



Presentation from
**2015 World Water
Week in Stockholm**

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Opportunities & Challenges in Water Reuse

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I

Global Water Crisis

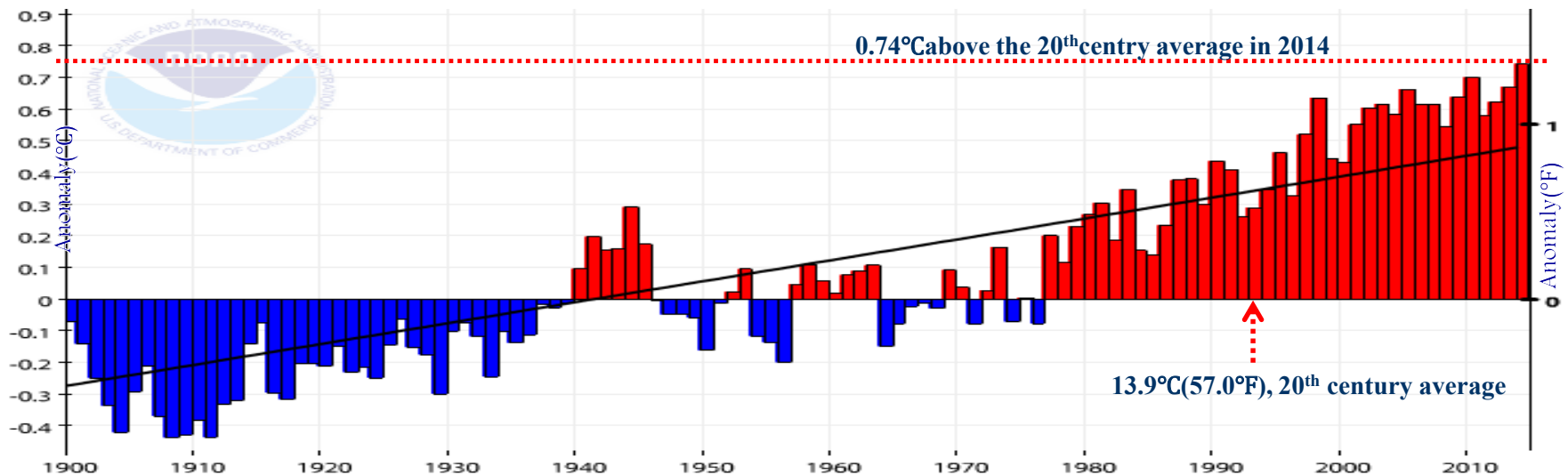


Global Land and Ocean Temperature anomalies

Continuous Global warming in 21st century

- ✓ 9 of the 10 warmest years in the record have occurred in the 21st century
- ✓ The year 2014 was the warmest year across the global land and ocean surface since 1880
- ✓ The average temperature in 2014 was 0.74°C (1.33°F) above the 20th century average

→ Increasing temperatures bringing more frequent and severe droughts and flood worsen the condition of water resources.



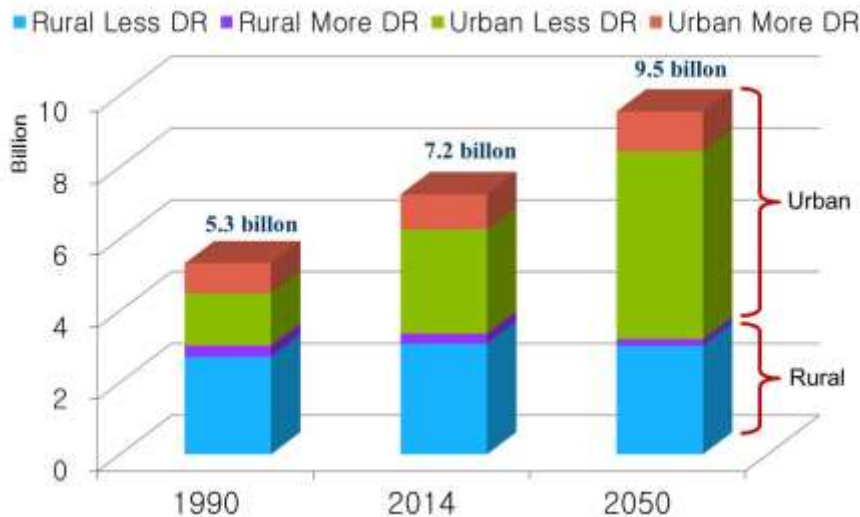
Population growth, especially in Urban areas

Substantial growth of the world's population

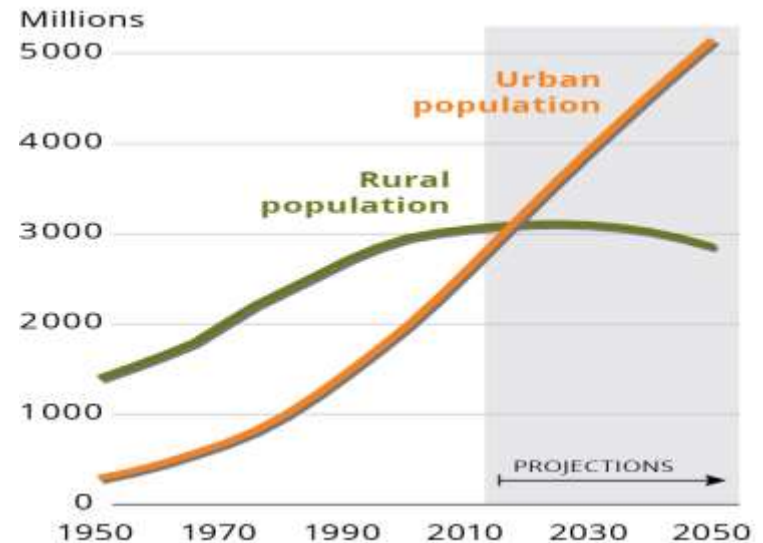
- ✓ From 5.3 billion in 1990 to 7.2 billion in 2014
- ✓ In 2014, 1.7 times higher compared to urban population in 1990 (as estimated 2.3 billion)

→ Expected to reach 8.1 Billion in 2025 and 9.5 billion in 2050

The population residing in urban areas is projected to exceed 6.3 billion in 2050 and it's growth is even higher than rural



Source : United Nations, World Urbanization Prospects, 2014

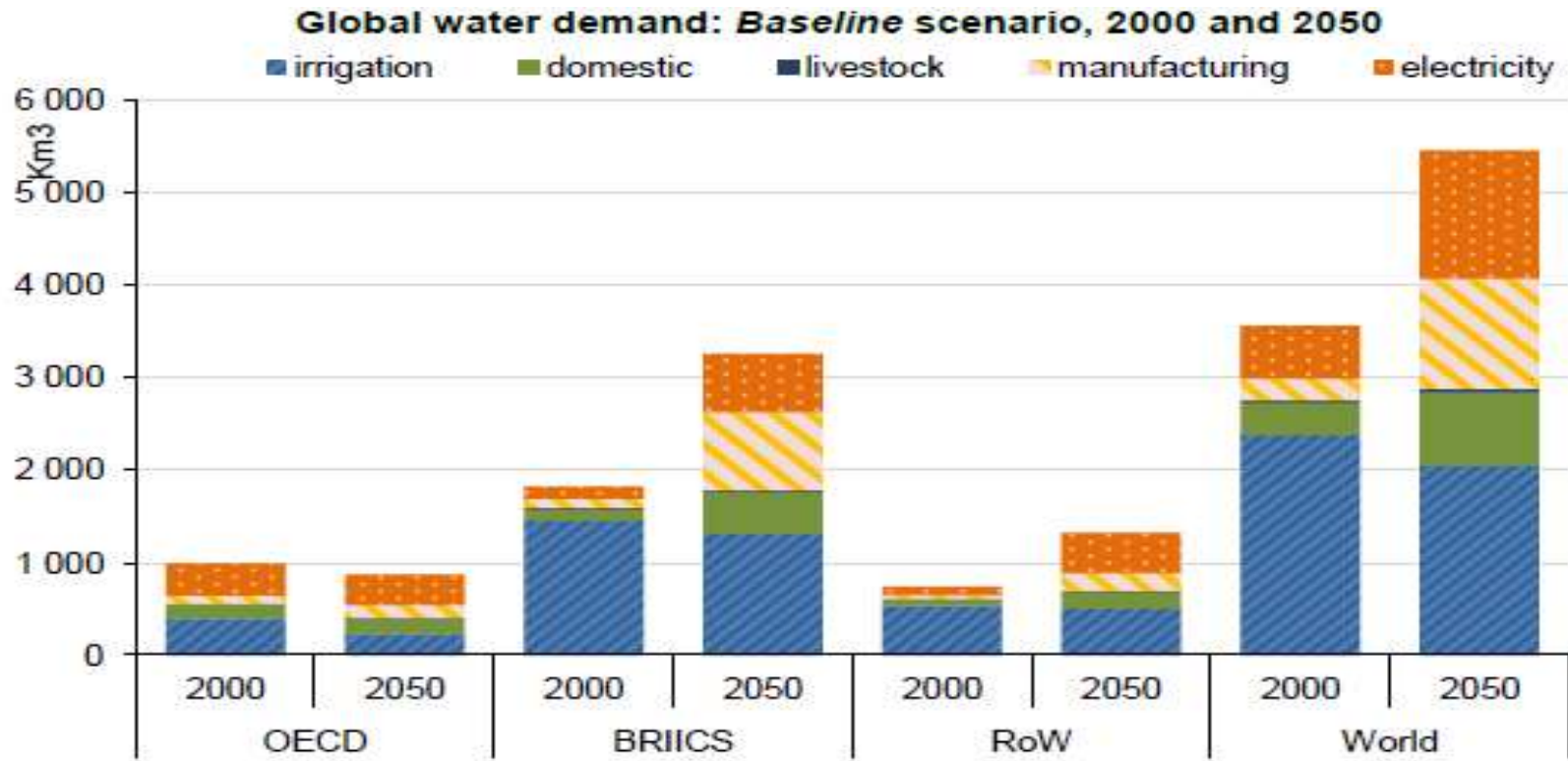


Source : European Environment Agency, 2014

Growth of Water Demand

Accompany with population growth and urbanization,

Global water demand is projected to increase 55% by the year 2050

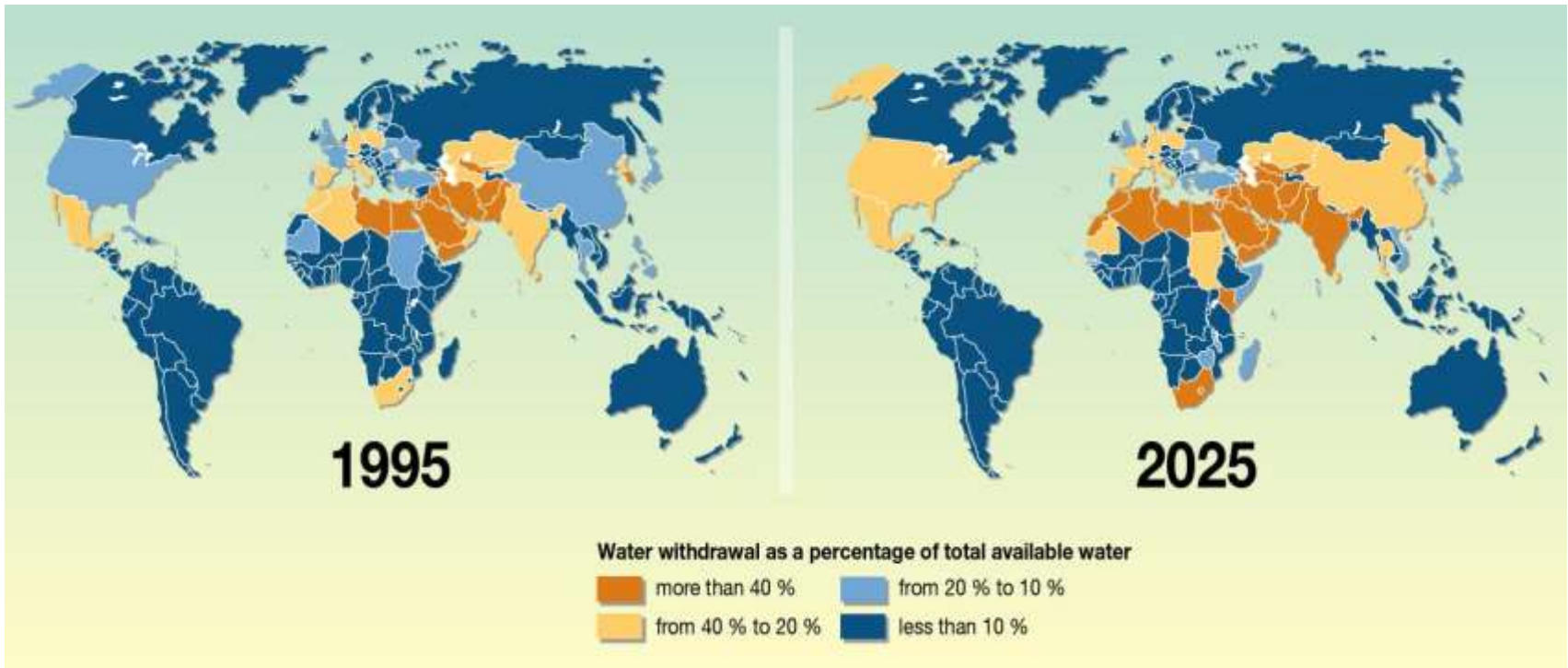


Note :BRIICS = Brazil, Russia, India, Indonesia, China and South Africa; RoW = rest of the world

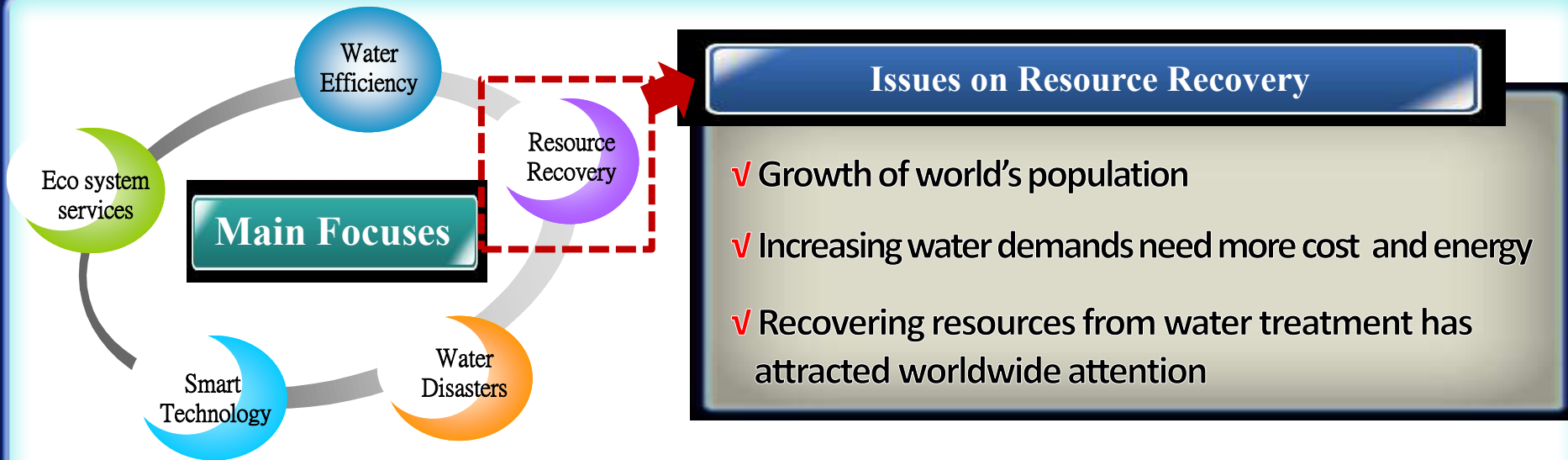
Source : OECD Environmental Outlook Baseline

The number of people living in water stressed basins is projected to reach 3.9 billion by the year 2050, totaling over 40% of the world's population

Increase of Water Stress(Global), 1995 and 2025



7th World Water Forum (Science & Technology)



World Water Challenge (Special Program in WWF)

- **World Water Challenge** is the special program in the 7th World Water Forum
This special program is aiming..
 - to discover water challenges that the world is facing and to find solutions to them
 - to bridge the global-local gap in the water sector and to forge network among them
- **15 water problems** out of 35 were selected as **World Water Challenges**
 - 35 water problems occurred around the world were proposed from 17 countries
- **10 solutions** out of 78 were chosen as **Outstanding Solutions**
 - 78 solution from 22 countries were proposed

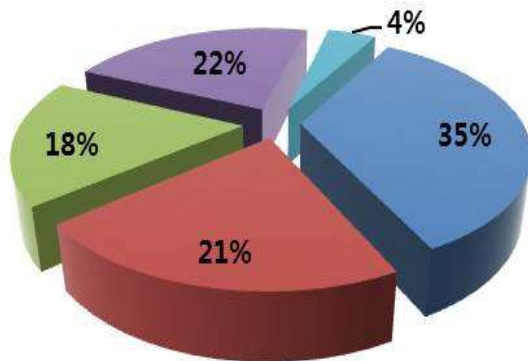
7th World Water Forum (World Water Challenge)

24(21%) proposals out of 113 are on the subject of resource recovery from water and wastewater system

88(78%) proposals out of 113 are related to water resource security

35 Water problems + 78 Solutions

MF 1 MF 2 MF 3 MF 4 MF 5

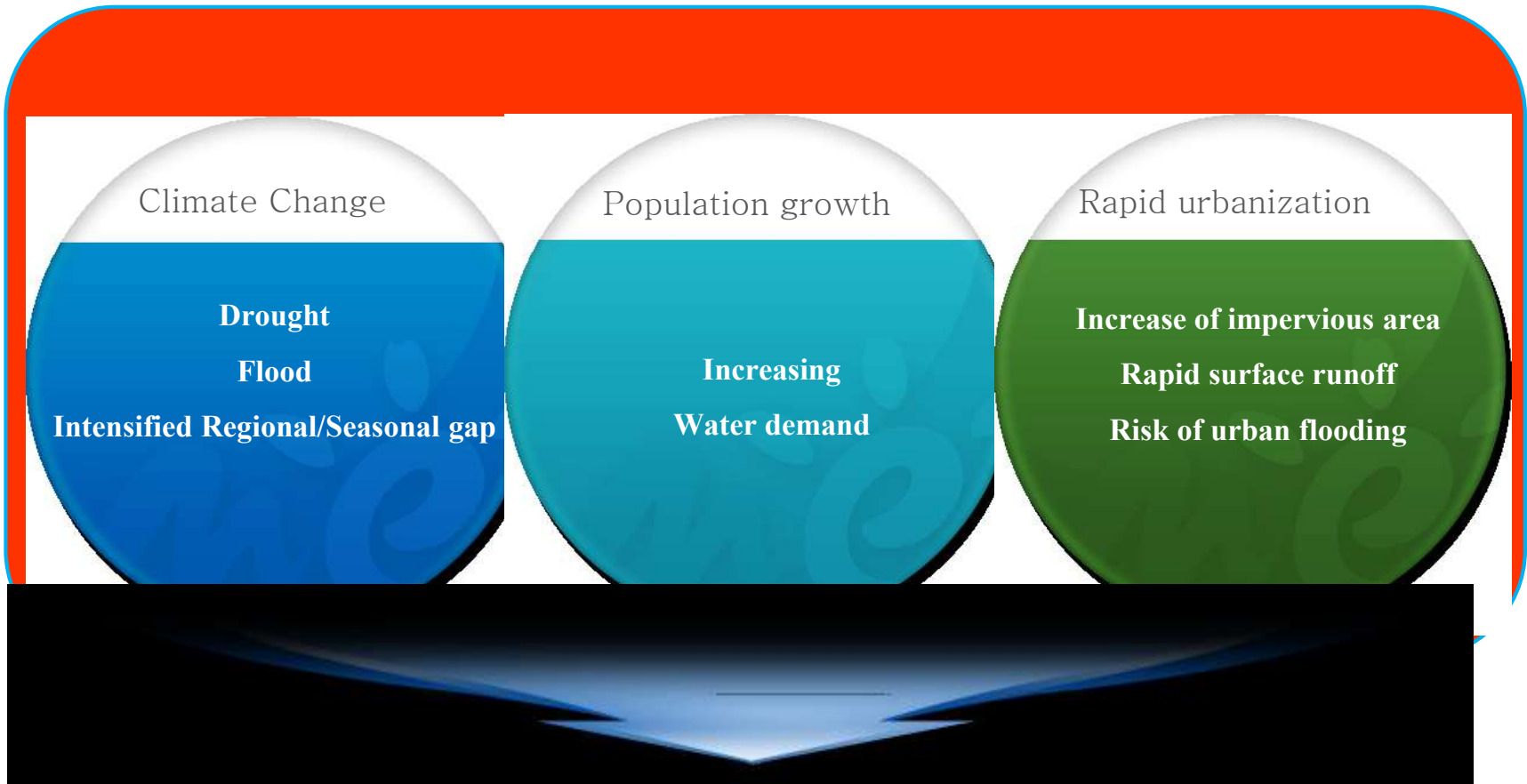


10 Outstanding solutions

<p>Solution 1 EKOMURO H2O + COLLECTING RAINWATER</p> <p>COLOMBIA</p>	<p>Solution 2 Low Cost Multi Effect Solar Still</p>	<p>Solution 3 Securing a good quality water supply using ONSEMIRO</p> <p>DONGZHUO LAKE</p>	<p>Solution 4 Securing Water for Food & Food for All</p> <p>PAKISTAN</p>	<p>Solution 5 Community-based Flood Warning System</p> <p>World Wide</p>
<p>Solution 6 Flood Forecasting and Warning System for Citarum River Basin</p> <p>BANDUNG Citarum-river</p>	<p>Solution 7 Desalination using Renewable Energy Sources</p> <p>GREECE</p>	<p>Solution 8 Rainwater Hippo banks and boat delivery</p> <p>MAKOKO</p>	<p>Solution 9 Low Energy Solar Pump</p> <p>NEPAL</p>	<p>Solution 10 Self sufficient triple-stage treatment process</p> <p>EGYPT</p> <p>Return to clean water</p>

- MF I : Water Efficiency (39)
- MF II: Resource Recovery (24)
- MF III : Water Disasters (20)
- MF IV : Smart Technology (25)
- MF V : Ecosystem services (5)





Water Reuse

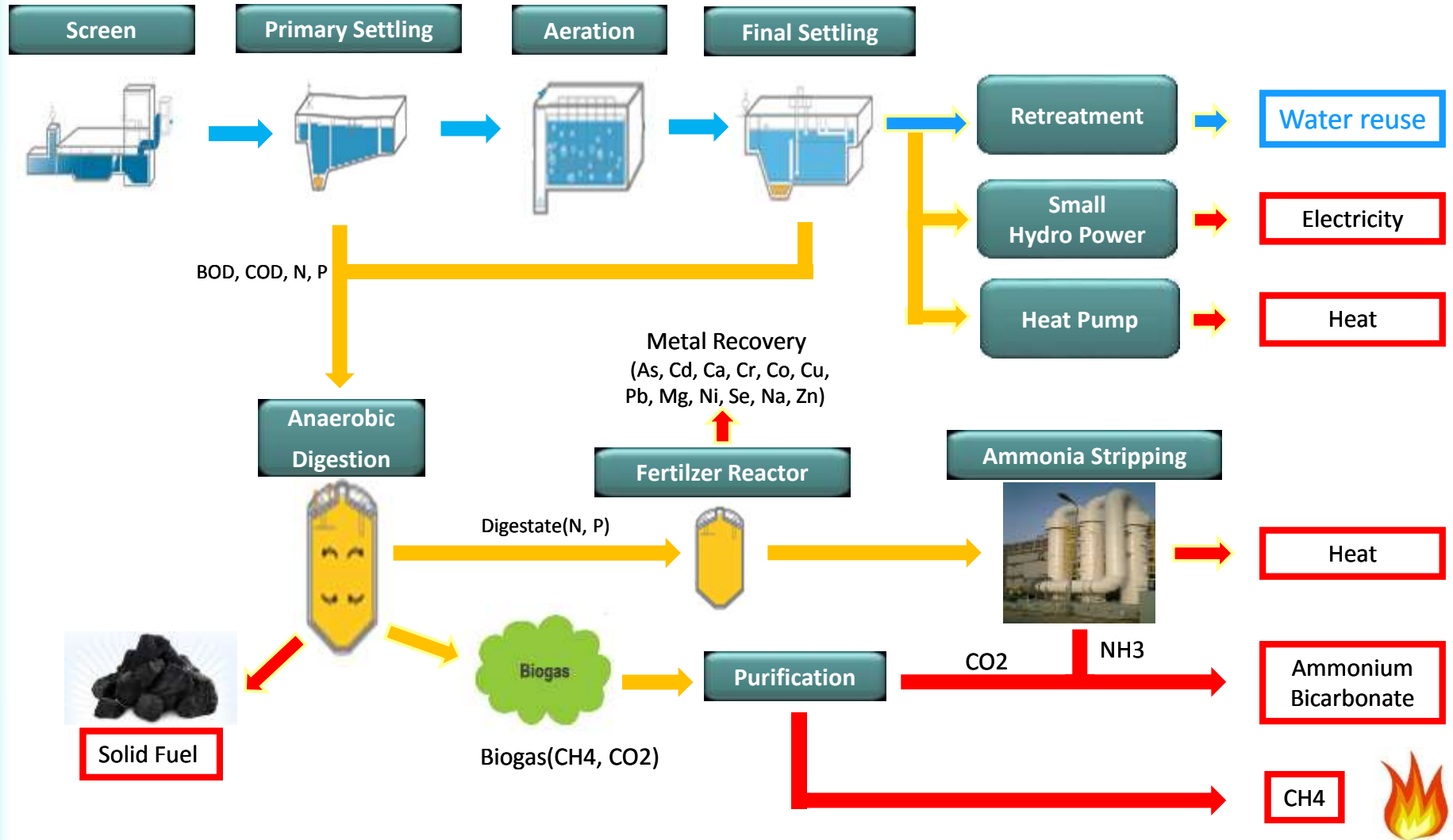
Essential for securing available water resources



Status of Water Recycling, Reuse



New paradigm in sewage treatment



Seonam Water Reclamation Center

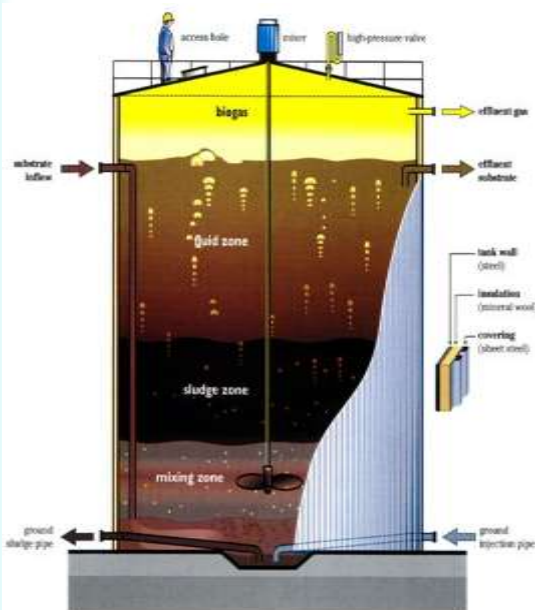


- ✓ Location : Seoul, Korea Republic
- ✓ Capacity : 1,630,000 m³/d

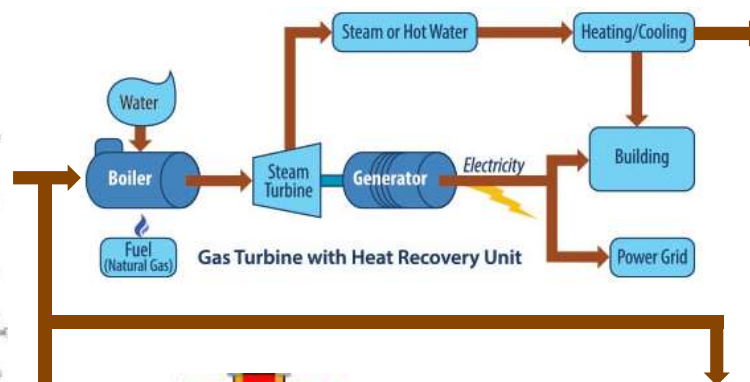
Seonam Water Reclamation Center

Energy recovery from **Sludge Digestion**

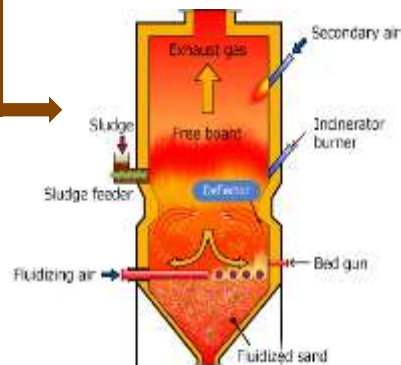
- ✓ Sludge incineration
- ✓ Fuel for Vehicles(CNG)
- ✓ Heat & Electricity



Sludge digestion



Combined heat & Power plant



Sludge incineration

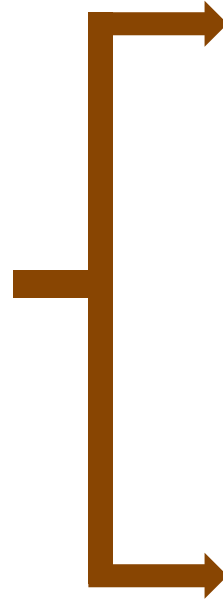


Fuel for vehicles

Seonam Water Reclamation Center

Energy recovery from **Discharging Water**

- ✓ Heat for District Heating
- ✓ Electricity



Heat Pump



Small Hydro Power

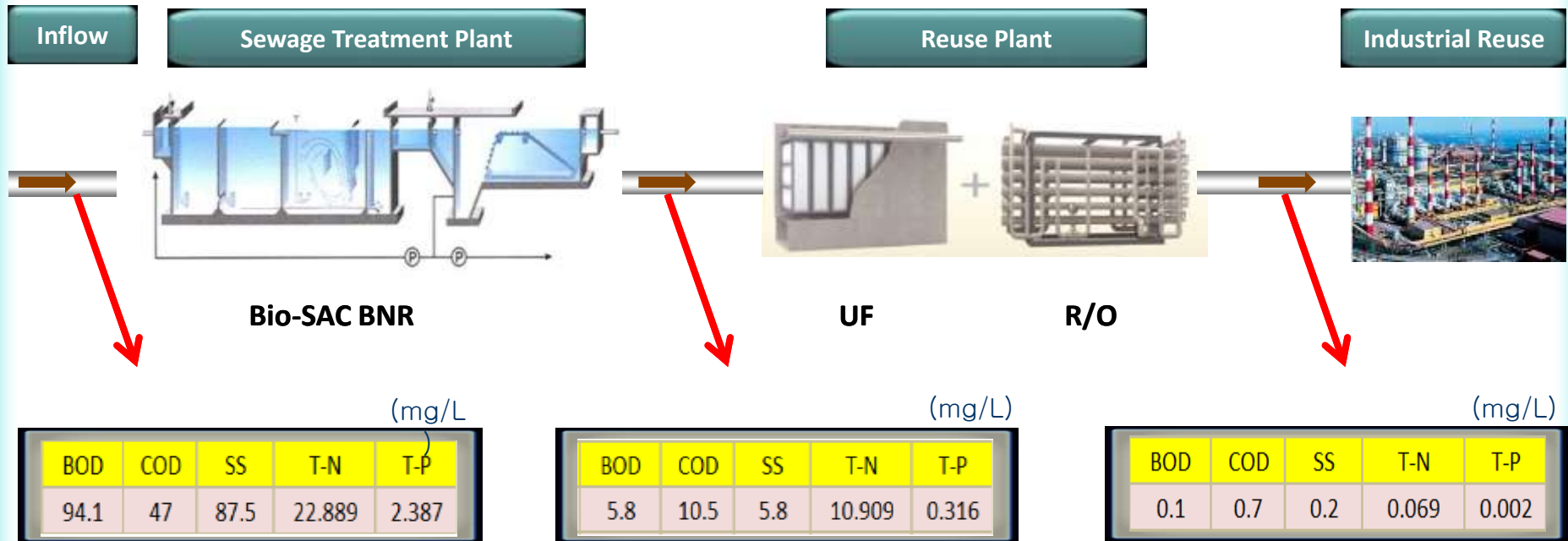


Pohang Sewage Reuse Plant



- ✓ Project manager : Keco
- ✓ Location : Pohang, Korea Republic
- ✓ Capacity : 100,000 m³/d
- ✓ Project Cost : \$ 128 Million USD
- ✓ Main Process : Reverse Osmosis(RO)

Pohang Sewage Reuse Plant



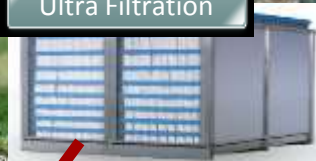
Pohang Sewage Reuse Plant

Water reuse facility

Reverse Osmosis



Ultra Filtration



3rd Floor

2nd Floor

1st Floor

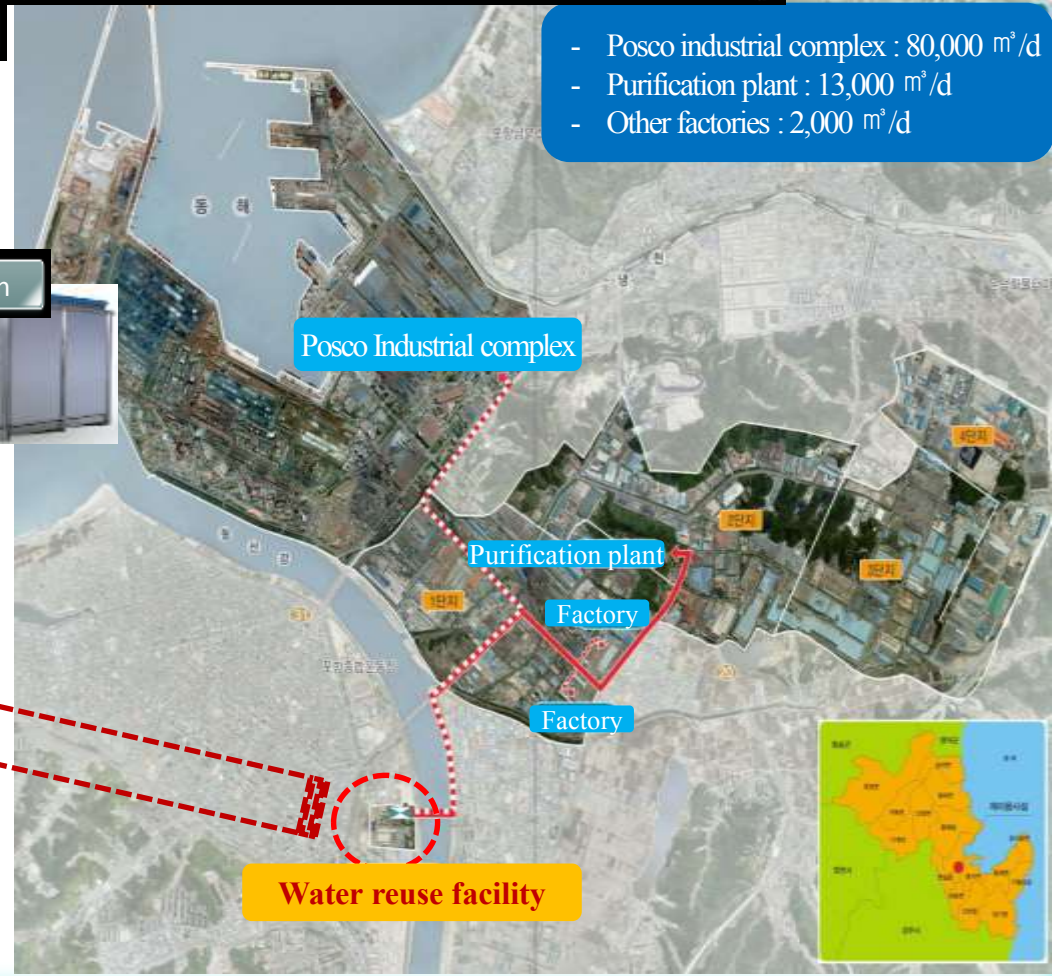
1st B Floor

2nd B floor



Water reuse in industrial complex

- Posco industrial complex : 80,000 m³/d
- Purification plant : 13,000 m³/d
- Other factories : 2,000 m³/d



Water reuse facility



The Benefits from Water Reuse Plant

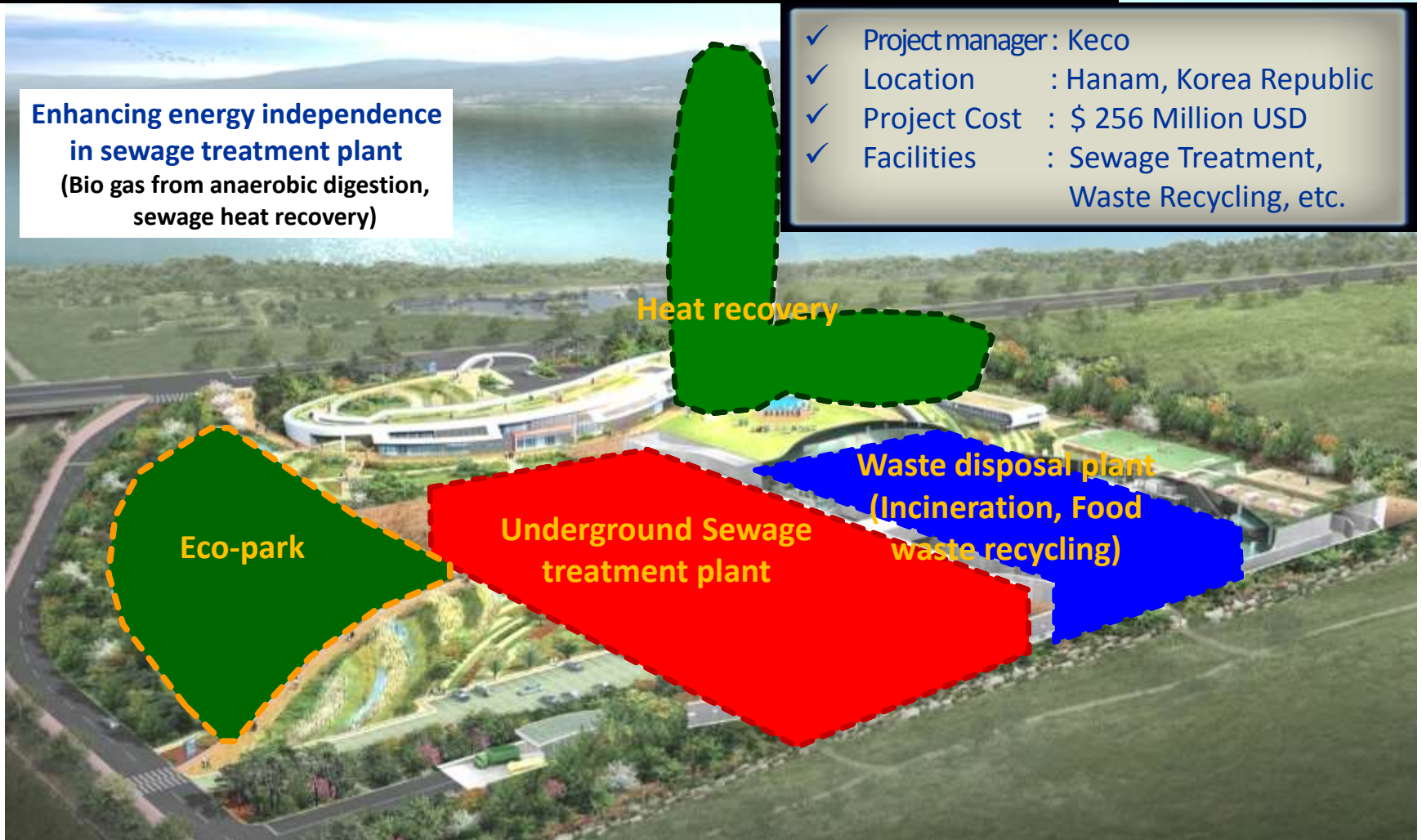
	Water Reuse	Dam construction*
Scale	Facility Capacity : 100,000 m ³ /d Supply Capacity : 100,000 m ³ /d Supply Pipe line : 11.71km	Dam Storage : 45,300,000 m ³ Supply Capacity : 113,000 m ³ /d Supply Pipe line : 62.6km
Construction Period	2.5 years	6 years
Cost	\$ 128 million	\$ 547 million
Impact on Environment	Low Impact to Eco-system No conflict with social community Reduced Discharging Pollution Load	Large-scale wildlife habitat destruction Risk of social conflict (Flood Area 3.07km ²)

* Reference : Preliminary Feasibility Study on Dalsan-Dam, 2011(KDI)

Energy independence & creating additional value

Enhancing energy independence
in sewage treatment plant
(Bio gas from anaerobic digestion,
sewage heat recovery)

- ✓ Project manager : Keco
- ✓ Location : Hanam, Korea Republic
- ✓ Project Cost : \$ 256 Million USD
- ✓ Facilities : Sewage Treatment,
Waste Recycling, etc.



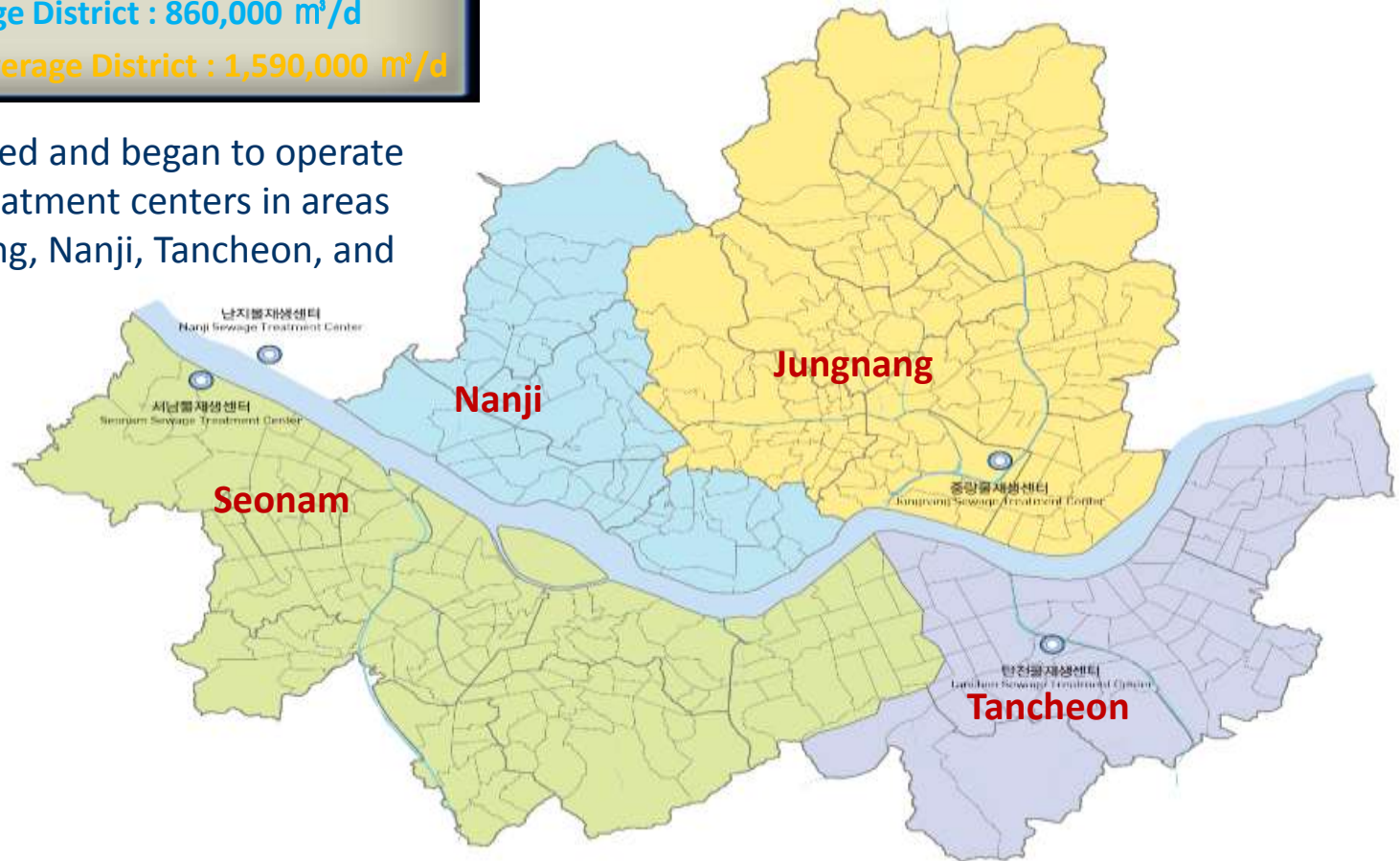
Sewerage Service Improvement by Decentralization

Centralized Sewerage System

- Seonam Sewerage District : 1,630,000 m³/d
- Tancheon Sewerage District : 900,000 m³/d
- Nanji Sewerage District : 860,000 m³/d
- Jungnang Sewerage District : 1,590,000 m³/d

Through the 1986 Asian Games and the 1988 Seoul Olympics, Seoul has been required to upgrade its status

Seoul constructed and began to operate four sewage treatment centers in areas such as Jungnang, Nanji, Tancheon, and Seonam.



Sewerage Service Improvement by Decentralization

Decentralized Sewerage System

Improving water quality & Increasing penetration rate of sewer system in upstream of 7 multipurpose dams in Korea



Approximately 400
STFs were constructed
in the period from
2006 to 2011
at 28 water supply
sources

ONSEMIRO™ system was
developed(2011) by Keco
to operate and manage
these 400 STFs
by district
in an integrated manner

* STFs : Sewage Treatment Facilities

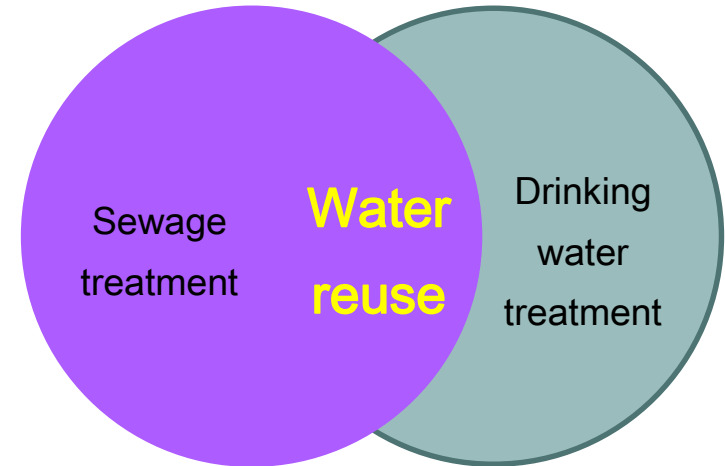


III

Challenges in Water Recycling, Reuse

Characteristics of water reuse

- ✓ Different from conventional (waste)water treatment system
- ✓ Alternative water resources
- ✓ Required water quality depends on various end users
- ✓ Should consider the impacts on human-health and ecosystem
- ✓ Possible uneasiness(even though safe enough)



Requirements for water reuse

Technology

- Low energy consumption
- Expertise
- Experience

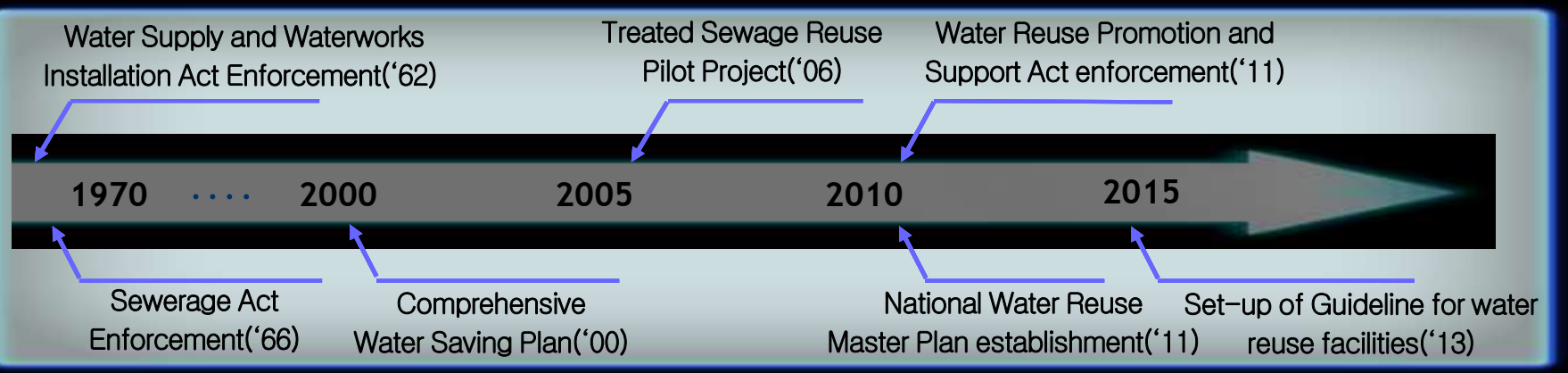
Institution

- Regulation
- Standard
- Guideline

Others

- Risk management
- Public awareness
- Financing

TIME FLOW



Changes in Water reuse legal Framework

	Sept. 2001	Sept. 2006	Jun. 2011
Rainwater	Water Supply and Waterworks installation Act	Water Supply and Waterworks installation Act	Water Reuse Promotion And Support Act
Grey water			
Treated sewage	Sewerage Act	Sewerage Act	

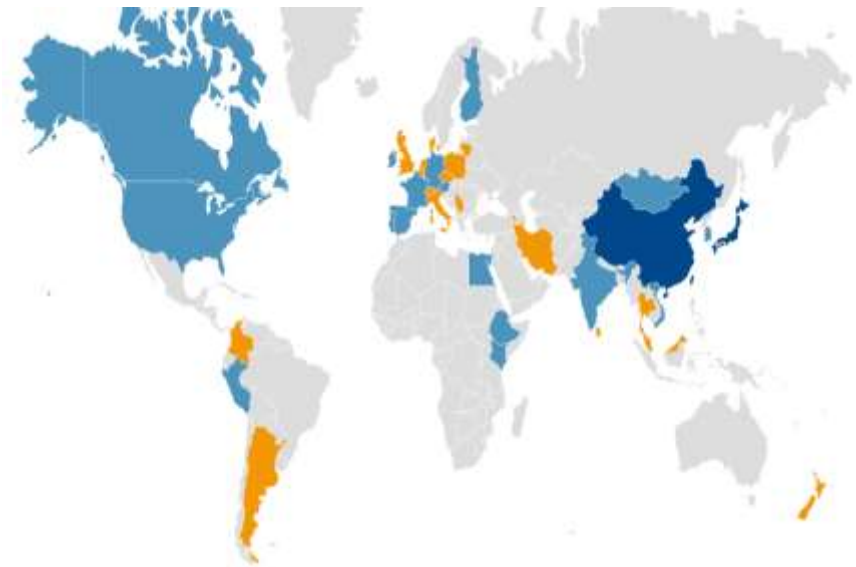
ISO/TC 282(Water reuse) : Standardization of water re-use of any kind and for any purpose
Including Technical, Economic, Environmental aspects of water reuse

ISO/TC 282 Water re-use

SC 1. Treated Wastewater use
for irrigation projects

SC 2. Water reuse in urban area

SC 3. Risk and performance Evaluation
of water reuse systems



- Secretariat: China(SAC) Japan(JISC)
- Participating Countries(20)
- Observing Countries(19)



Secure, Safe, Sustainable
Water Reuse !

