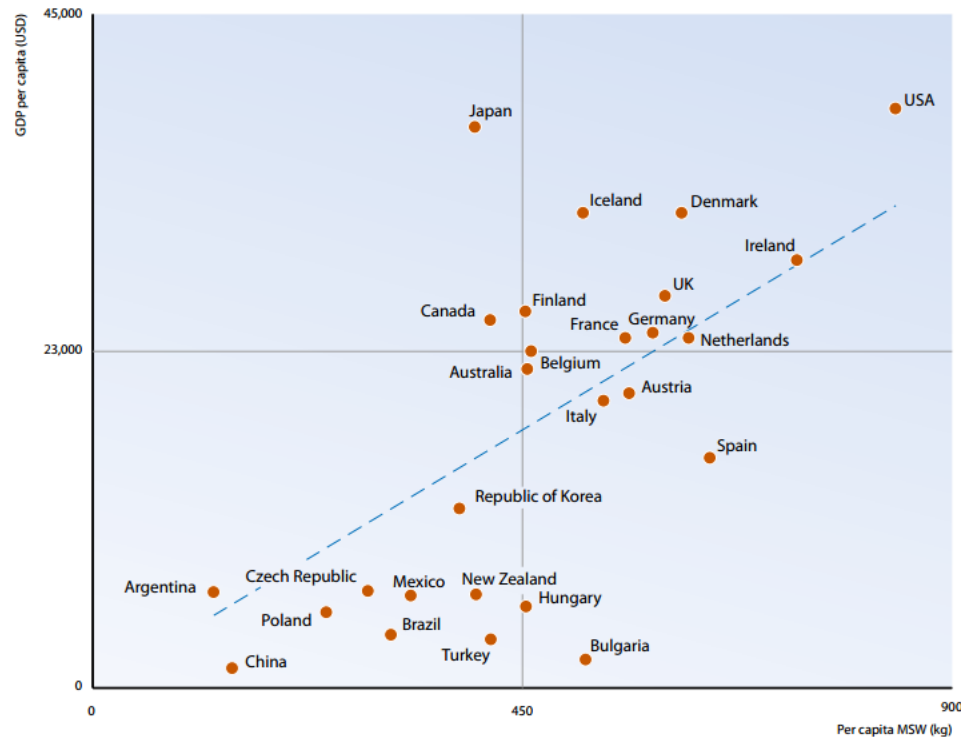
- Why solid waste management?
 - Waste management policy over time
 - Major challenges in 1980s
 - Smart solutions
 - Achievements and lessons
-



Why Solid Waste Management?

✓ Challenges

GDP vs. Per Capita Waste



Source: UNEP (2011) Waste investing in energy and resource efficiency

- Environmental Perspective
 - Land and water pollution
 - GHG emissions
- Social Perspective
 - Scavengers
 - NIMBY (Not In My Back Yard)
- Health Perspective
 - Negative impacts on health including cancer incidence, mortality, birth defects and low birth weight



Open dumping landfill in Seoul (1990)



Open dumping landfill in Indonesia (2012)



However, there are opportunities..



Source: http://apps.co.marion.or.us/imagegallery/ES_PhotoGallery/recycling_bins_rollcarts.htm

- Environmental Perspective
 - GHG emission reductions
 - Energy saving
 - Reduction in resource use
- Economic Perspective
 - Low operational costs
 - Extended use of landfill
 - Creation of green jobs
 - Energy saving



A Snap Shot of Solid Waste Management Trend in Korea

1980s

- Fast economic growth
- Industrialization & Urbanization

Seoul Olympic Games in 1988

GNI \$4,548 per capita (1988)

1990s

OECD Member in 1996

GNI \$7,607 per capita (1996)

2000s

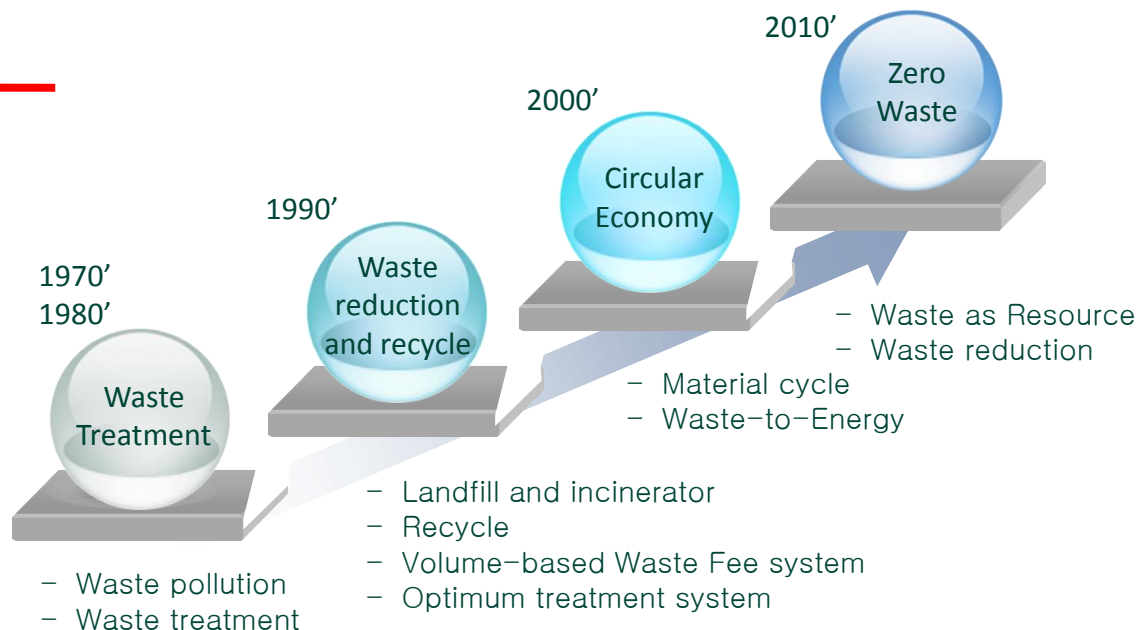
Korea · Japan World Cup in 2002

GNI \$12,100 per capita (2002)

2010s

G20 Seoul World Summit in 2010

GNI \$22,451 per capita (2011)



Source: Ministry of Environment, 2011 Modularization of Korea's Development Experience: Volume-based Waste Fee System in Korea

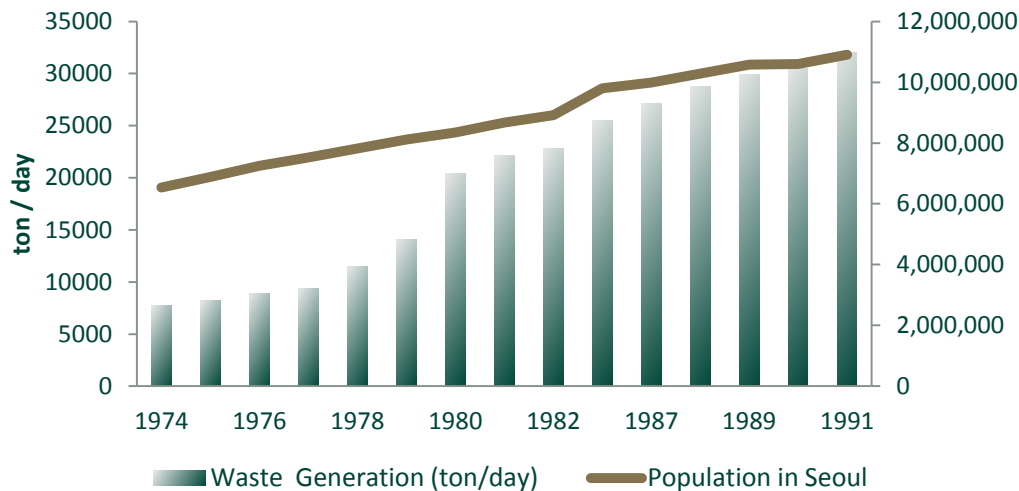
MAJOR CHALLENGES IN 1980S



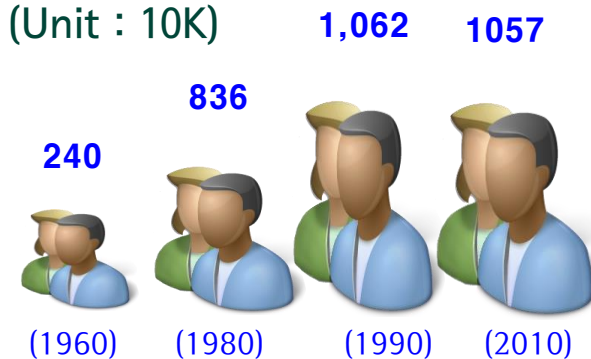
ISSUE 1: Increase in Waste Generation

- Rapid increase in waste generation driven by 1) population & 2) economic growth

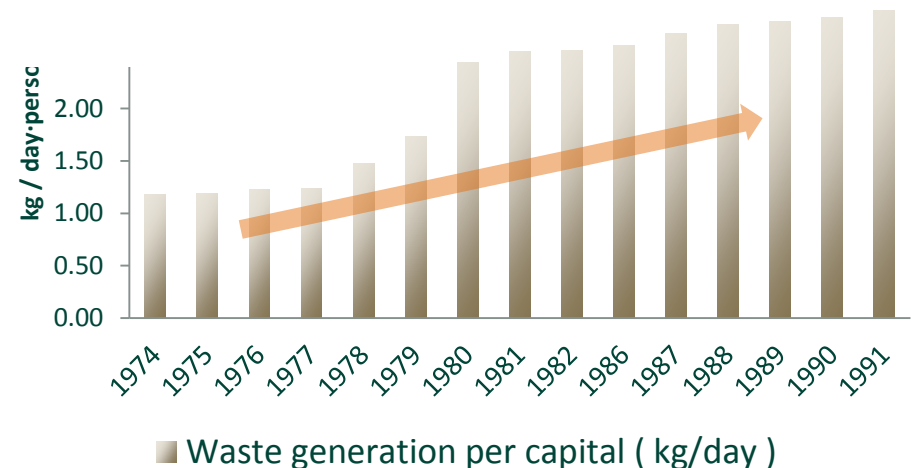
Total Amount of Waste Generation



(Unit : 10K)



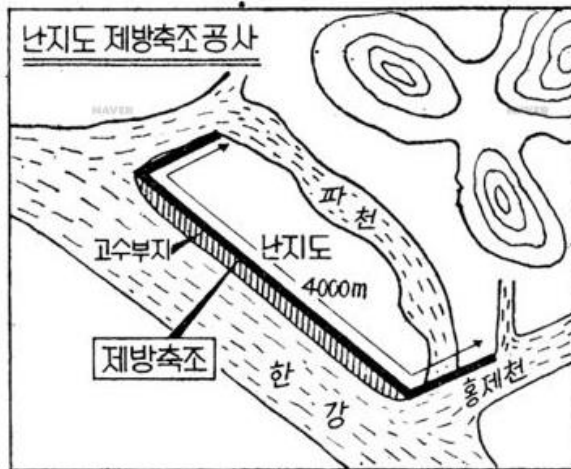
Per Capita Waste Generation



ISSUE 2: Limited Disposal Capacity

- Limited disposal capacity at Nanjido + Heavy Reliance on Landfill

■ Nanjido: Mountains of Garbage

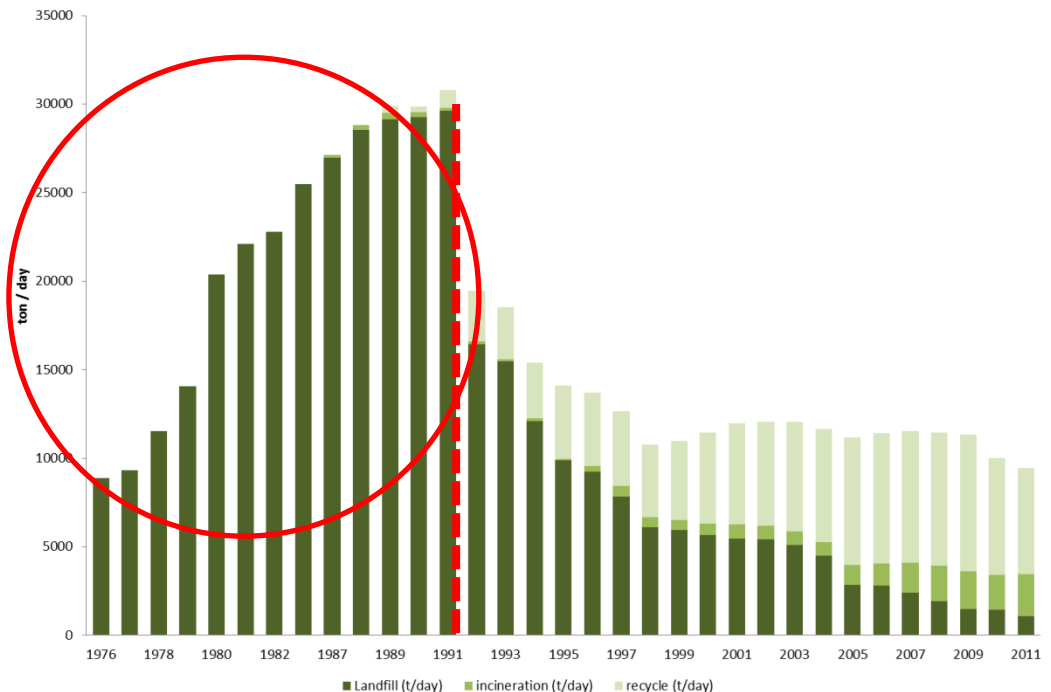


Source: Dong-A News paper 1977.1.7



Nanjido: Main landfill site for Seoul during 1978 ~ 1993
(Initially expected lifetime until 1984)

- ✓ 92 million tons of waste dumped on the island
- ✓ Two 90-meter-high mountains of garbage
- ✓ Serious environmental and safety concerns





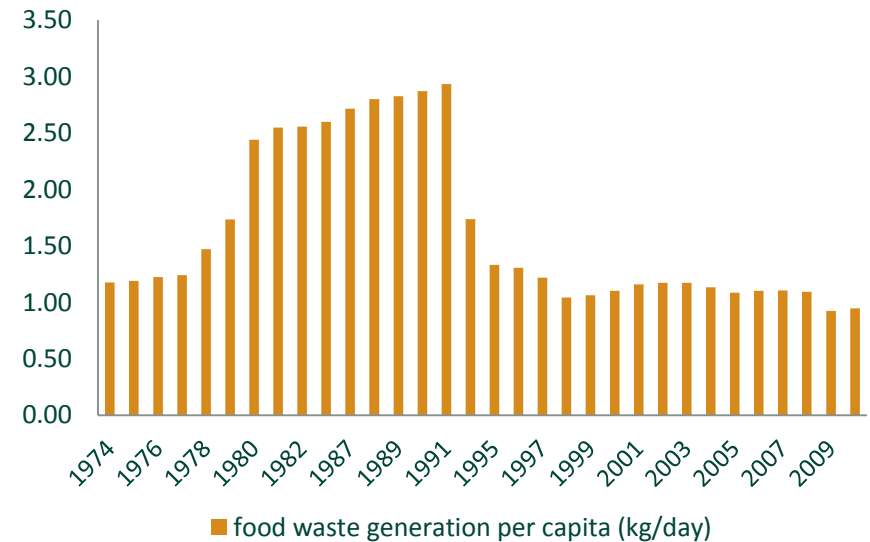
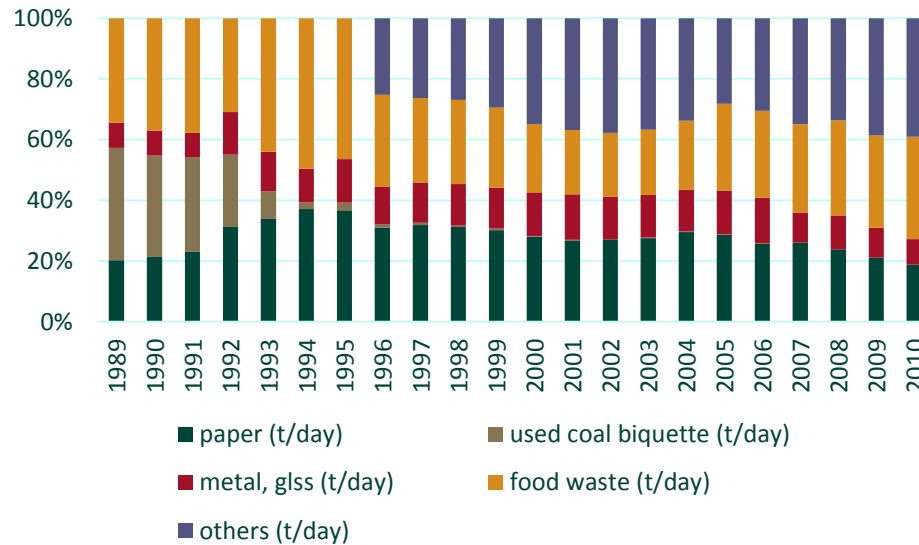
ISSUE 3: High Proportion of Food Waste

- Difficulty in treating food waste due to its high moisture, salinity and organic content

■ Problems with food waste

- Soil and groundwater contamination due to the high volume of leachate
- Strong landfill odor
- Not proper for landfill

Types of waste generation





ISSUE 4: NIMBY (Not In My Back Yard)

• Strong Resistance from Residents



■ Difficulty in building waste facilities

- Interested in incineration by Seoul Metropolitan Government in 1980s
Influenced by JICA
- ➔ “1 Gu 1 Incineration policy” in 1993 proposed by the city but confronted a strong resistance from the public due to the concern on dioxin
- ➔ Currently 4 Resource Recovery Facilities in Seoul

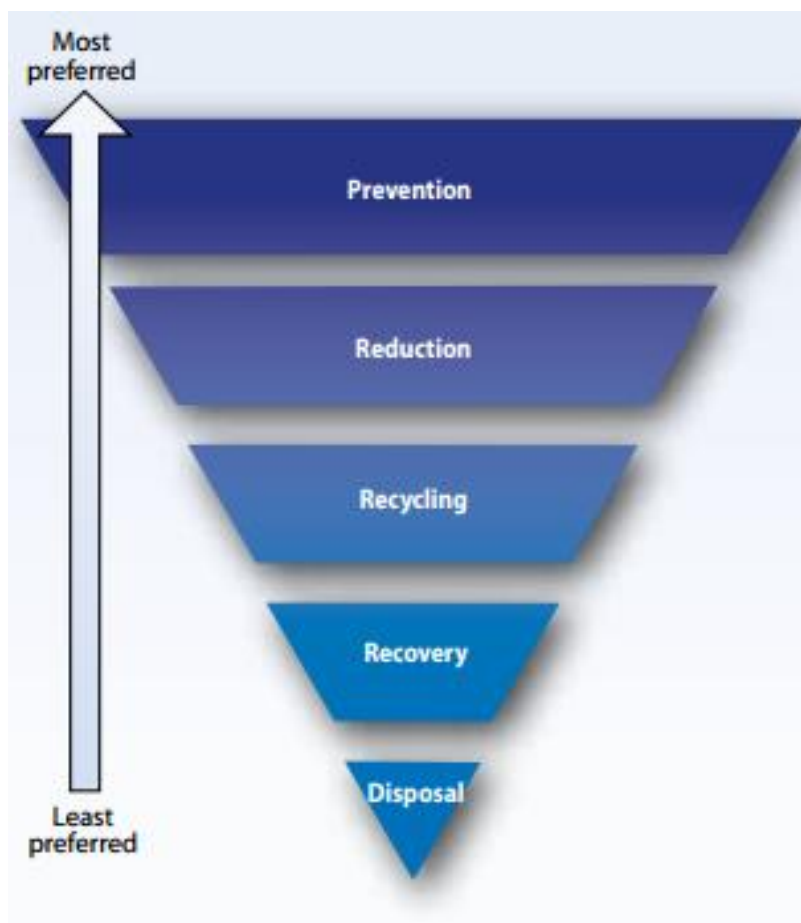


Source: Dong-A News paper, 1997.6.9.

SMART SOLUTIONS



How to Manage Municipal Solid Waste



✓ Regulate disposable products and excessive packaging

✓ **Introduce Volume-based Waste Fee System**

✓ Reduce food waste

✓ Improve separation, collection and sorting system

✓ Support recycle related industries

✓ Recover energy from waste

✓ Utilize food waste as resources

✓ Stabilize Nanjido Landfill

✓ **Manage Sudokwon Landfill Site**

Source: UNEP (2011) Waste investing in energy and resource efficiency

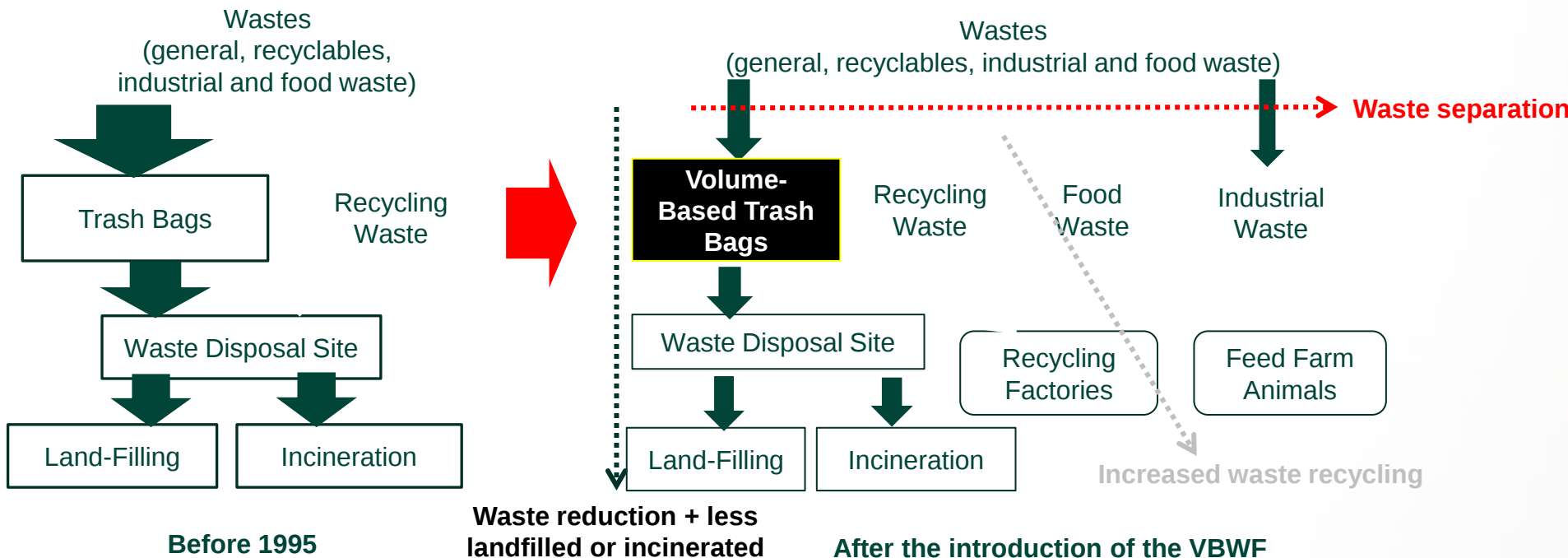
Smart Solution 1

Volume-based Waste Fee System

“Producer-pays” Principle

Volume-based Waste Fee (VBWF) System

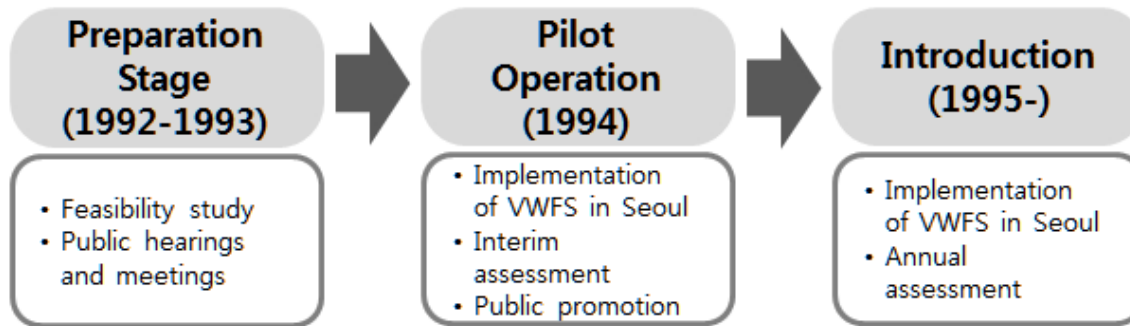
- ✓ To require users to purchase designated VBWF plastic bags to dispose their wastes
- ✓ Objectives:
 - 1) Induce reduction in generation of waste at source
 - 2) Encourage the collection of recyclable wastes by providing free collection service for recyclables wastes including food waste



Volume-based Waste Fee System

Preparation and Implementation

■ Preparation



- Feasibility study by Korea Society of Waste Management
- Extensive publicity and education programmes to educate the public on the use of a pre-paid bag and classification of recyclables

■ Volume-based Waste Fee Bag

- Price of VBWF Bags = f (Cost of waste disposal, financial status of the local government, residents' standard of living)
- Accounting for 30~40% of the total waste treatment costs
- Free distributions for low income residents.

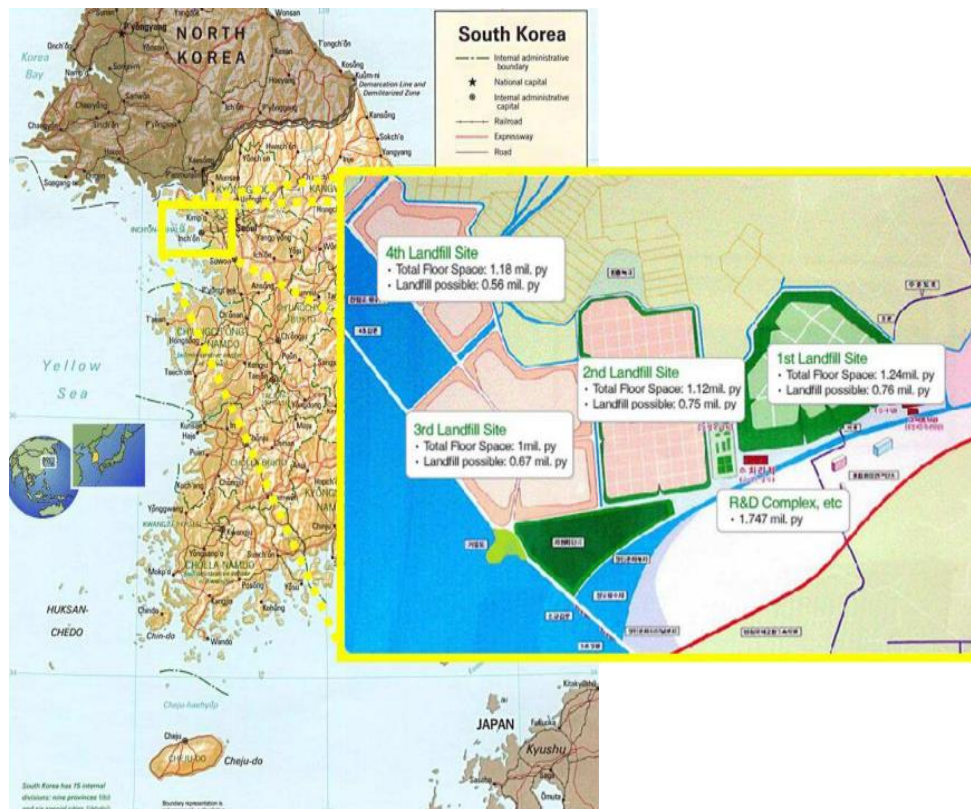


Smart Solution 2

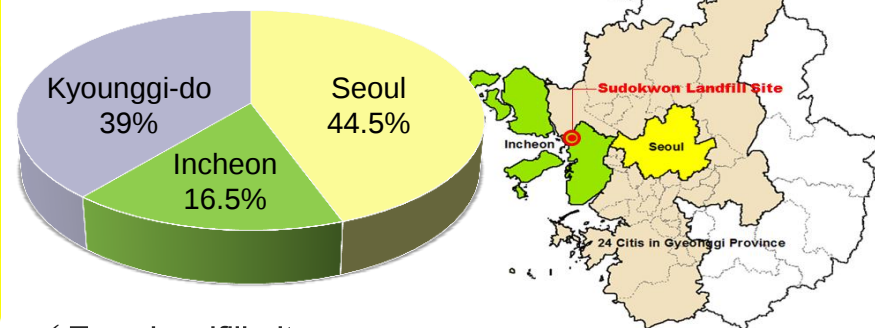
Multi-jurisdictional Cooperation on Waste Treatment

1) Sudokwon Landfill (SL)- Seoul Metropolitan Landfill

Location of the SL



- ✓ The largest landfill site in the world, around 20km², operated since 1992
- ✓ 13,400 tons of waste daily from the Seoul Metropolitan area (Seoul+Incheon+Kyeonggi-do) with a population of 24 million people
- ✓ Landfilled Waste Amounts by City



- ✓ Four landfill sites
- ✓ 1st site: landfill completed in 2000
- ✓ 2nd site: currently open, expected until 2015
- ✓ 3rd & 4th sites: to be filled from the year 2015

Smart Solution 2

Multi-jurisdictional Cooperation on Waste Treatment

How the SL has been built and operated

- Site selection: constructed on reclaimed land
 - In 1980s, coastal land-use change by reclamation was popular to expand land areas for food production in Korea.
 - Coastal reclaimed land
 - :relatively low land prices and no strong residents' conflicts vs. leachate treatment issue and long transfer distance
 - Selection of Kimpo site

■ Sharing of Costs

Land Purchase

- ✓ Land purchase from Dong-A construction company, paying approximately US \$ 50 Million
- ✓ US\$ 15Million (30%) by the central government + US\$ 35Million (70%) by Seoul Metropolitan Government

Construction costs

- ✓ Given the population size and financial status of the local governments, the share of each city for construction costs were determined
- ➔ Seoul 100: Incheon 16: Kyonggi-Province 16

Reclamation work of Landfill (1987)



Source: -Sudokwon Landfill site management public corporation 10 year 'dream green'

Making the first Landfill area (1990)



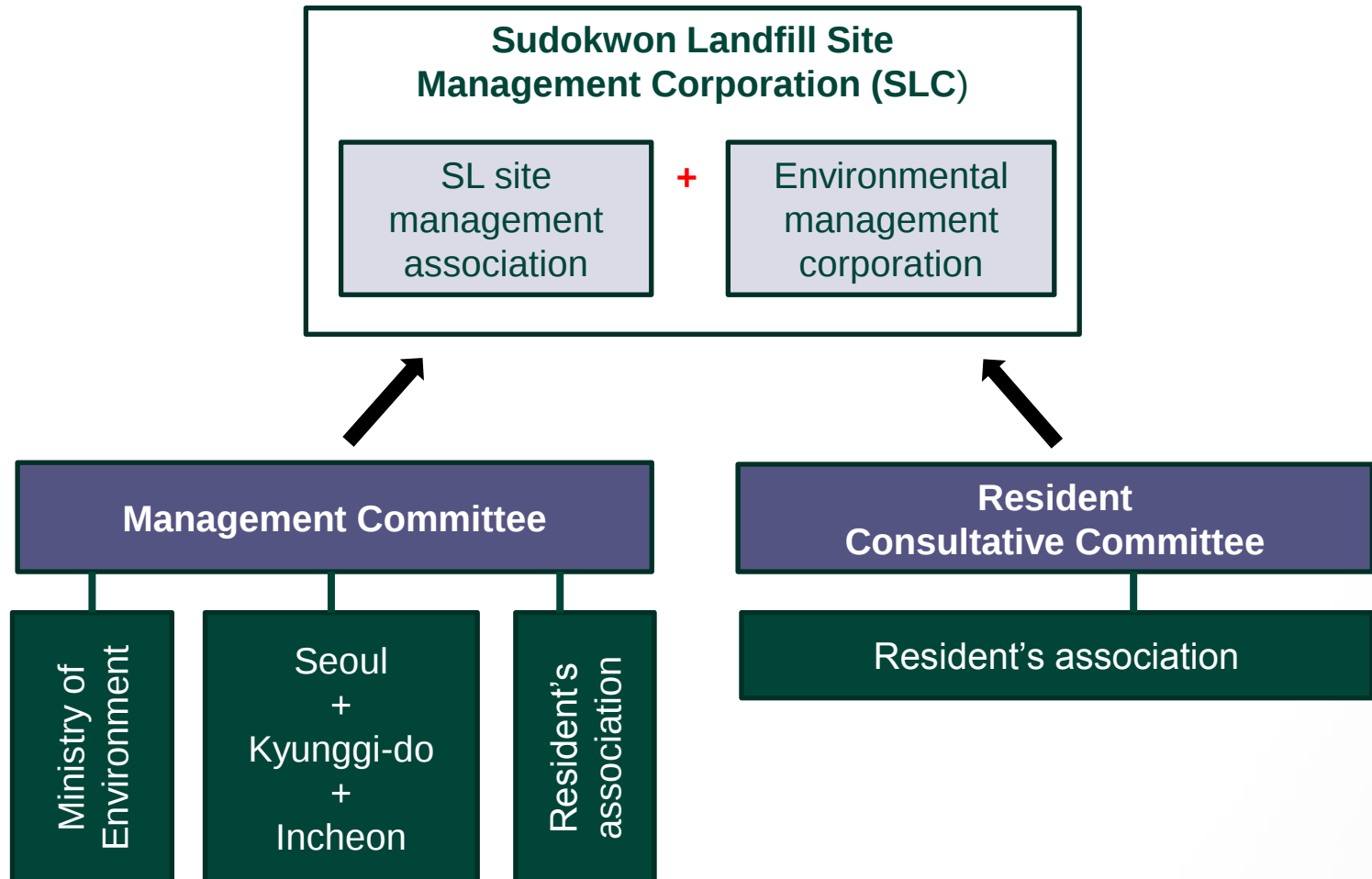
Source: -Sudokwon Landfill site management public corporation 10 year 'dream green'

Smart Solution 2

Multi-jurisdictional Cooperation on Waste Treatment

Institutional Framework of SL

- ✓ Law on the establishment and operation of Sodokwon Landfill Site Management Corporation (2001)



Smart Solution 3

Waste as Resources

Four Resource Recovery Facilities in Seoul

Features

- Incineration + Heat Recovery
- Co-utilization of Resource Recovery Facilities



Smart Solution 2

Waste as Resources

Electricity from Landfill gas

✓ 50MW Landfill Gas Electricity Generation Project

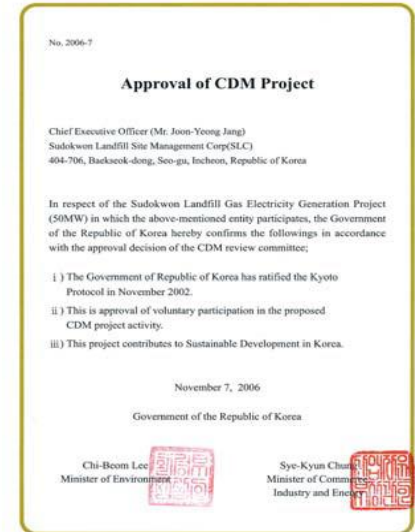
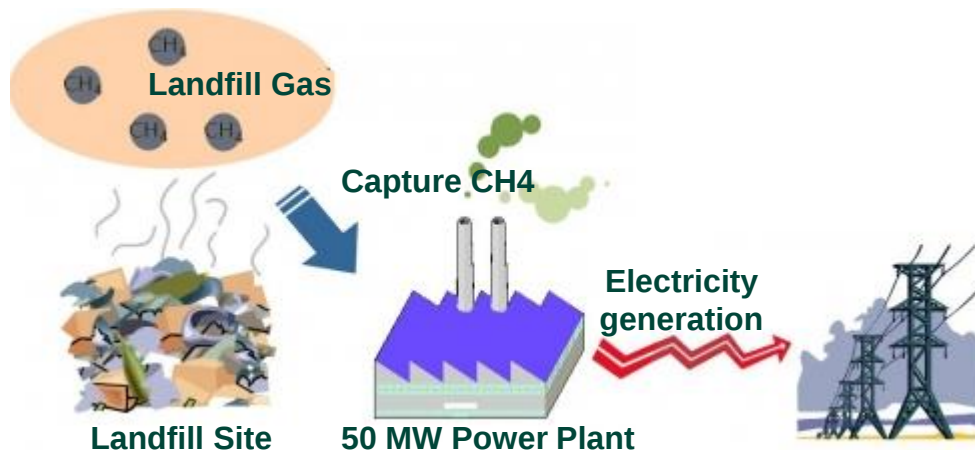
- The world's largest power plant utilizing landfill gas
 - ➔ Could provide electricity for 43,000 of residents
- Registered as a CDM (Clean Development Mechanism) project, generating electric power worth of US\$ 30 Million annually and a certified emission reduction equal to 850,000 CO₂ tons



Economic
Benefit

+

Environmental
Benefit



Smart Solution 3

Waste as Resources

Trashy Tourism

World Cup Park at Nanjido

- ✓ An ecological part built to commemorate 2002 World Cup Games on Nanjido (landfill site)
 - Open in May 2002 after 6 years of stabilization and 1 year of construction, creating five parks
 - Around 90 million visitor every year
 - Landmark for renewable energy generation facilities



Dream Park at Sudokwon Landfill Site

- ✓ An environmental theme park
 - Green Bio Complex
 - Sports facilities for residents (under construction)
 - Metropolitan Eco & Energy Town designed to be running on a self-sufficient bases with a target energy production of 2.61 million Gcal energy year, consisting of Waste-to-Energy Town, Natural Energy Town, Bio Energy Town and Eco –Culture Complex

Asian Games in Incheon 2014



ACHIEVEMENTS AND LESSONS



Achievements

Major Performance Indicators in 1990 vs. 2010

1990



Open Dumping

2010



Sanitary Landfill + Park

VS

2.44kg/day

Waste
Generation
per capita

1.06kg/day

57% reduction

29272 t/day

Landfilled

1445.7 t/day

95% reduction

338 t/day

Recycled

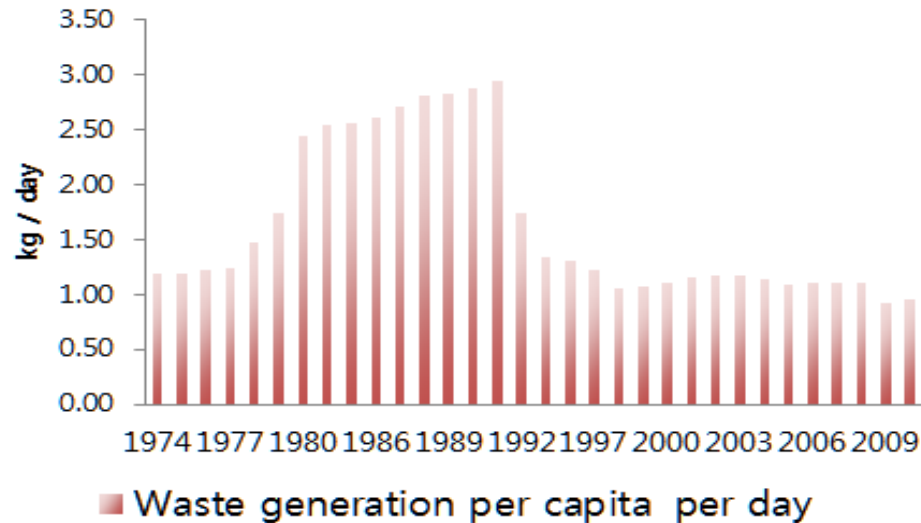
6592.7 t/day

1850% increase



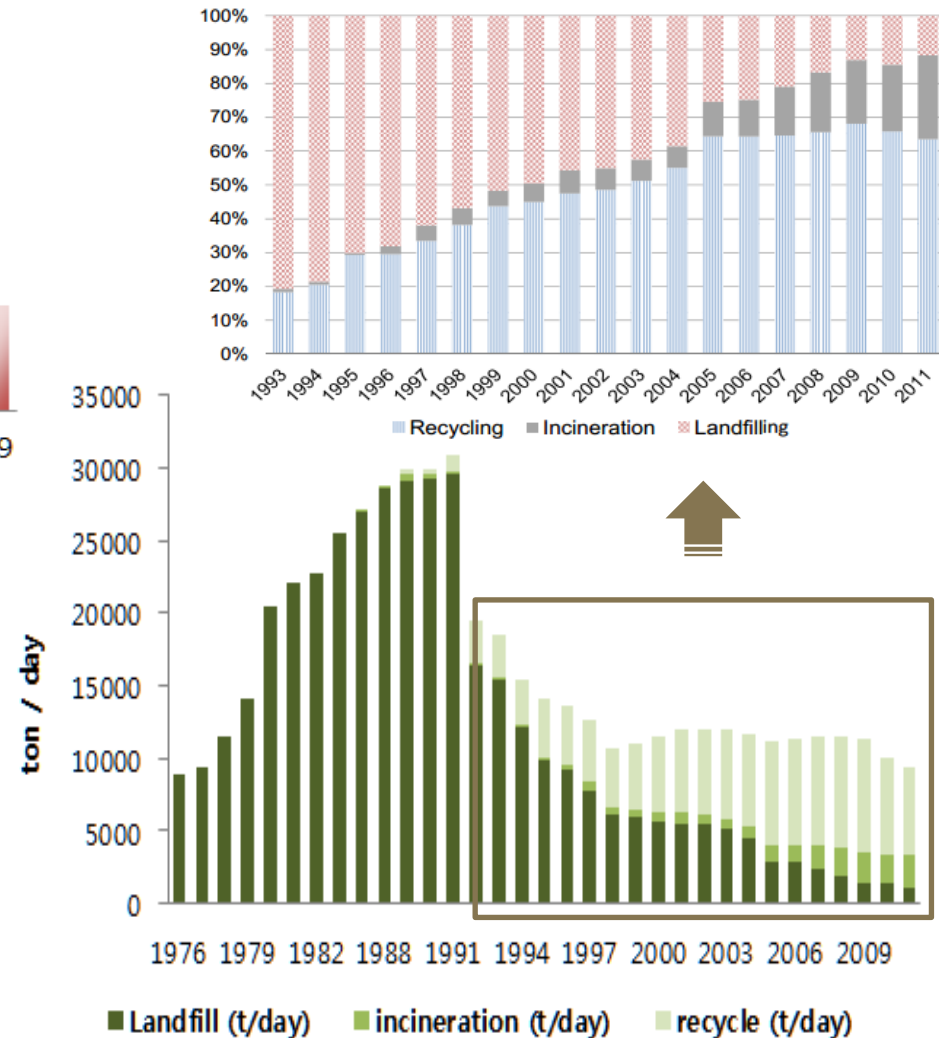
Achievements

■ Waste reduction & Increased recycles



➔ Extension of SL landfill site by 27 years

➔ Reduction of costs in operation and construction





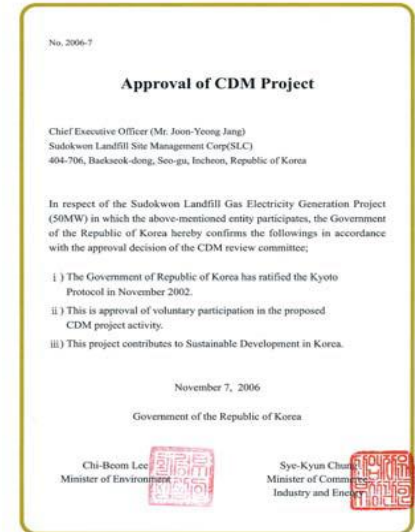
Achievements

Creating Environmental & Economic Benefits

■ Waste to Energy: Constructing City of Circular Economy

✓ 50MW Landfill Gas Electricity Generation Project

- The world's largest power plant utilizing landfill gas
 - ➔ Could provide electricity for 43,000 of residents
- Registered as a CDM (Clean Development Mechanism) project, generating electric power worth of US\$ 30 Million annually and a certified emission reduction equal to 850,000 CO₂ tons



✓ Renewable Biogas Energy Project

- Biogas produced from food waste and wastewater, producing high quality renewable compressed natural gas
- Renewable biogas gas to be used to fuel Seoul's fleet of low-emission CNG buses



Lessons: Waste is NOT Waste!

✓ Paradigm shift - Smart Waste Management Framework

- From Maximum Treatment to Minimum Waste
- Recognition of Waste as Resource → Creation of **a city of circular economy**
 - ❖ Resource recovery from waste generating **economic + environmental benefits**
 - ❖ Transformation of landfill sites into eco parks

✓ Respond smartly to the NIMBY syndrome

- The Korean government approached the NIMBY syndrome from two directions:
 - To persuade neighborhoods in the area by providing incentives (resident support fund) and ensuring the environmental quality (participation in monitoring)
 - To promote the inter-jurisdictional use of waste treatment facilities among neighboring local municipalities, which improves the economic and technical efficiency of the treatment facilities

Lessons: Waste is NOT Waste!

- ✓ **Use of an economic Incentive to induce changes in the public perception and behaviors**
 - People react to incentives!
 - Change in the public perception recognizing waste as resources
 - Increase in waste reduction efforts, reuse and exchange, separation and recycling practice
- ✓ **Increase the effectiveness of policies with sufficient preparation and enforcement**
 - A thorough and systematic preparation: a rigorous feasibility study followed by the implementation of a pilot project and extensive publicity
 - Strictly monitored violation → a monetary penalty + CC TV monitoring
- ✓ **Active citizen participation**
 - Close partnership between the government and citizens- Eg Special Citizen Council
 - Enhancement of the public awareness on waste and education
 - Education and promotion to raise the public awareness on waste issues