

# Toward a sustainable finance for sewage works in Republic of Korea



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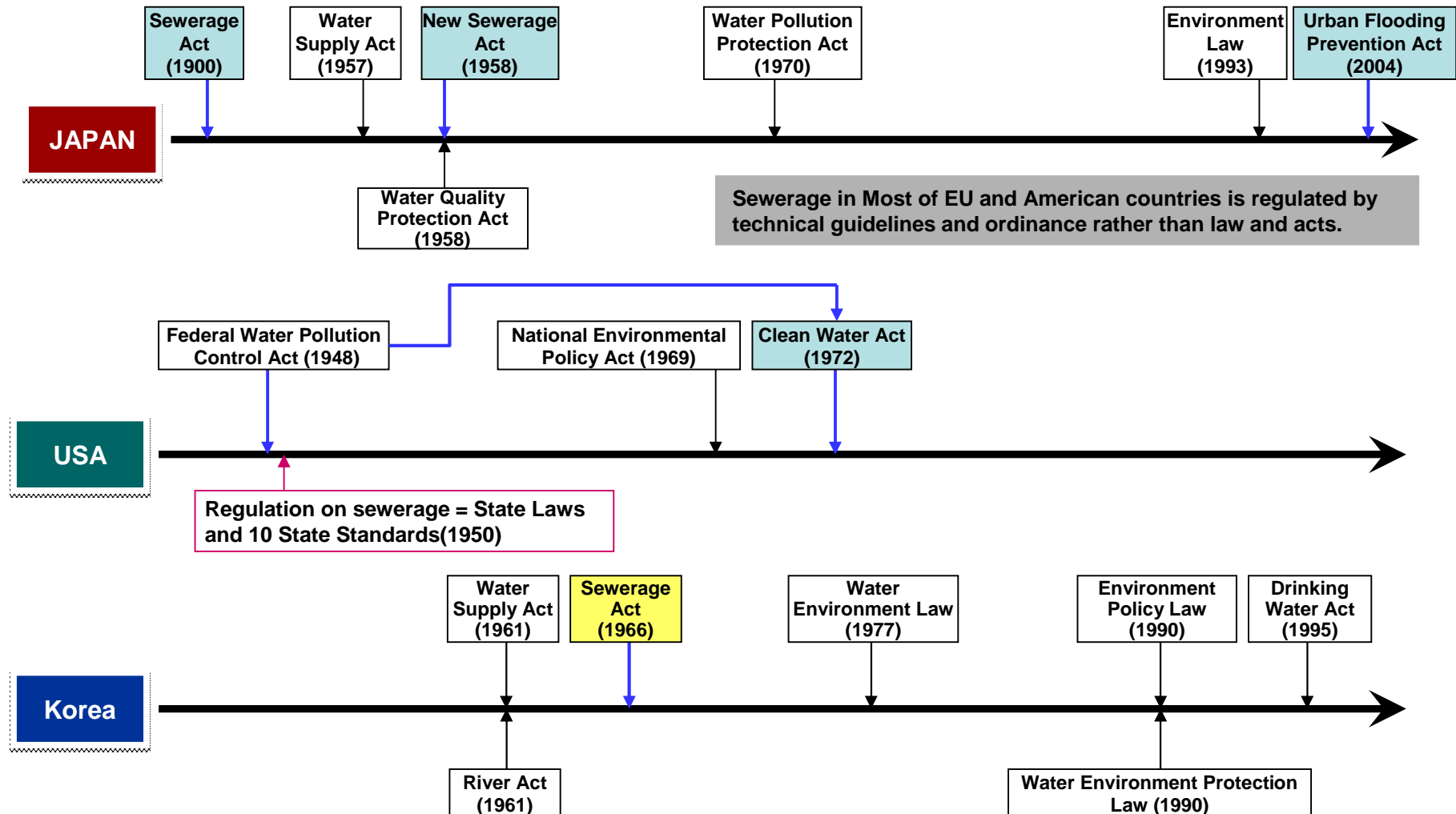
**JSC-ADBI-JSWA Regional Workshop on Sanitation In the Asia Pacific,  
Oct 5th 2011, 10:00~10:40, Meeting room, Japan Sewage Works Association**



# **Introduction to Sewage Works in Korea**

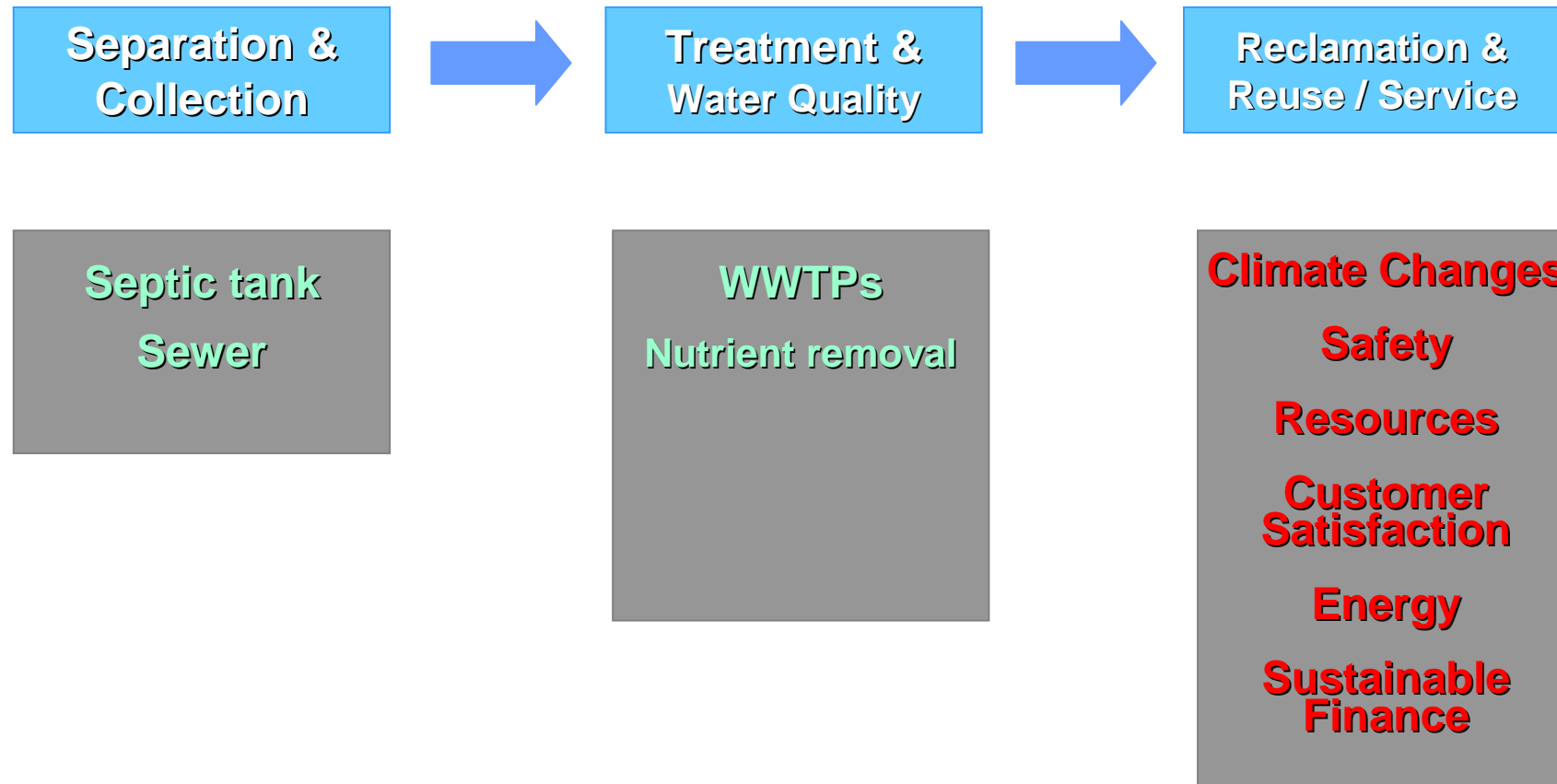


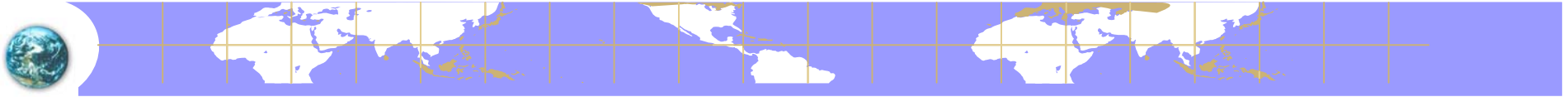
# Legal Frameworks of Sewerage in Japan, USA & Korea



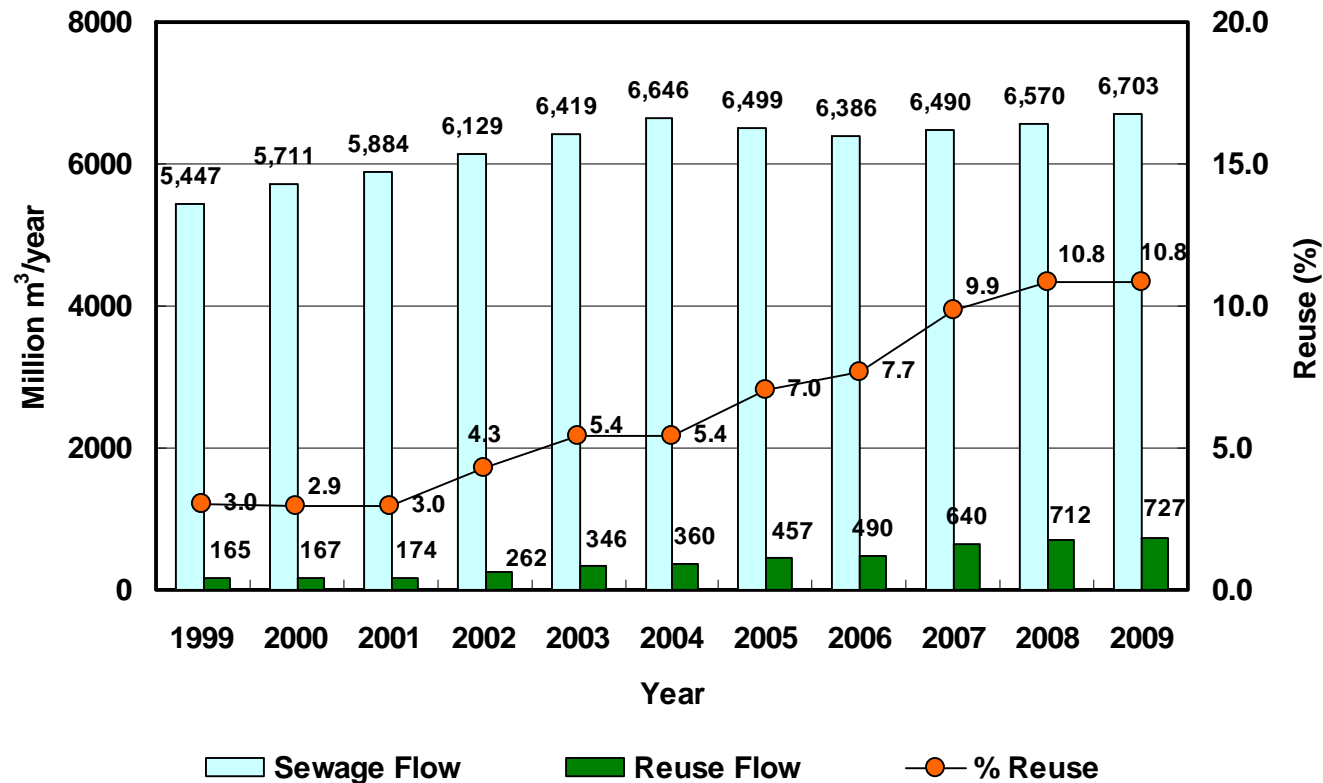


# Conceptual Evolution of Sewage Works





# Sewage Works & Water Reuse in Korea



- Wastewater reuse is a mandatory regulation by the law
- 10% of wastewater flow must be recycled to reuse, but it is not widely accepted because of the low water fee.



# Progress of Effluent Standards in Korea

BOD: 30 mg/L  
SS: 30 mg/L

Adopted  
secondary  
effluent guideline  
of USA (1975)

Based on technical  
feasibility for law  
enforcement

A minimum  
regulation than  
environmental need

BOD: 10 mg/L  
SS: 10 mg/L  
TN: 20 mg/L  
TP: 2 mg/L

Stringent effluent  
standards (2000s)

Social awareness  
on water  
environment

BOD: ? mg/L  
SS: ? mg/L  
TN: ? mg/L  
TP: ? mg/L  
Trace ?

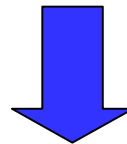
4-river Project  
(2008-2012)

Urgent need to  
protect from  
eutrophication



# New Effluent Standards with 4 River Project

Receiving Water Bodies	BOD (mg/L)	COD <sub>Mn</sub> (mg/L)	SS (mg/L)	TN (mg/L)	TP (mg/L)
Zone I	< 5	< 20	< 10	< 20	< 0.2
Zone II	< 5	< 20	< 10	< 20	< 0.3
Zone III	< 10	< 20	< 10	< 20	< 0.5
Zone IV	< 10	< 20	< 10	< 20	< 2.0



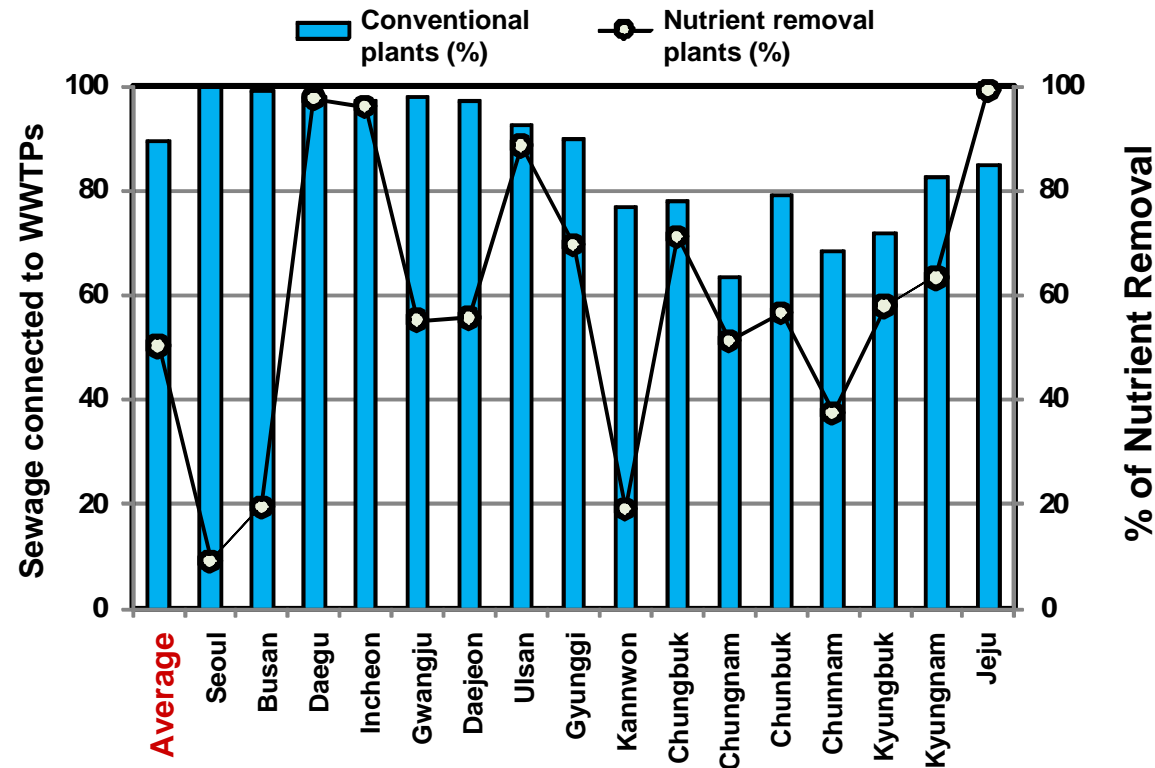
**Tougher P removal**

**Organic removal = P removal enables lower BOD**

**Further TN removal ?**



# Types of WWTPs in Korea



- Most of WWTPs in Korea designed with biological processes (activated sludge, etc)
- About 50% of WWTPs remove nutrient biologically
- Most of WWTPs rapidly upgraded to nutrient removal system





## WWTP Operators\* in Korea

	Total	Types of Operation				
		Local government	Cosigned operation			
			Subtotal	Local Public company**	Private Company	K-Water
Number of Plant* (%)	392 (100)	131 (33.0)	261 (67.0)	49 (13.0)	197 (50.0)	15 (4.0)
Design capacity (10 <sup>3</sup> m <sup>3</sup> /d) (%)	24,279 (100)	8,036 (33.0)	16,243 (67.0)	6,908 (28.0)	9,102 (38.0)	233 (1.0)

Source: Ministry of Environment (MOE), Korea (2009)

\*Excludes small, on-site WWTPs usually with less than 500 m<sup>3</sup>/d

\*\*Public company owned by local government

- ❖ All WWTPs are owned by local governments
- ❖ Only 1/3 of larger plants are owned and operated by local authorities



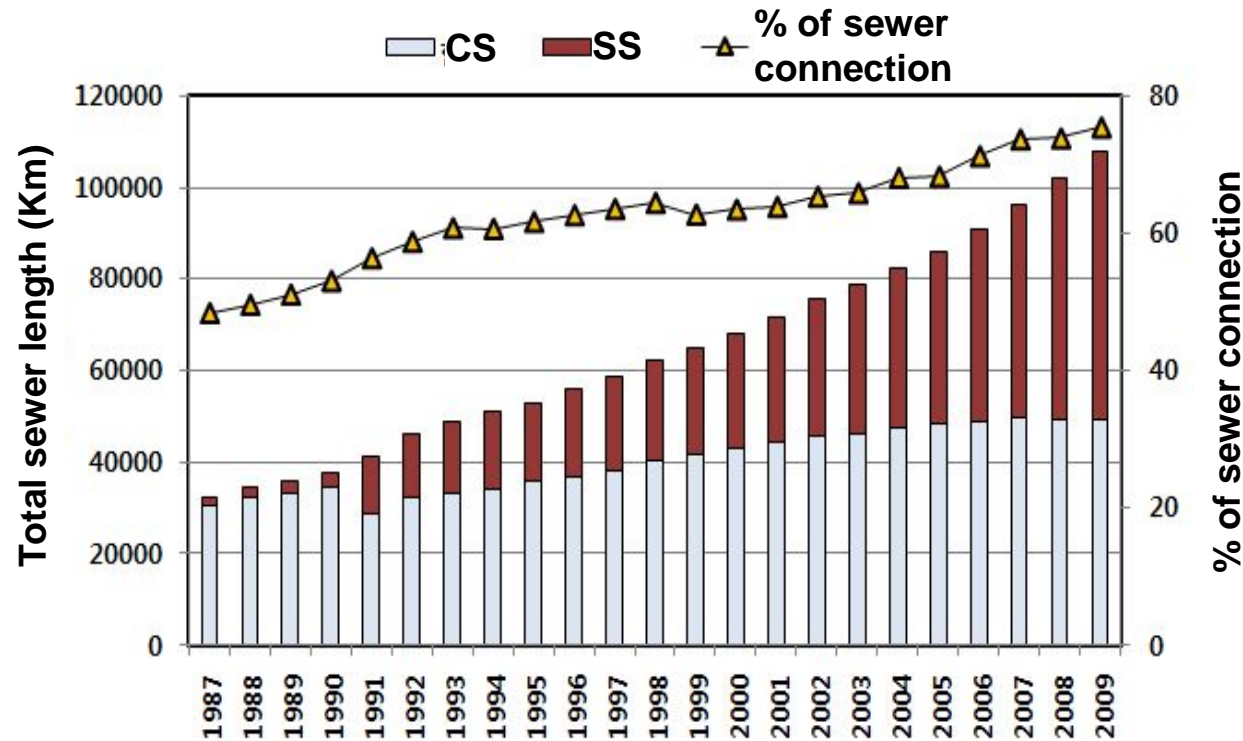
# Private & Public WWTP Operators

Rank	Name of operator	WWTP		
		No of Plants	Design Flow (1000m <sup>3</sup> /d)	Type of Operator
1	Environment Facility Management Corp (Kolon)	63	2,158	Private
2	EnviTech Inc(Taeyoung)	31	764	Private
3	K-Water	15	34	Public Co.
	Jeonbuk EnviTech Ltd	15	216	Private
4	Busan Environment Corp.	9	1,852	Public Co.
	Gwangju Local Public Co.	9	12	Public Co.
5	Kun Yang Ltd	8	68	Private
Etc		282	19,622	83 Private Co operates 282 plants

Private company operates mostly small WWTPs while public company owned by local government operates larger WWTPs ➡ Difficult to maintain trained technical staff and financial



# Type of Sewer

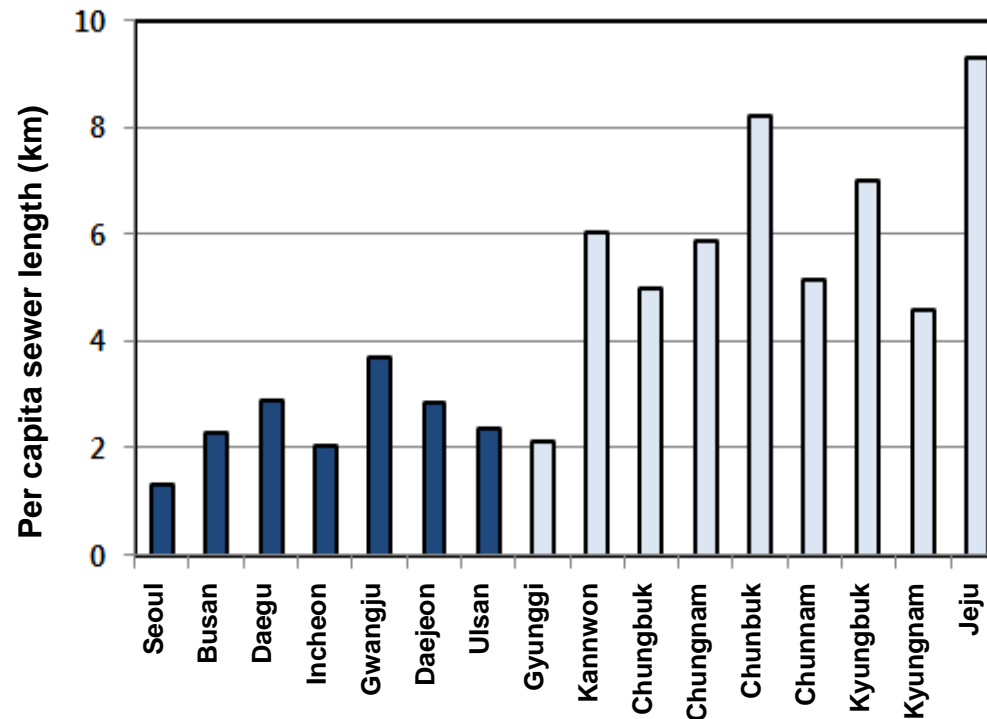


New construction is mainly **separated sewer (SS)**

Length of **combined sewer (CS)** is decreased, but total length is not decreased due to the complexity of construction



# Length of Sewer per Capita



- Rural provinces facing a difficulties on sewer maintenance because of longer sewer and high cost
- Urban cities facing the financial problems on high cost to upgrade the aging sewers
- ✓ Different per capita length of sewer → difficult to reflect pricing of sewage fee



# Status of Finance & Sewage Fee in Korea

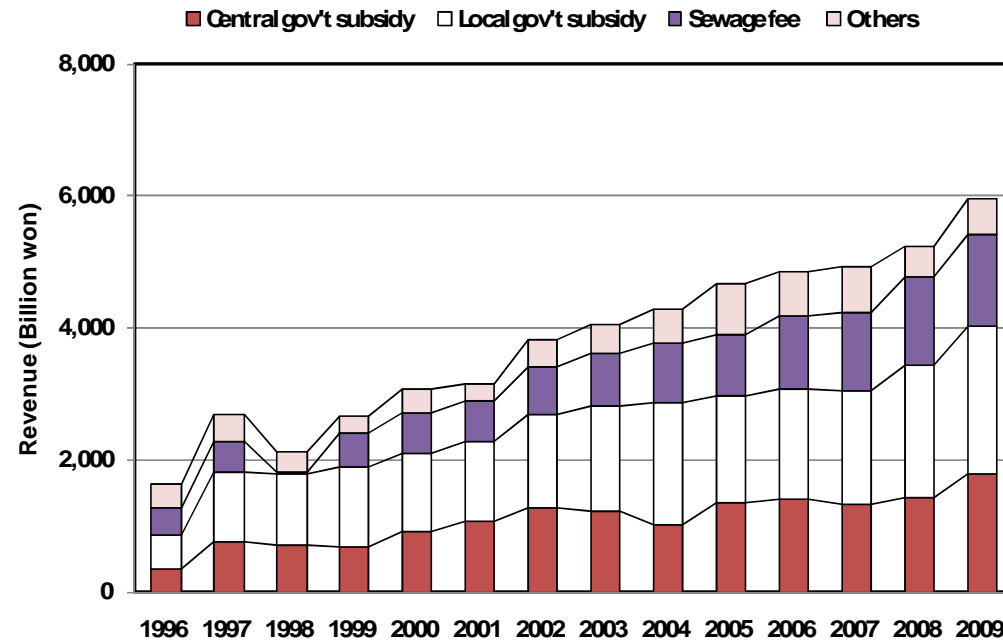
Note: Korean Won was used in this paper. Averaged yearly exchange rate to US\$ are:

In 2009, 1 US\$ = 1,276 Korean Won

In 2010, 1 US\$ = 1,156 Korean Won



# Revenue: Income



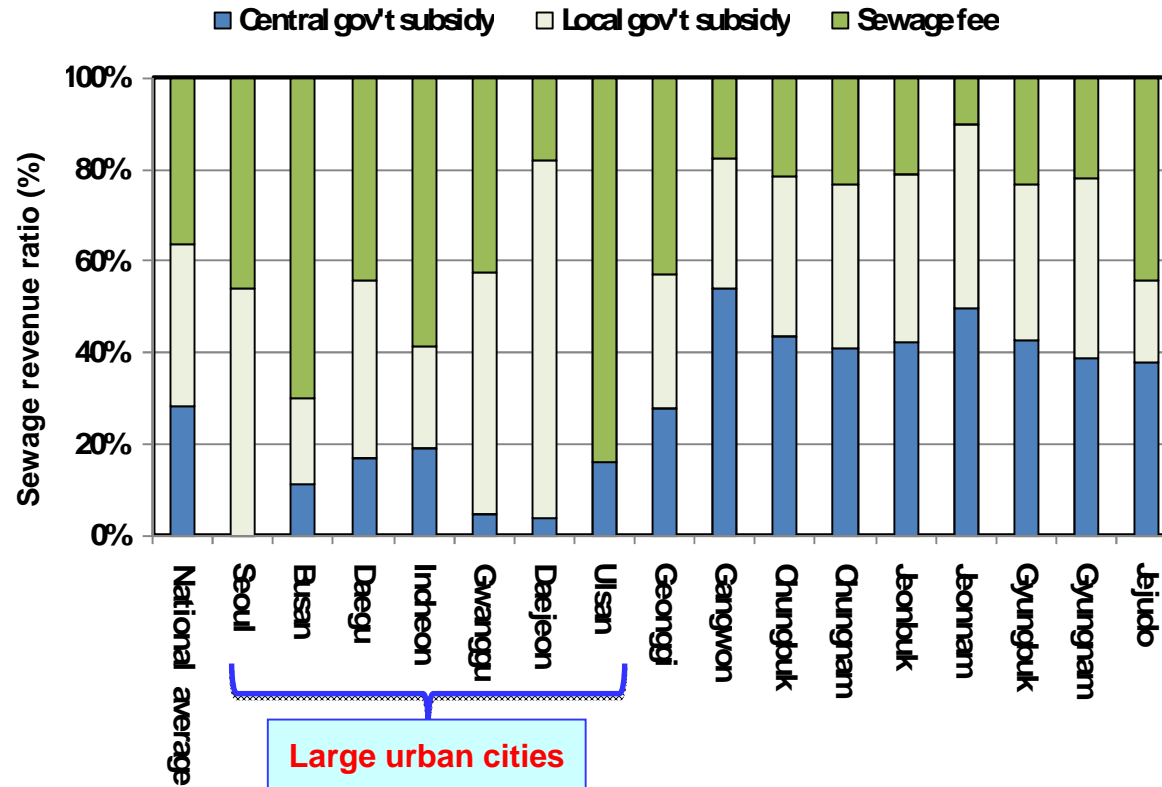
Total revenue of sewage sector

Sewage fee covers only about 1/3 of total revenue.

Heavy government (central + local) subsidy supported sewage works aimed to protect water environment.



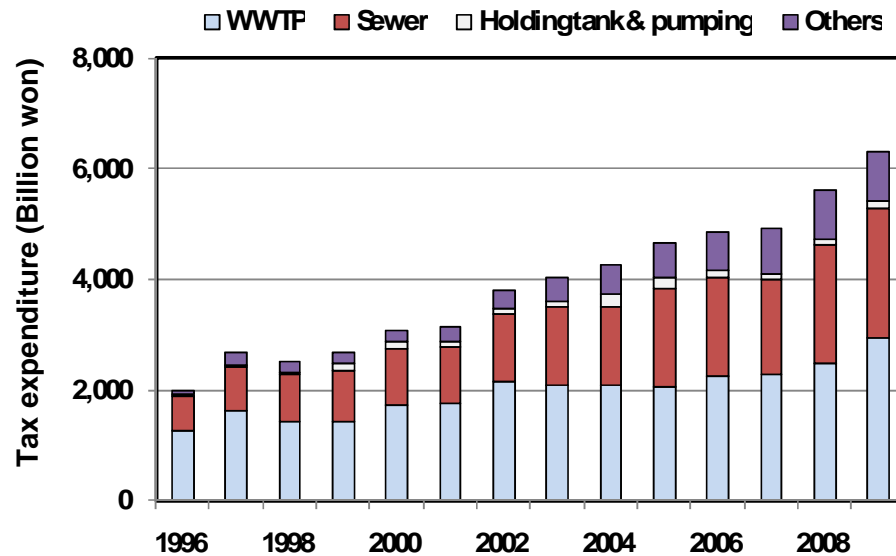
# Source of Revenue in Local Sewage Utilities



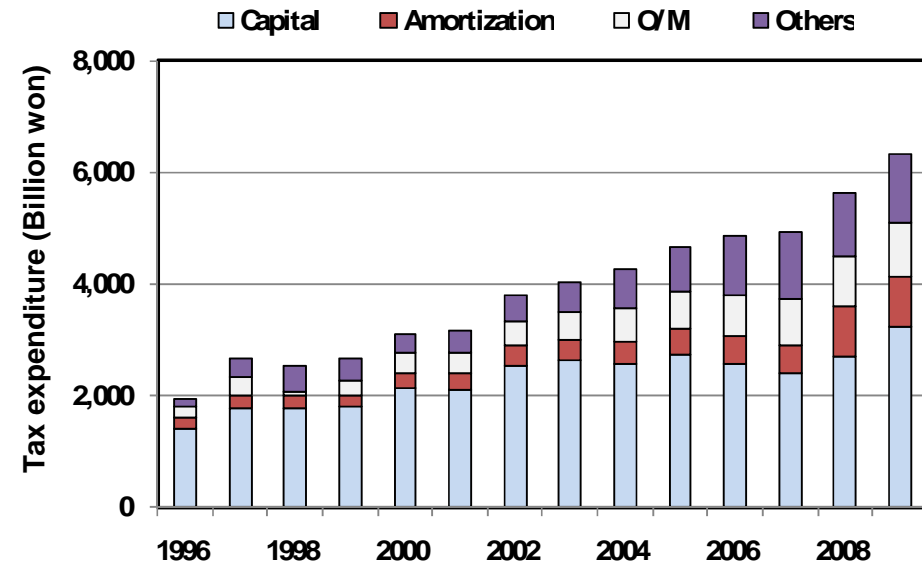
- ❖ Varied revenue sources in regional sewage utilities
- ❖ Sewage fee is not main revenue, except 2 large cities (Busan & Ulsan)



# Expenditure: Spending



Allocation of spending in terms of facilities



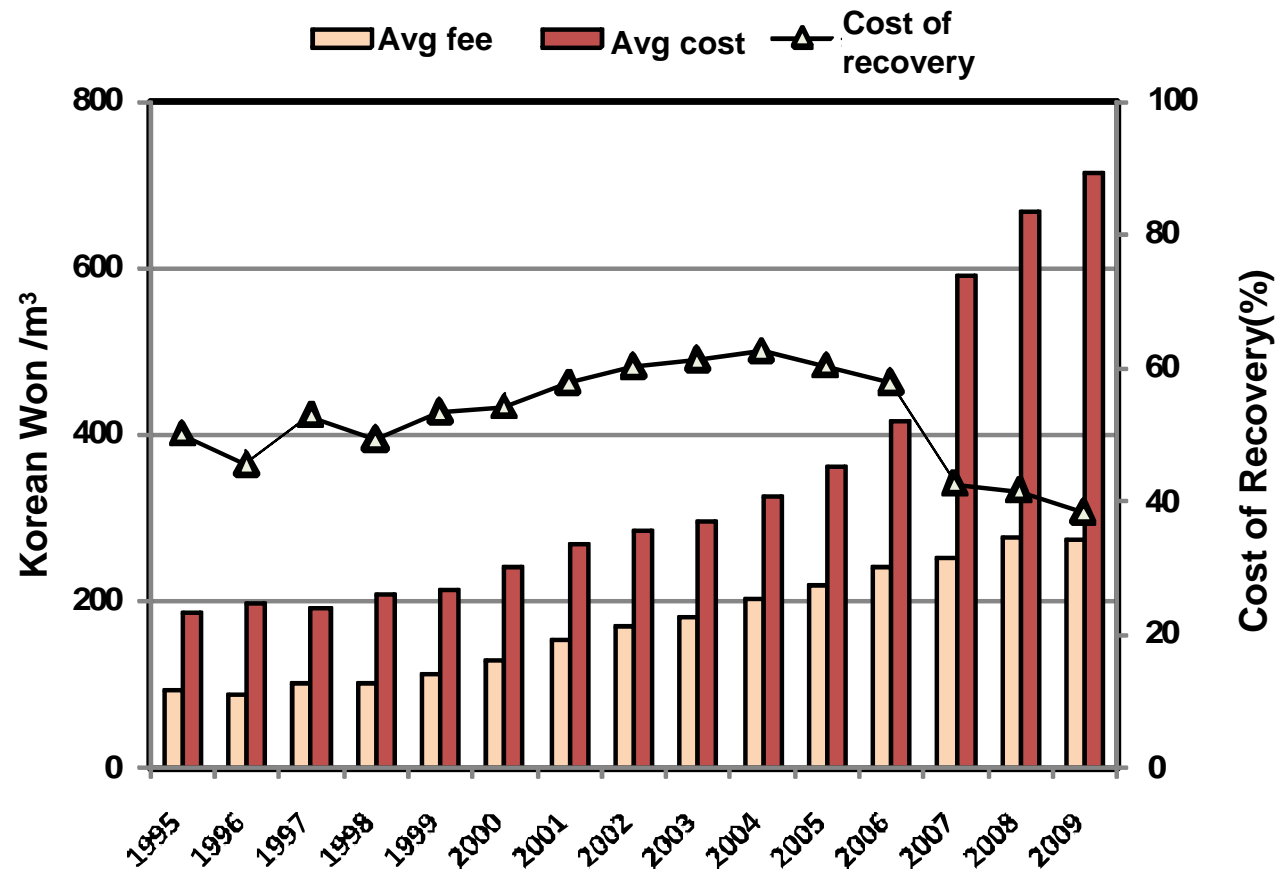
Allocation of spending in terms of financial operation

Most of spending focused on construction of WWTPs & sewer  
Increasing trend in O/M & depreciation spending  
Increase on upgrading facilities for nutrient removal in recent years





# Sewage Fee: Cost of Recovery (COR)





# Cost of Sewage Works in Korea

Design Flow (1,000m <sup>3</sup> /d)	No of Operator	Pop connected to Service Area (%)	Construction Cost (Mil K Won)	Operating flow (x1000m <sup>3</sup> /d)	Avg Fee to Customer (KWon/m <sup>3</sup> )	Full Cost (KWon/m <sup>3</sup> )	Cost of Recovery (%)	Productivity (x1000m <sup>3</sup> /d/ person)
Average	164	89.4	39,246 /plant	118.35	273.9	715.7	38.3	3.4
>1,000	8	98.6	260,430	1,129.33	303.7	651.3	46.6	5.7
500~1,000	8	96.3	82,217	376.99	257.2	607.9	42.3	5.5
300~500	14	88.6	53,635	161.86	256.4	762.8	33.6	3.3
100~300	31	83.1	41,138	68.37	210.3	905.1	23.2	2.1
<100	103	55.7	15,513	15.01	218.3	1,038.4	21.0	1.0



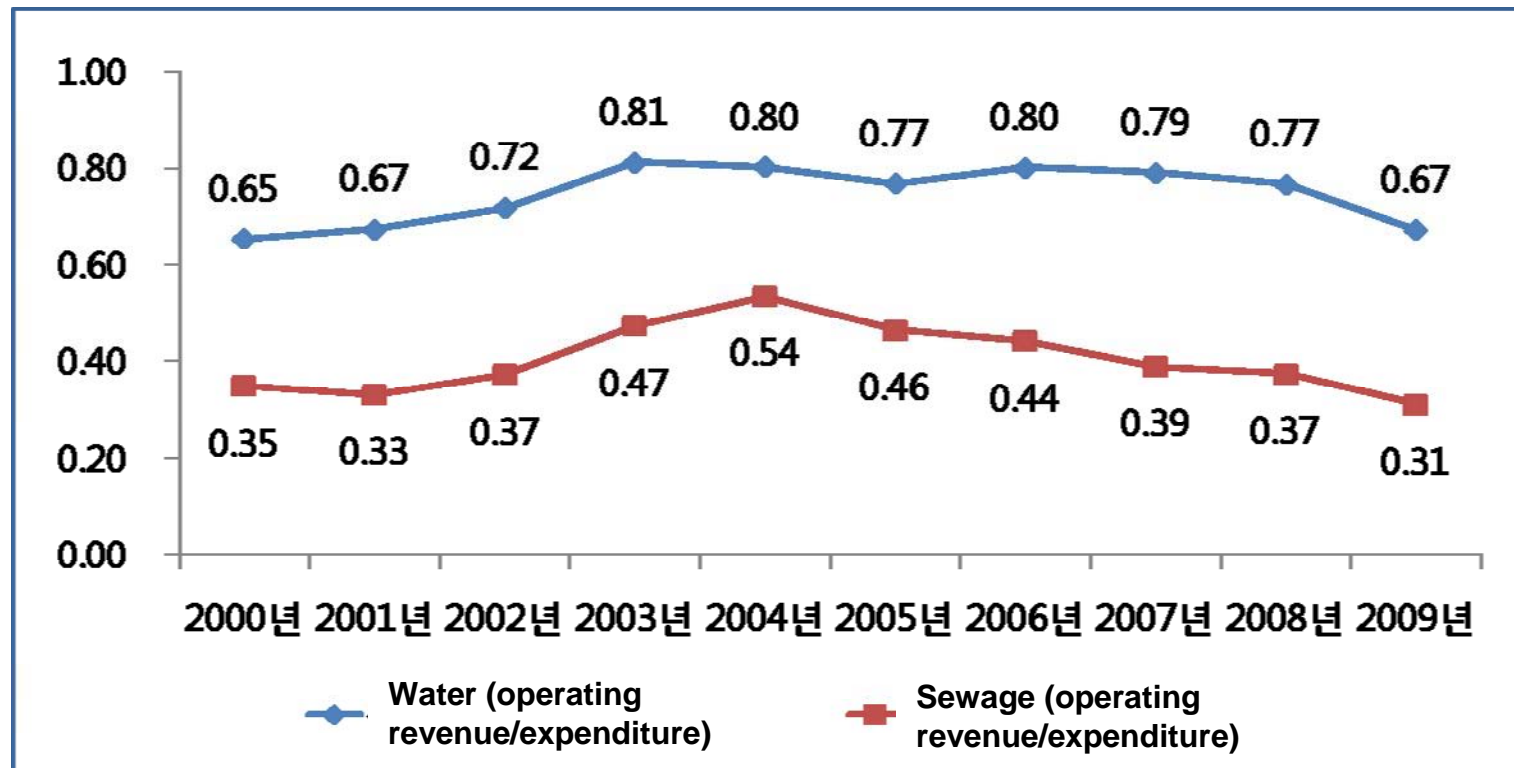
# Sewage Fee of Major Cities in Korea

Cities	Sewage Fee (KWon/m <sup>3</sup> )	Total Cost (KWon/m <sup>3</sup> )	Cost of Recovery (%)	Need to Increase
Seoul	286.3	596.9	48.0%	108.5%
Busan	387.2	571.7	67.7%	47.6%
Daegu	293.8	421.6	69.7%	43.5%
Incheon	298.0	467.7	63.7%	57.0%
Gwangju	349.6	432.3	80.9%	23.7%
Daejeon	312.7	478.1	65.4%	52.9%
Ulsan	289.9	410.5	70.6%	41.6%

Data: For Seoul, KWI auditing(2008) and other cities by Ministry of Interior (2009)



# Financial Status in Korean Waterworks



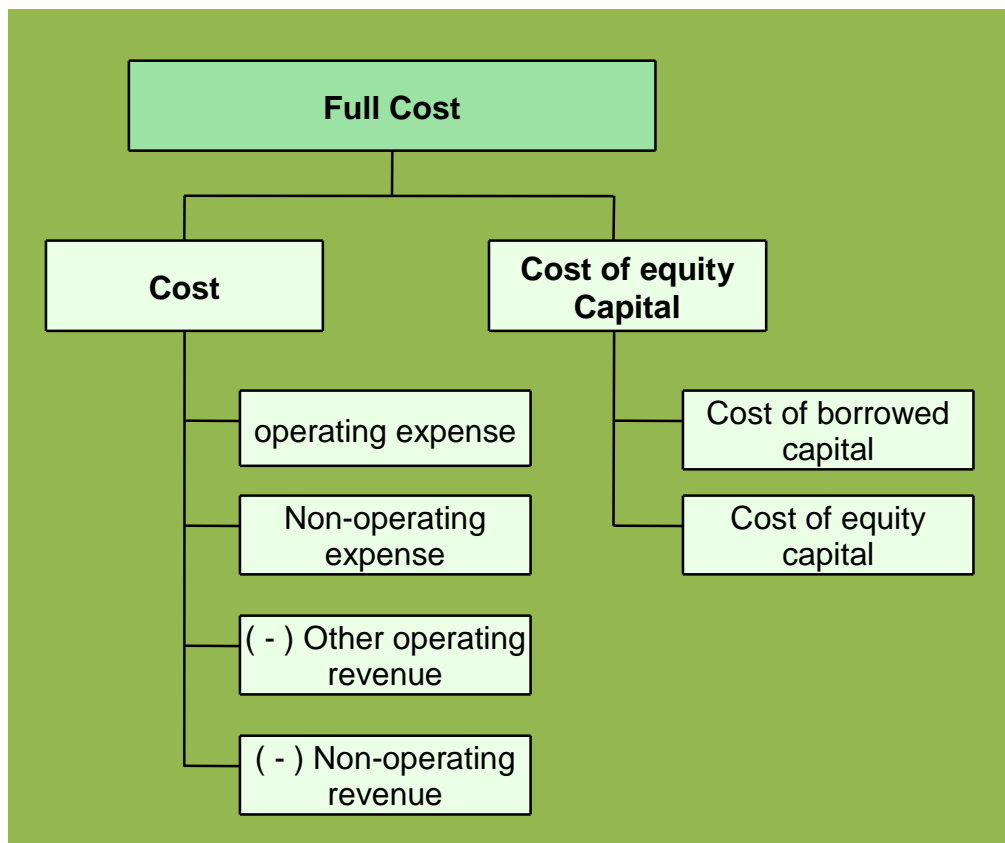
Heavy subsidies maintained waterworks (water + sewage)



# **Toward the Sustainable Finance of Sewage Works**



## Full Cost = Operating Cost + Cost of Equity Capital



### Purpose of Full Costing

- Recovery of investment
- Upgrading and retrofitting of plant & sewer
- Meet the stringent effluent standards
- Adopt new technologies
- Future expansion



# Why Very Low Sewage Fee ?

## 1. Populism

- Elected mayors & governors did not want an increase of utility fee

## 2. Heavy government subsidy

- During the rapid construction of sewerage, various subsidy enabled to cover the finance

## 3. Poor legal frameworks for sustainable sewage works

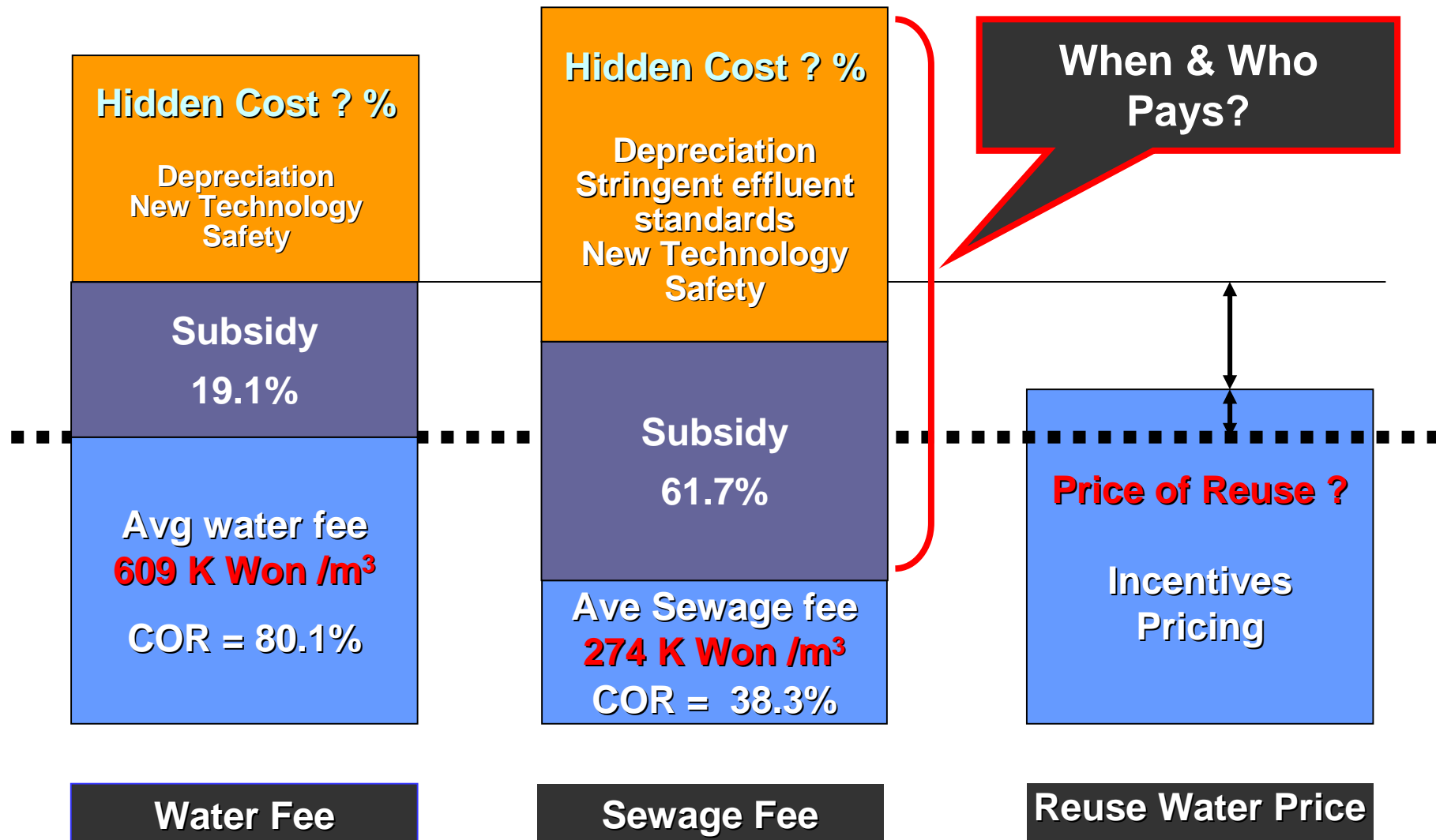
- Pricing function is missing in sewage pricing in Korea
- Different function of pricing principal between water and sewage was not rationalized ➡ Similar to most of countries

## 4. Overlooked financial problems in sewage works

- Need to re-evaluate financial principals based on the characteristics of sewage works



# Cost of Sewage Works in Korea: **Fee or Price ?**







# New **Financial Needs** In Sewage Works

## ● **Safety Issue 1 - Climate change**

- **Urban flood prevention - Need massive investment on sewer**

## ● **Safety Issue 2 - Water environment**

- **Advanced treatment of hazardous & priority pollutants**

## ● **Service Issue - Public (customer) attention**

- **Odor prevention**
- **Food waste disposer**
- **Effluent as environmental flow**

## ● **Energy Issue**

- **Enhance the energy efficiency**
- **Full recovery of energy within WWTPs**
  - **As a service industry, WWTPs use at least no external electric energy in near future**
  - **Wastewater is 'water and energy resources'**



# Modify To A Better Pricing Mechanism

- **Sewage fee must reflect full cost; Need a new accounting process including characteristics of sewage works**

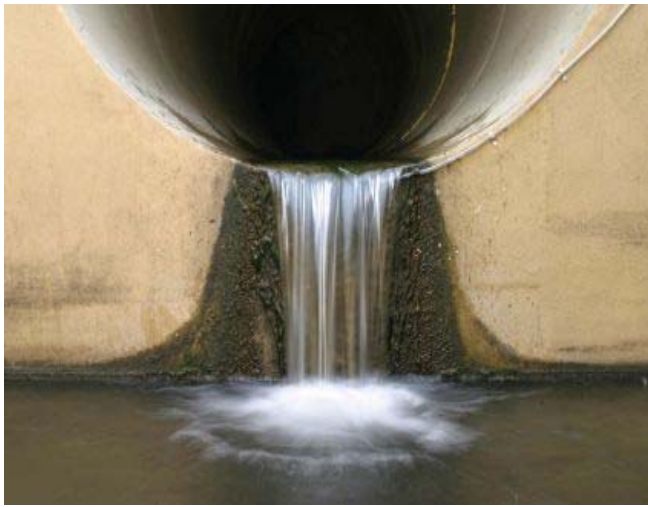
- Depreciation cost must include an increased cost to meet the plant upgrading and stringent effluent standards
- As a first step, increase of COR by fee hike

- **Change the existing pricing paradigm**

- Need a legal frameworks (new legislation) to ensure a sustainable financing
- Charging of sewage fee should be separated from the water supply bill



# Finally, We Should Re-name the 'Sewage Works' Stands Closer to Public and Policy Makers



**Neo Water resources**  
**Products**  
**Service**

'Sewage' evolved from sewer, means 'to drain water'.  
Originated from Latin 'sedere (To sit)'.

Sewage = Negative feeling and forgettable word,  
Low tech, less attention, not very important, etc.



# New Identity for New Resources



Since 2008, The name of WWTPs in Korea have been changed to Water Reclamation Plant (WRP). The same plant with new name gives a new thinking.



**Thank you for your attention**

**Q/A**

