Status and Issues of Waterworks in Korea

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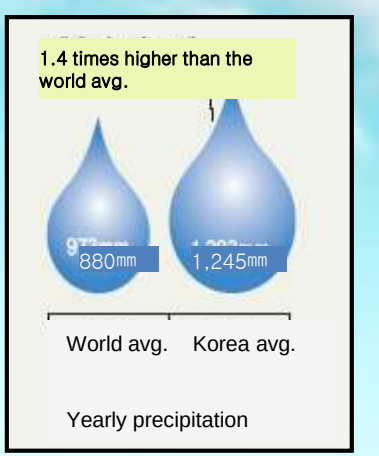
CONTENTS

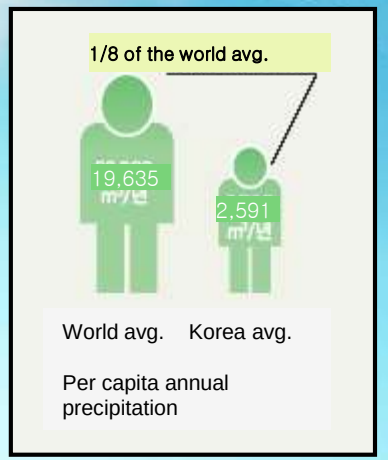
1. Challenges of Water Management

Challenges in Water Management

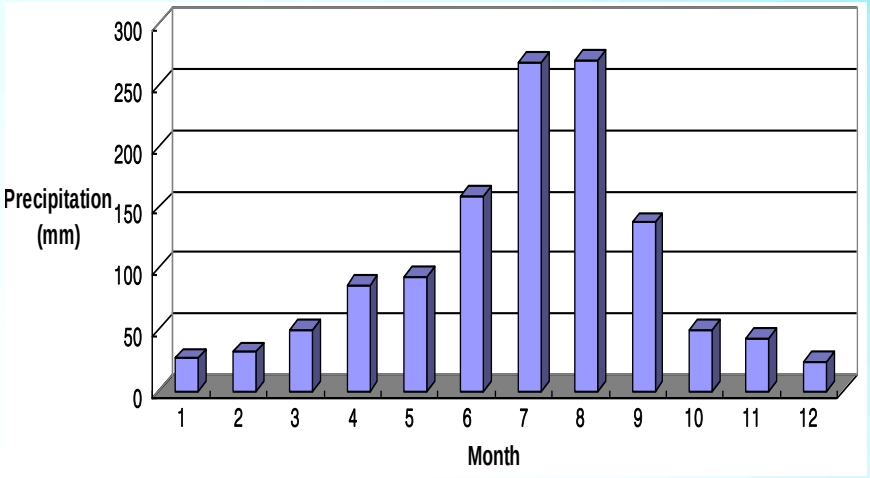
Precipitation and Runoff

- Average yearly precipitation: 1,277 mm (1.4 times higher than the world average)
- Per capita annual precipitation: 2,591 mm (1/8 of the world average)





- 75% of precipitation and runoff are concentrated from June to September
- Precipitation concentrated in Summer → repeated flood and drought



Average monthly runoff

Challenges in Water Management

Climate Change

- **Changes in precipitation pattern**
  - Cases of torrential rainfalls over 100mm in a day have increased by 1.7 times

Increased Imperviousness in Urban Area

- **Impervious areas expanded clean water cycle damaged due to industrialization & urbanization**

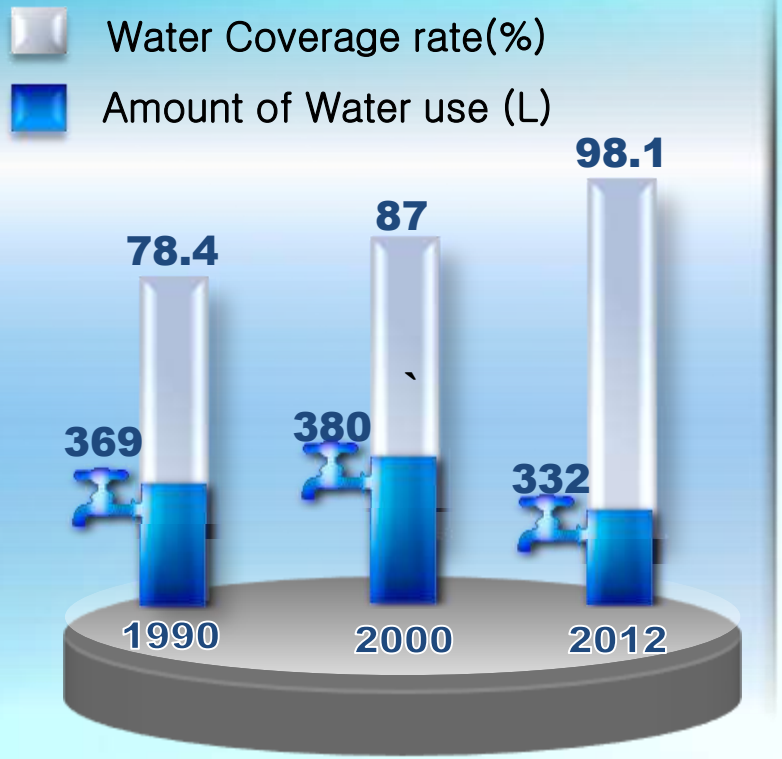
Increase in Demand

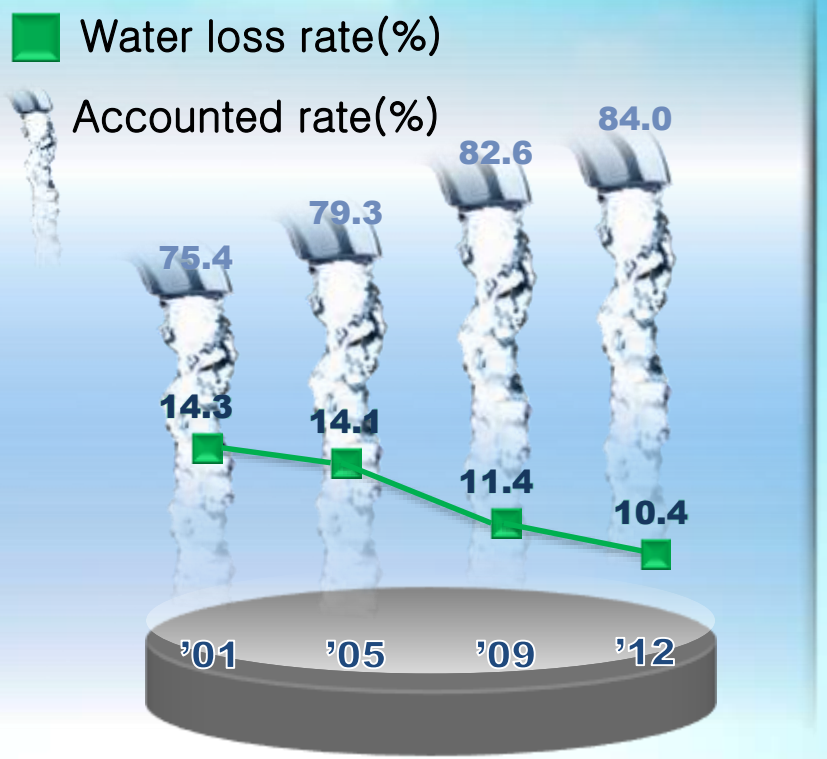
- **Higher demand for cultural and leisure activities in waterfronts**
- **Higher demand for clean & safe water**

2. Current issues

1. Status

- Water Coverage rate : 98.1%
- LPCD : 332 L





1. Status

Intake Resource

- Total Intake amount : 36,924 thous. ㎥/d
- River and Lake(48%), Dam(45%)

Contents	River and Lake	River-bed	Dam	Others	Ground Water	Total
Total (Thous.㎥/d)	17,649 (47.8%)	1,621 (4.4%)	16,652 (45.1%)	395 (1.1%)	607 (1.6%)	36,924 (100%)

Water Treatment Capacity

- Continuously increasing the rate of advanced water treatment process such as membrane process

Contents	Disinfection only	Slow sand filtration	Rapid sand Filtration	Membrane	Advanced treat.	Etc.	Total
Numbers (Percentage)	371 (1.2%)	675 (2.1%)	22,678 (72.2%)	39 (0.1%)	5,558 (17.7%)	2,097 (6.7%)	31,416 (100%)

2. Issues (General)

Water Resource

- Surface water is 90% of total water resource.
  - It could have problem when there are water contaminants outbreak or drought.

※ Phenol(' 08), 1-4 Dioxane(' 09) Outbreak in Nakdong river
Limited-time water supply to 150,000 citizen when heavy drought (' 08~ ' 09year)

⇒ Diversification of Water resource such as Riverside filtration, River bed intake and subsurface dam, etc.

Treatment and Production

- Increased risk of water quality (new harmful substances and pathogenic microorganisms) in water resource

⇒ Strengthen water quality standards and adapt advanced treatment process(eg. GAC, membrane)

2. Issues

Urban Area

- High water coverage rate : 99% (2012 year)
- Increasing needs and interest of the citizens to high quality tap-water due to income increases
- Deterioration of the facility
  - 107 old facilities adapting sand filtration (22% of total 495 WTPs)
  - Over 30 years old water network is 18,000km (11% of total water network]
- Low recovering rate of water tariff (Nationwide 78.5%)
  - Raising water tariff is low, Production cost keep continuously increasing
  - (Central govern.] Water Sector funding (400 Million US $, 12year) is 20% of the wastewater sector investment
  - (Local govern,) Deficit water service business due to poor funding and Indifference of the governors

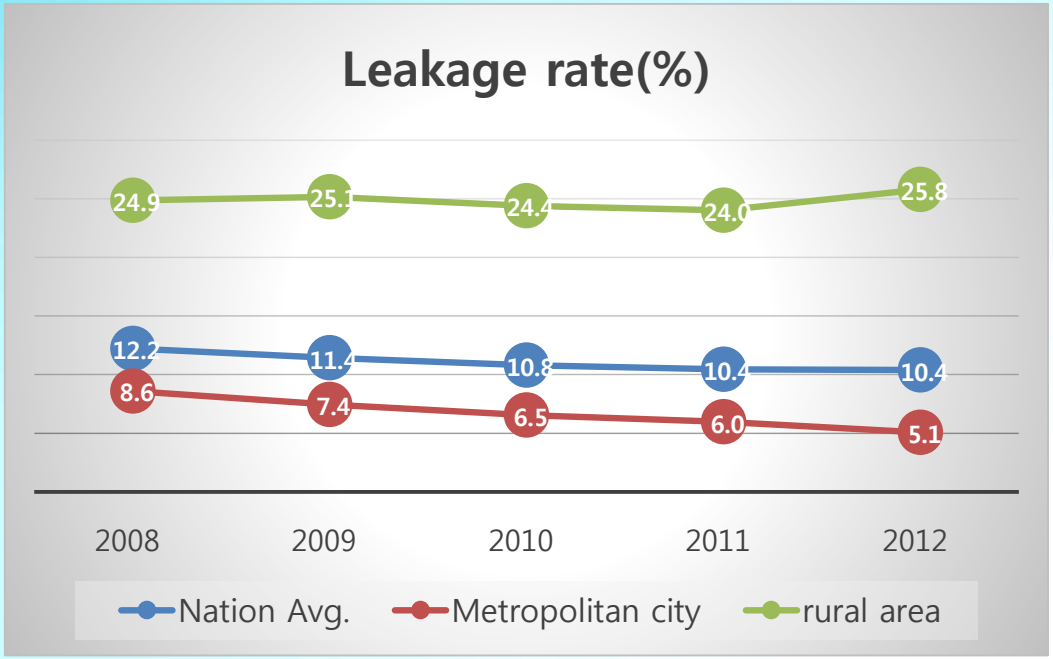
2. Issues

Rural Area

- Low water coverage rate : Rural (58.5%) vs. Nation-wide avg. (93.5%)

  ⇒ Problem of supplying safe drinking water when drought emergency

- Increasing leakage rate when comparing with urban area



2. Issues

Rural Area

- [Low Operating efficiency]

  - 162 cities and counties separate operation following to administrative district
  - Low efficiency and competitiveness due to small scale and low specialty of operation

  • **134** small utilities (population served is below 300,000), 83 % of total

  • **362** small WTPs (below 10,000㎥/d), 70 % of total

Population served	Below 100,000	100,000 to 300,000	300,000 to 500,000	Over 500,000
Utility numbers(%)	100 (61%)	34 (21%)	13 (8%)	17 (10%)

- [Water treatment Plants]

  - Many small water treatment and supply systems

    • **19,052 facilities (20 to 500 ㎥/d, total production capacity is 1,471 thous. ㎥/day)**

    • **Average production capacity : 77㎥/d/each**

  - Most water resources are underground water and only disinfection process
  - Lack of expertise manager(village foreman), Resistance to pay water tariff

2. Issues

Rural Area

- [Finance]

Contents (Number)	National Wide	Metropolitan city(7)	City(76)	County (81)
Production cost (US$/㎥)	0.7	0.6	0.9	1.4
Water Tariff (Recovering rate)	0.6(78.5%)	0.5 (87%)	0.7 (75%)	0.7(51%)

Contents	Top Five city or county
Water Tariff (US$/㎥)	Jeong-sun 1.4 Pyung-chang 1.1 Tong-yong 1.1 Ga-pyung 1.1 Yeong-wol 1.0
Production cost (US$/㎥)	Jang-su 2.9 Im-sil 2.7 Yeong-wol 2.6 Jeong-sun 2.5 Pyung-chang 2.4

- High production cost when comparing major cities due to low population served and long pipeline network
- Low recovering rate due to worrying about residents opposition when raising water tariff

Main Polices and Future Plans

1. Integrating Water Supply system

- Readjusting water supply systems into 9 large zones

Integrate water supply businesses

Resolve water imbalance

Excess water supplied to local governments that lack water supply

Rationalize management

Improve water supply businesses operated individually

Secure competitiveness

Strengthen competitiveness through integration of small and medium-sized water supply businesses

➔ Resolve water imbalance, enhance operational efficiency and secure competitiveness of water-related industries

2. Adapting advanced treatment technology

Major waterworks in main streams of 4 major rivers

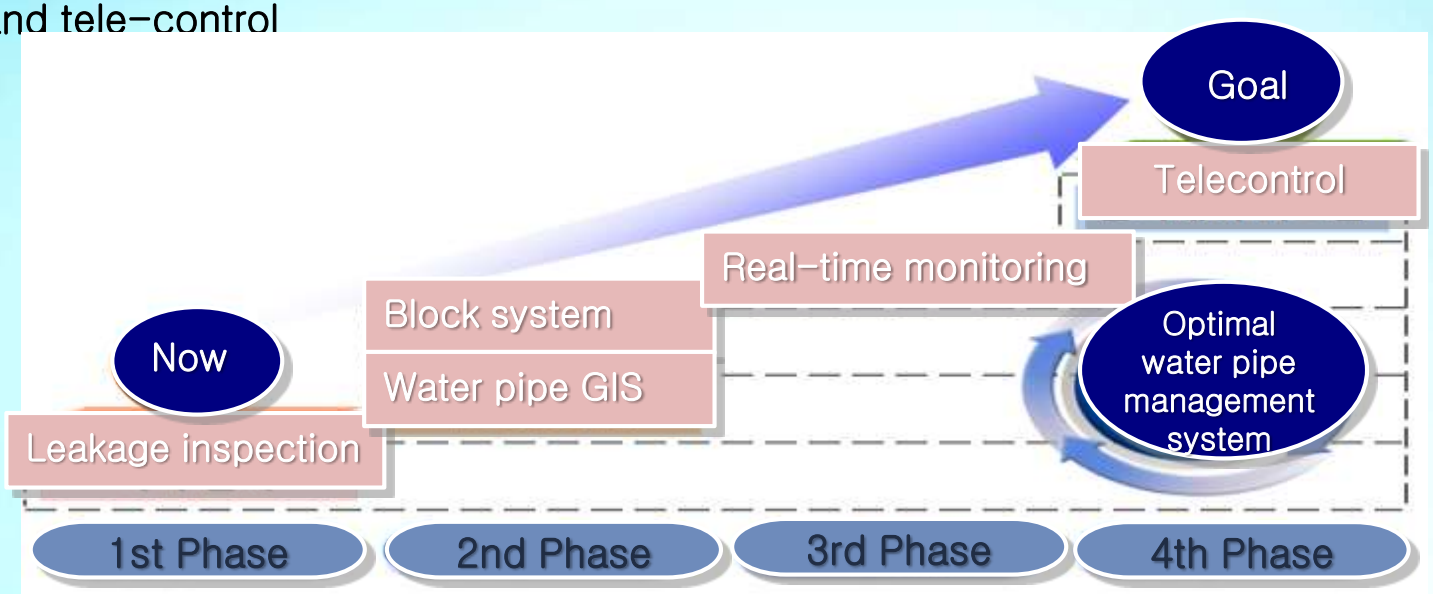
- Granular activated carbon, biological activated carbon, ozone, membrane filtration, etc.
- Eliminate contaminants and abnormal odor and taste
- 22 plants, invest 114 Million US$ (’14year)
- Rate of Tertiary treatment : 48.6 % (32.3%, ‘13year)

- Increase membrane filtration on WTP
  - **Supply high-quality tap water**
  - **Eliminate pathogenic bacteria etc.**
  - **Certification of performance test of module (by KWWA)**

3. Urban area

Organizing Pipeline Network

- Advance water pipe management e.g. by introducing an optimal management system
  - Increase fiscal investment to reduce gap between urban and rural areas
    (Invest 2.8 trillion won by 2020)
  - Establish water pipe diagnosis system early on by introducing a pre-diagnosis and post-improvement principle
  - Establish a optimal water pipe management system combining real-time monitoring and tele-control



3. Urban area

Rehabilitation/Improvement of Old Pipes

- Support for improvement of indoor water pipes

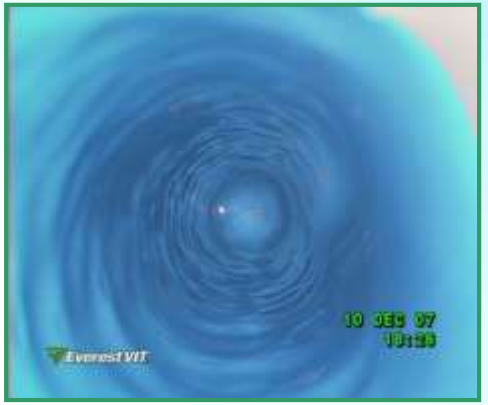
-Resolve the problems of rusty water outflow and lowered water pressure

-- Support improvement of indoor water pipes for low-income families

Time passage after installation	Within 5 years	6-10 years	11-15 years	16-20 years	Over 21 years
Percentage (100%)	22.4	18.7	20.5	18.6	19.8

Before application

After abrasion



After coating

4. Rural area

Stable Water supply

- Expand Water coverage rate

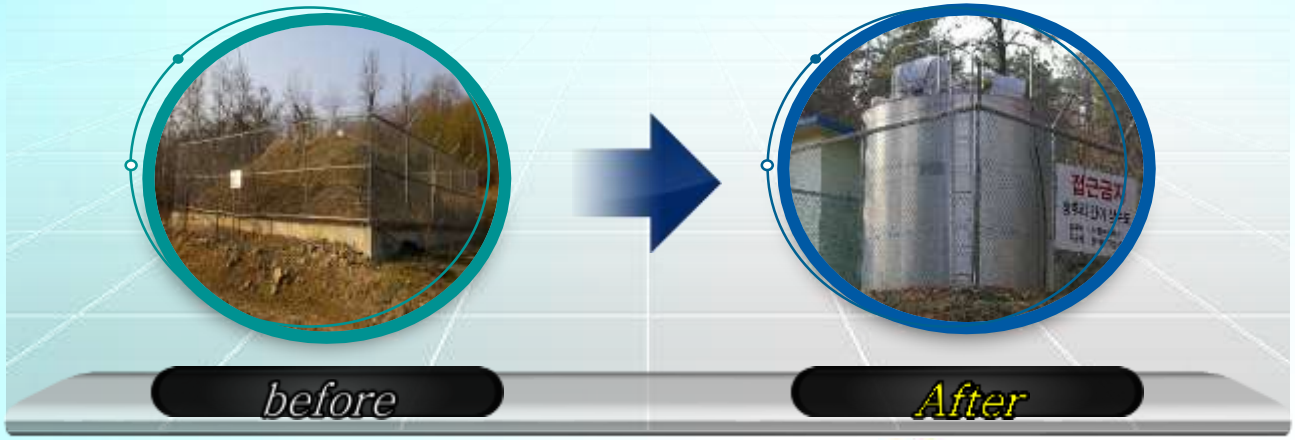
  - Water coverage rate in rural areas will be reached at 80% until 2017 year.

Year	‘12	‘13	‘14	‘17
Coverage rate	62.2%	67.6%	70.0%	80.0%
Additionally covered population	-	155,000	315,000	810,000

- Improvement of small village water supply systems

  - Renovation of decrepit(worn-out) and exceed water standard facilities

  (Invest 240 million US $ by 2017 year)



4. Rural area

Integrating small water supply systems

- Induce to connect main water supply system by utilities
  - Close unsuitable small wells and water treatment facilities
- Combined small water supply systems & Operate them by IT tech.
  - Grouping several(over 50) facilities and control by monitoring systems.
  - Invest 20 million US$ (‘2014 year) by central and local government (50:50)
- Adapt low energy consumption and automation systems

[그림 1] 소규모 수도시설 DB 및 모바일 시스템

Thank you for your attention !

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