THE FUTURE OF SUSTAINABLE CITY: BUSAN ECO DELTA SMART WATER CITY

HKU Water Centre Smart Water Cities Forum

Ⅰ. About K-water

A major water-managing public corporation in Korea with a history of fifty years of water management

* Water(flood control 94%, water supply 61%, tap water production 31%, reuse 69%), renewable energy(7.7%), **smart city(27㎢)**

Established in 1967

Total Water Service Provider

Water Resources

Water Supply & sewage

Clean Energy

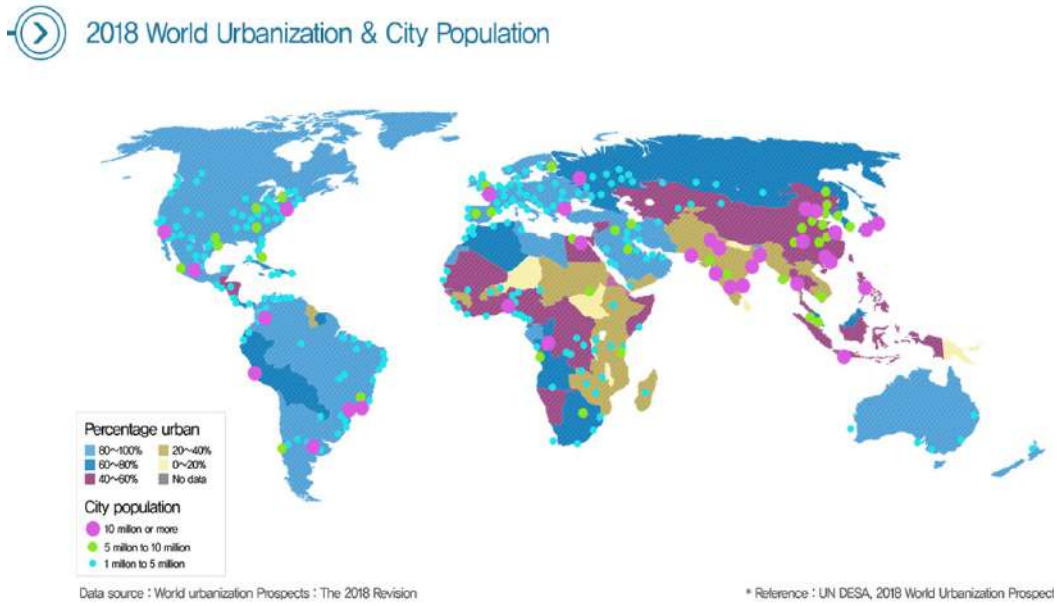
Waterfront Cities& Industrial Clusters

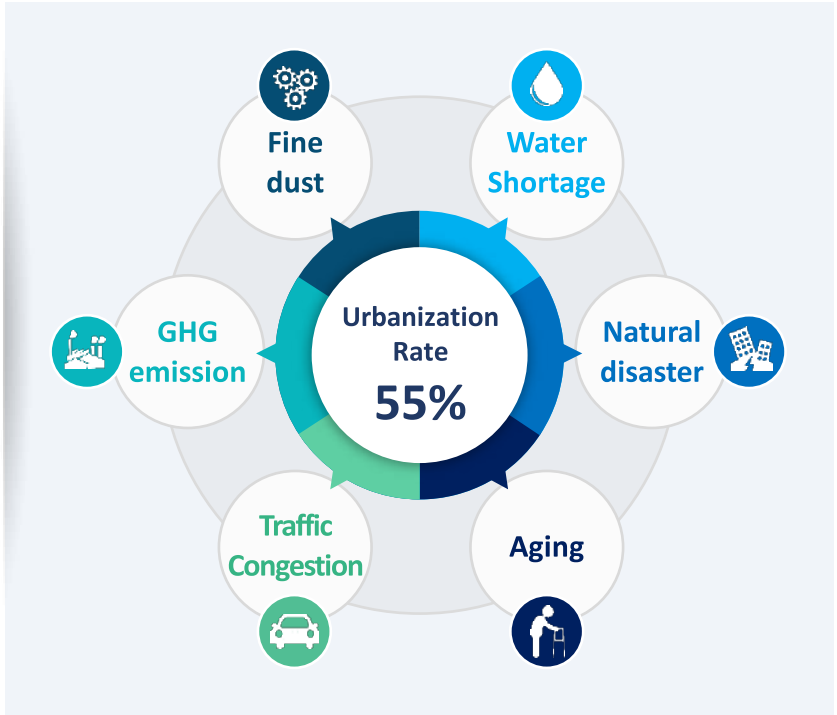
Overseas Projects

Ⅱ-1. Why Smart Cities?

Rapid Urbanization and Social Problems

According to the UN, by 2050 the world's population will grow from 5 billion to 9 billion, with the urbanization rate reaching up to 70%.





As population and resource consumption are concentrated in cities due to rapid urbanization, various social problems such as fine dust, traffic congestion, water shortage and disaster safety are intensifying, posing as a major threat to the city's sustainability.

Ⅱ-1. Why Smart Cities?

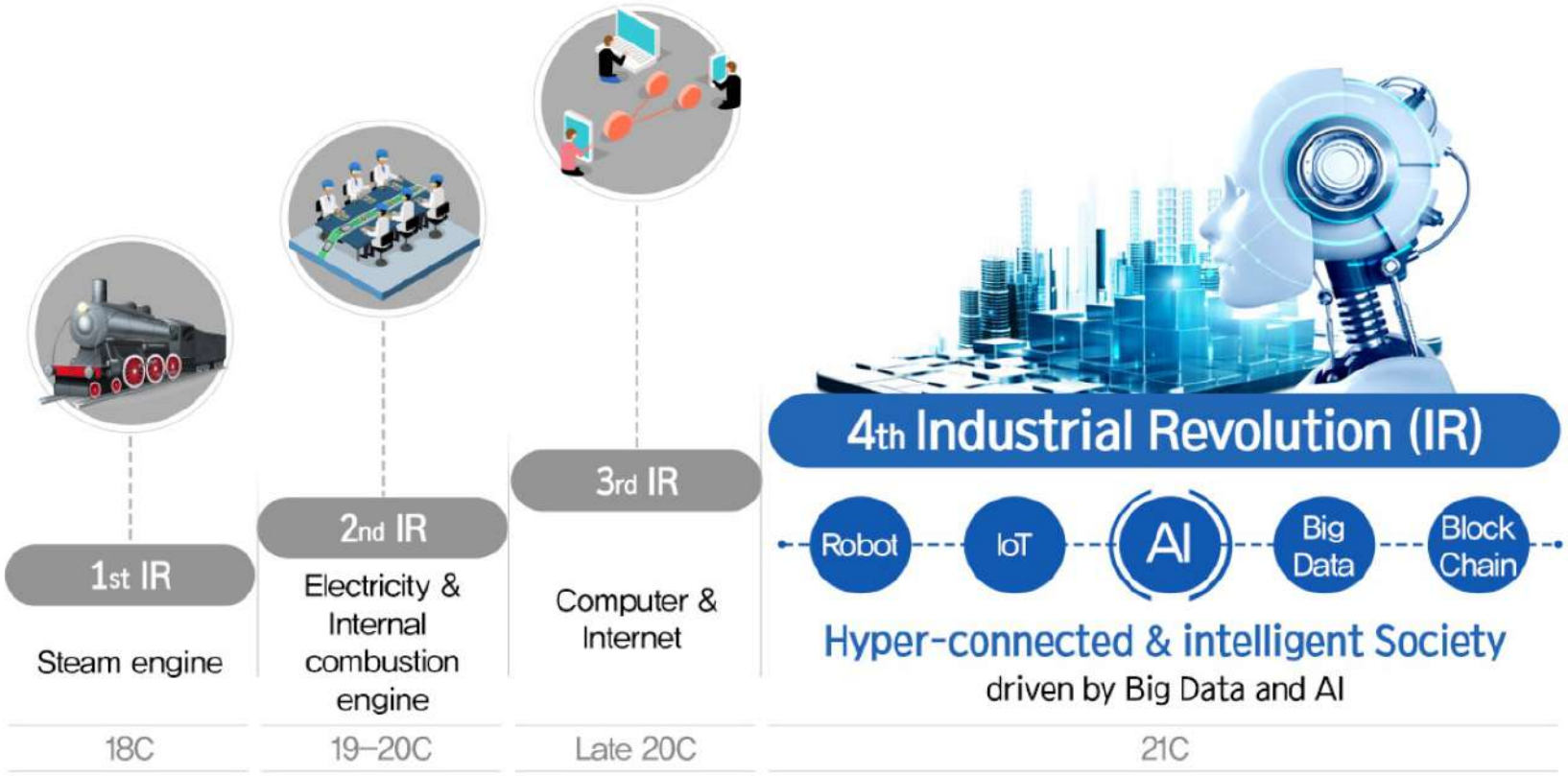
Global Issues

Problem on traffic, Energy, Safety, pollution, water, etc. : Result in Indiscreet Urbanization

Now, Our City Need Innovative changes

Use of Innovative Technology to Solve Problems

Countries around the world are paying attention to smart cities as a new alternative to solving urban problems, and making full-fledged efforts to promote smart cities using 4th industrial revolution technologies such as big data and AI.



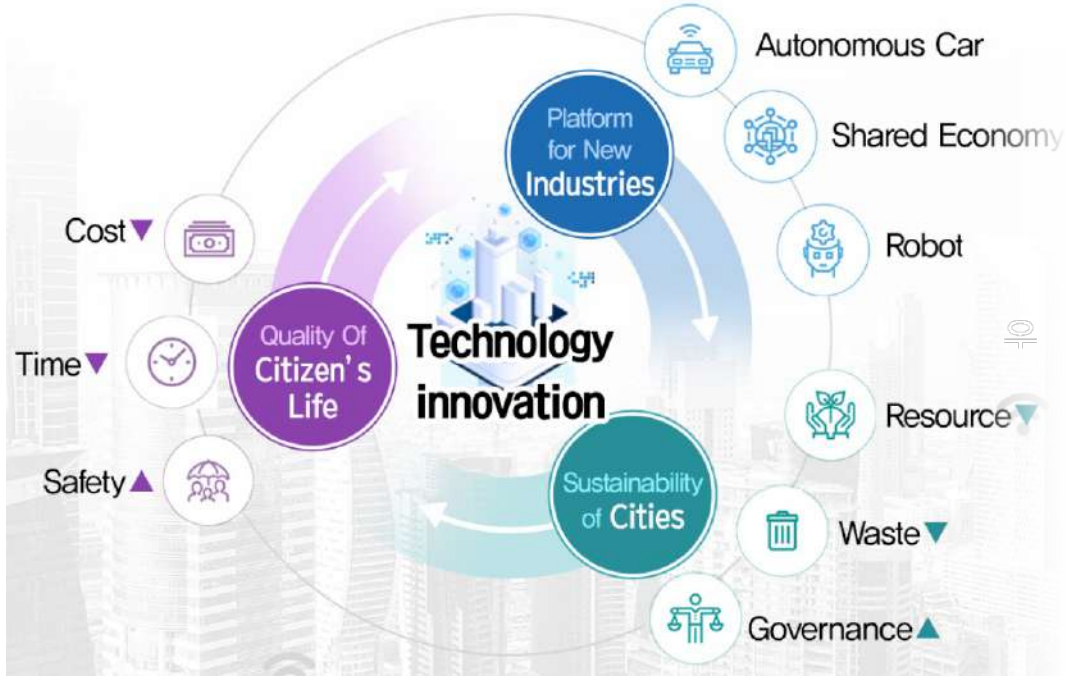
Ⅱ-2. What is a Smart City?

Diverse Thoughts on Smart Cities

What is Smart City?

Smart Cities are defined in Various ways, and each country's approach to Smart cities is varied.

* Depending on the level of economic and city Development and city conditions of each country



Smart cities of Korea – Our Idea of Smart City

Korea define Smart City as a platform to improve the quality of life for citizens, enhance the sustainability of cities, and foster new industries by utilizing innovative technologies of the 4th Industrial Revolution.

Ⅲ. Smart Water City : Busan (Eco-Delta City)

Overview & Locational Advantages of Busan Eco Delta Smart City

Busan Eco Delta City(Eco Delta City)

Area	11.77㎢
Population	76,000 people(30K households)
Functions	Residence, commerce, R&D, Logistics, and etc.
Project by	Busan Metropolitan City K-water Busan Metropolitan Corp.

Smart City National Pilot Project

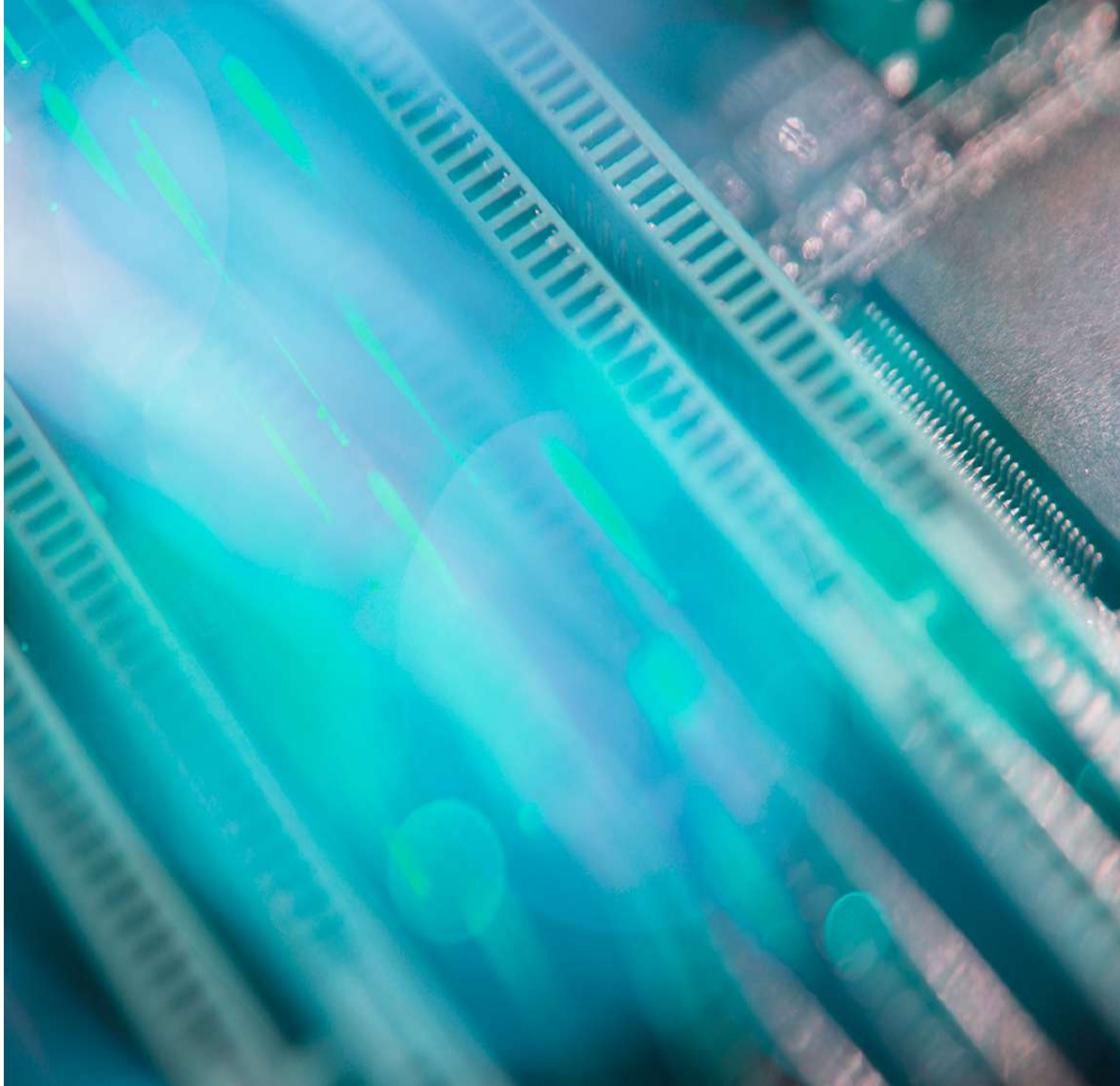
Area	2.2㎢ ✱2.8㎢ including the healthcare cluster
Population	8,500 people(3,380 households)
period	2019 ~ 2023
Expenditure	1.7 billion US$ (Public 1.2 billion)

Ⅲ. Smart Water City : Busan (Eco-Delta City)

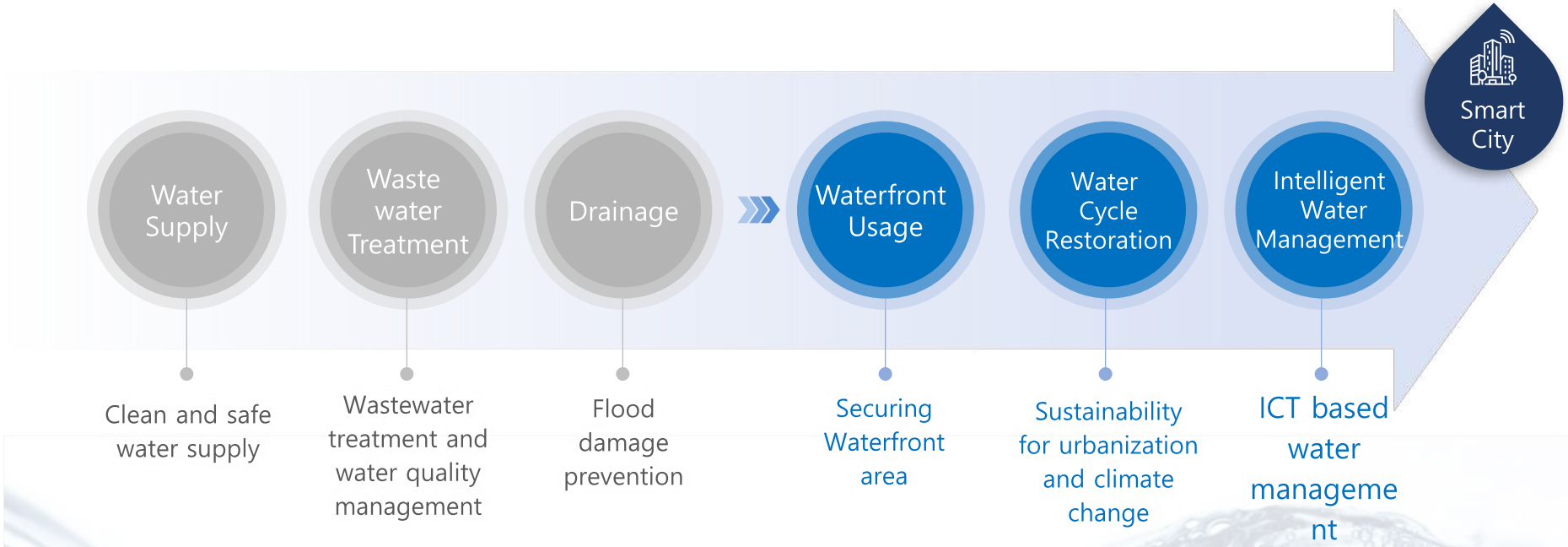
10 innovative technologies that improve quality of life

Next generation city management platform

A Smart Water City is Not only about ITs, But also a solution for a Sustainable City



The Future of Smart City Water Management shown by Busan Eco Delta Smart City



Conventional Water Management → Future Water Management

* Improvement of economical, settlement conditions, new industry creation

Water specialized from the urban design phase

Waterfront Eco City Design

Develop as a most Iconic "GLOBAL" waterfront landmark locally and Improve the quality of life

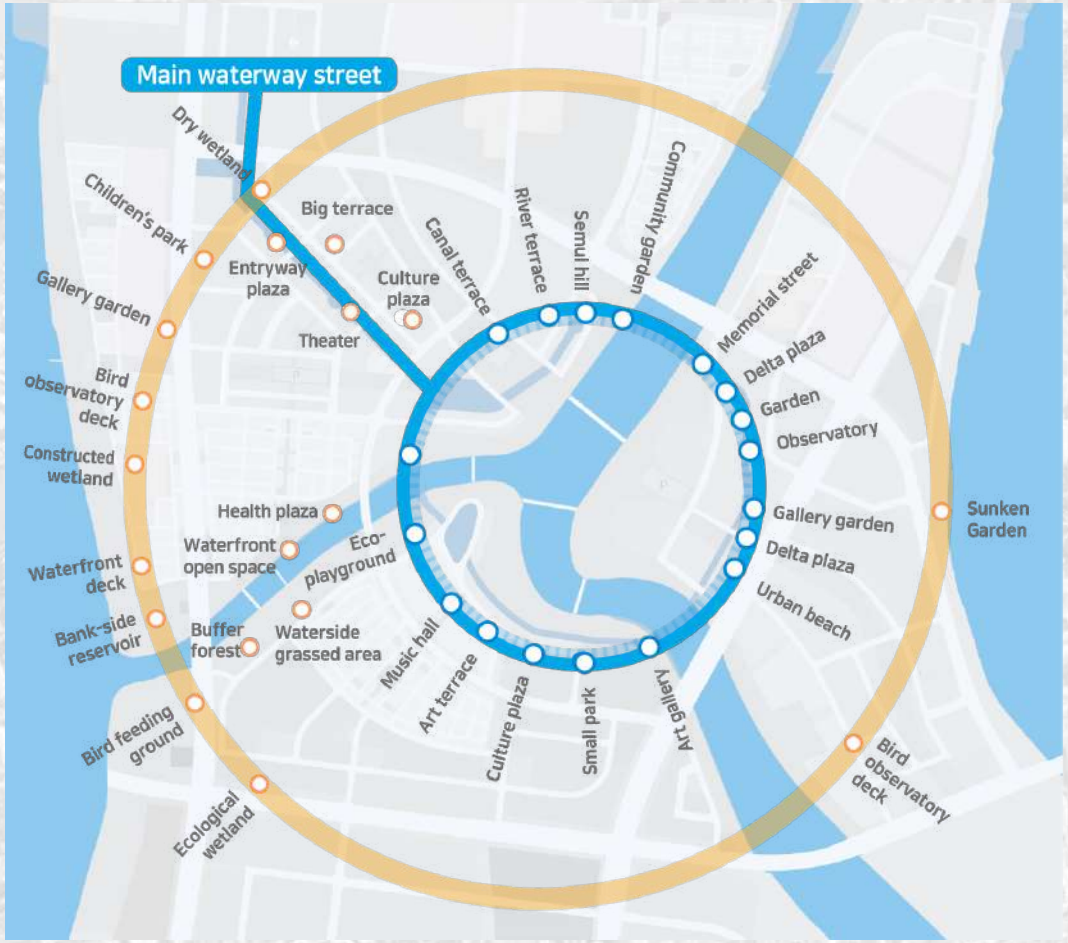
+

Urban Water Cycle Restoration

Solve water problems in existing cities based on advanced water management technology.

Eco-Delta City Design based on Waterfront

Create a Culture-front (Culture Waterfront) where people can experience nature, leisure, and various leisure activities



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Urban Water Cycle Restoration

Solve water problems in existing cities based on advanced water management technology.

Urban Water Cycle Recovery

Urban Problems

Urbanization

System loss in fist step of water circulation because the city is covered with concrete

Climate Change

Frequently occurring drought and floods

Water Leakage

About 15% of purified water is leaking from the pipe

Non-drinking Water

Tap water drinking rate is only about 7% in Korea

Adoption of smart water management technologies by K-water's 50-year water management know-hows

Introduce smart waterworks in new city for the first time in Korea
→ Provides services such as quality and quantity of water, as well as drought and flood information

① High-precision small scale precipitation radar

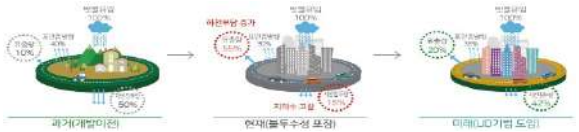
Improve the quality of river water and raw water through environmentally friendly water treatment based on natural or artificial recharge technology from developed countries.

② Urban Disaster Integrated Management System

Develop an Integrated Urban Water Disaster management system through constant monitoring water levels, gates, and drainage facilities

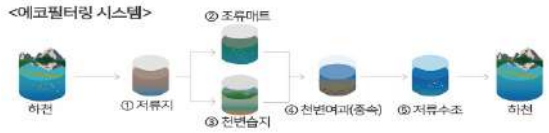
③ Low Impact Development(LID)

Construction of customized green infrastructure to restore urban water circulation to buildings such as roads, parks, green areas, rivers, and public buildings



④ Improving Water Quality in city rivers (Eco-filtering)

Improve the quality of river water and raw water through environ mentally friendly water treatment based on natural or artificial rec harge technology from developed countries.



⑤ Decentralized Smart Water Treatment Plants (Pilot project)

Prevent secondary contamination/water outage and diversify water sources by installi ng compact water treatment facilities near consumers.

⑥ Smart Water Management (SWM)

Providing consumer-oriented services such as applying SWM technology to manage water quality and quantity in real time for the whole water supply process and providing real-time water quality information to the public

⑦ Water Recycling

Process rainwater, sewage, and wastewater according to the p urpose, e.g., use them for housing, industry, agriculture, landsc aping, and river maintenance, among others.

⑧ Hydrothermal Energy System

Reduce the use of energy through the temperature differences of river water and raw water for heating and cooling.

01 Urban water-related disaster response system

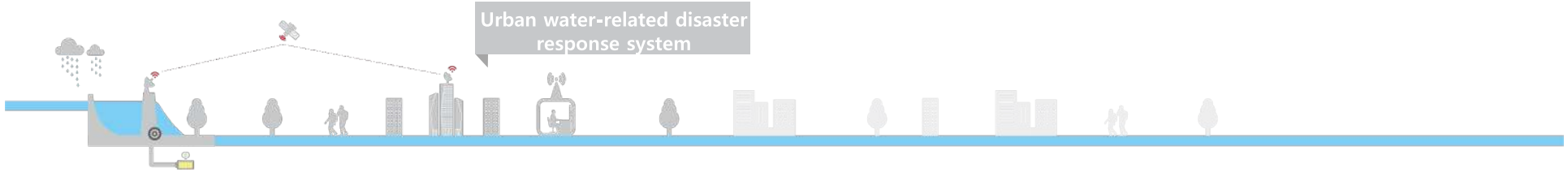
Small-sized precipitation forecast radar and Water disaster management system

Small-sized precipitation forecast radar

Installation and operation of high precision small rainfall radar to predict and respond to floods by analyzing the amount of rain falling in cities in real time

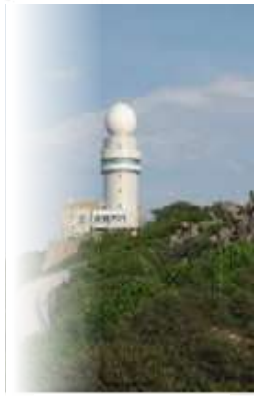
Water disaster management system

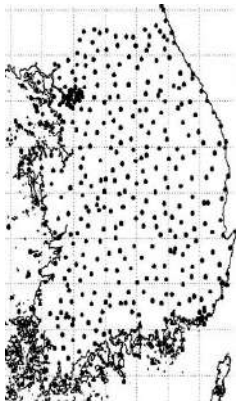
Built an integrated urban water disaster management system that constantly monitors water management infrastructure such as river level, flood gates and drainage facilities



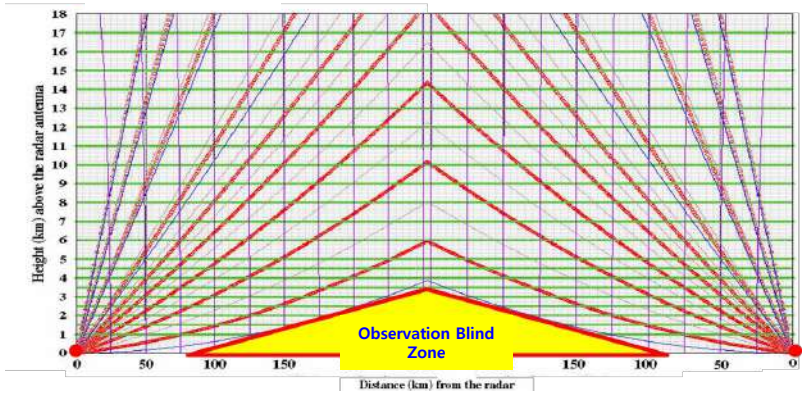
As-is

- High-level rainfall observations centering on large rainfall radar
- Inadequate local rainfall response system due to predicted rainfall using rain gauge system



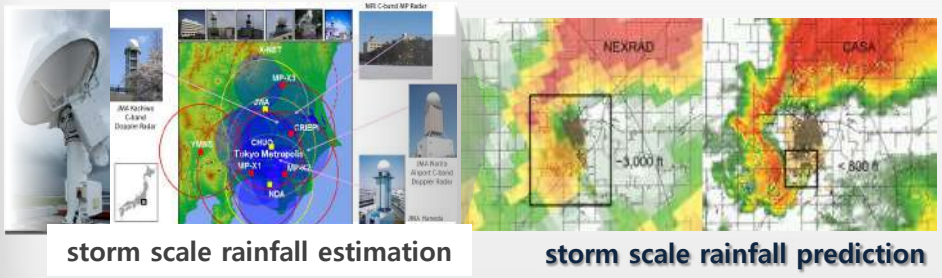


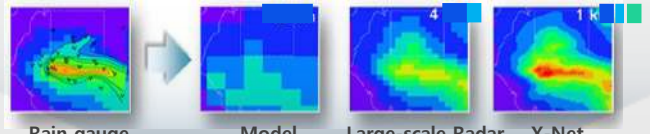
● Rainfall Radar



To-be

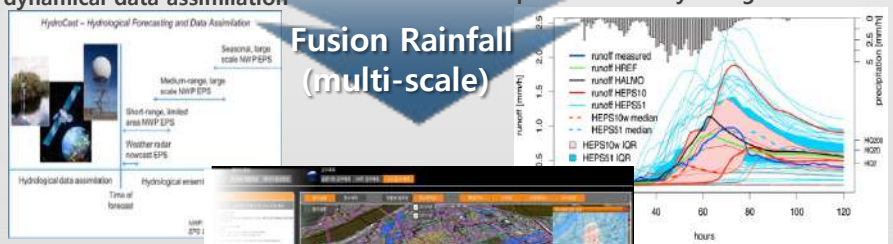
- Development of high-resolution radar based localized heavy rainfall and flash flood monitoring, prediction and evaluation technology

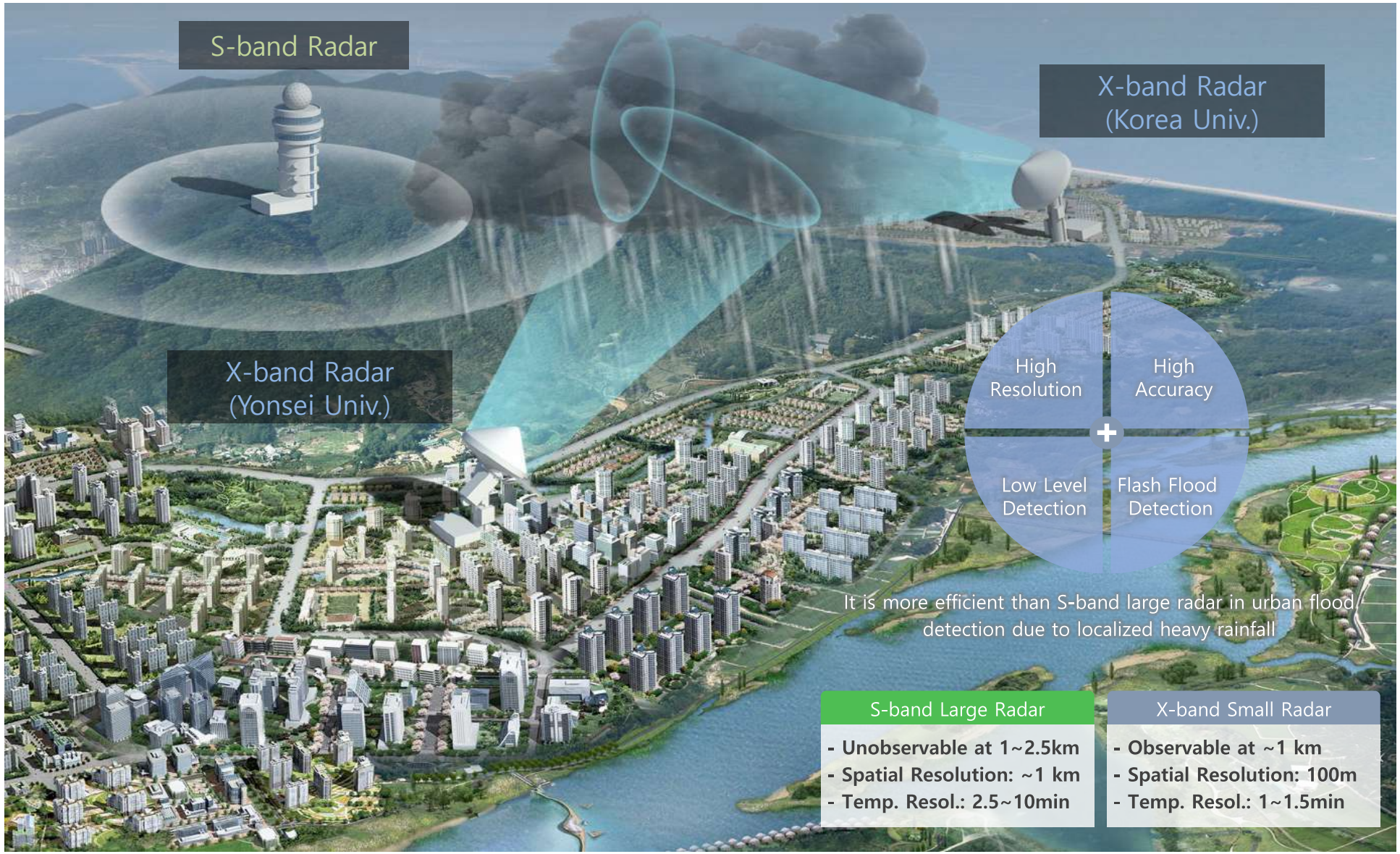




dynamical data assimilation

Super-ensemble hydrological forecasting




S-band Radar
X-band Radar
(Korea Univ.)
X-band Radar
(Yonsei Univ.)
High Resolution
High Accuracy
Low Level Detection
Flash Flood Detection
It is more efficient than S-band large radar in urban flood detection due to localized heavy rainfall
S-band Large Radar
- Unobservable at 1~2.5km
- Spatial Resolution: ~1 km
- Temp. Resol.: 2.5~10min
X-band Small Radar
- Observable at ~1 km
- Spatial Resolution: 100m
- Temp. Resol.: 1~1.5min

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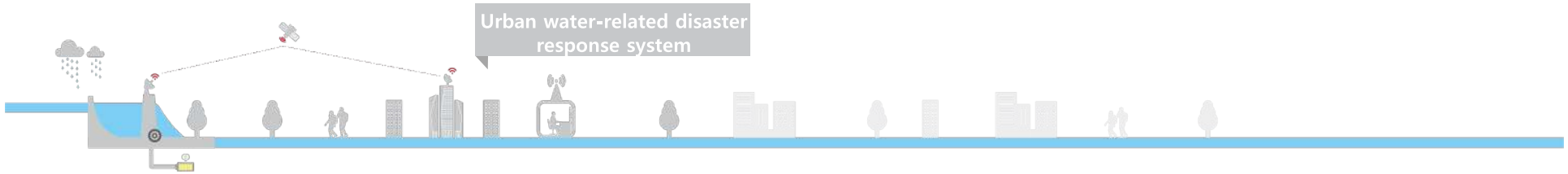
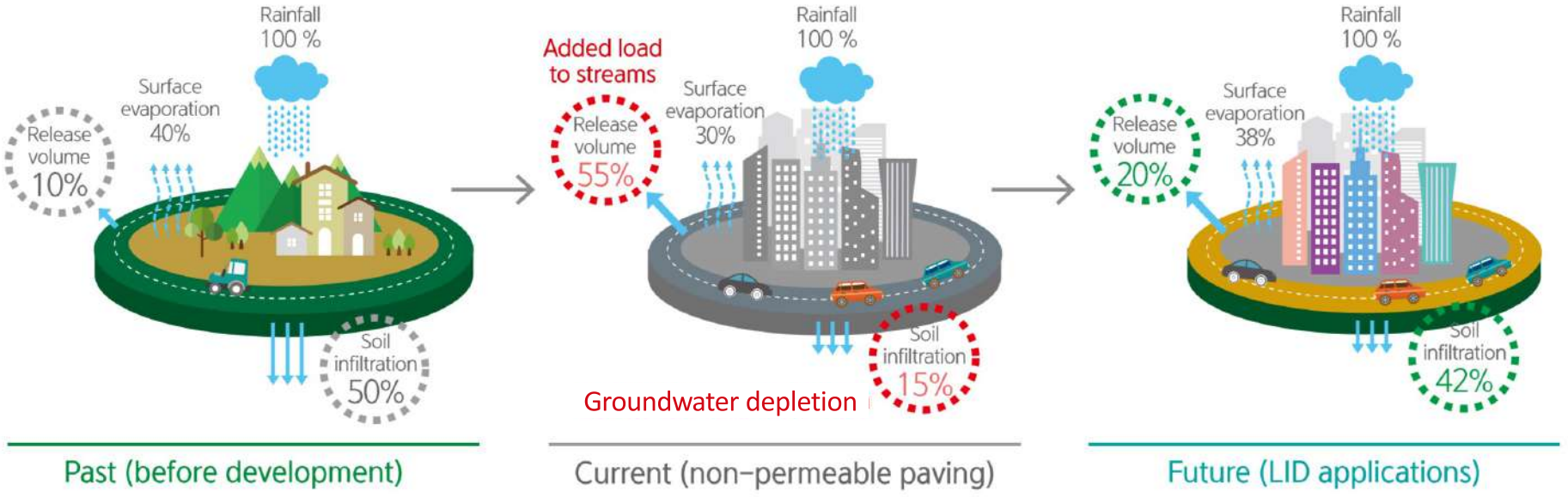
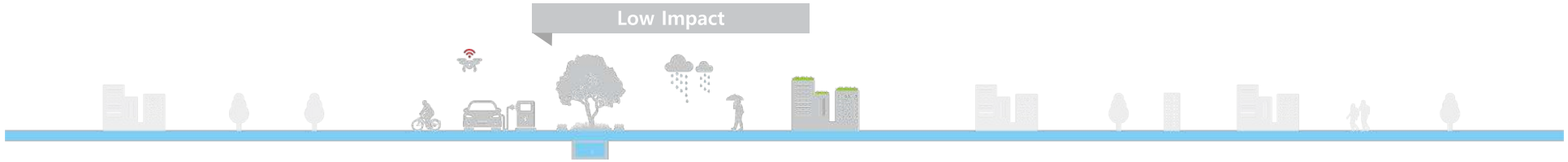


02 Low-impact development(LID)

Naturally structured city covered with greenery and gardens instead of concrete

* Develop city that rainfall penetrates well into the soil



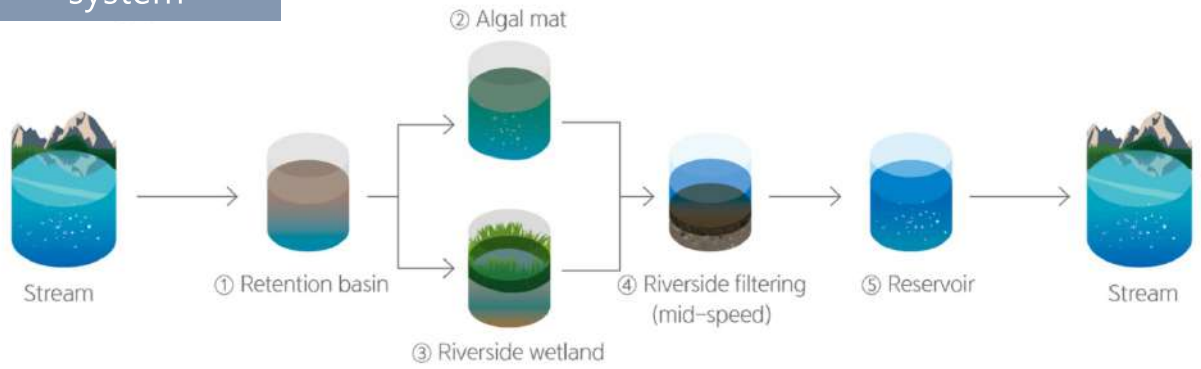


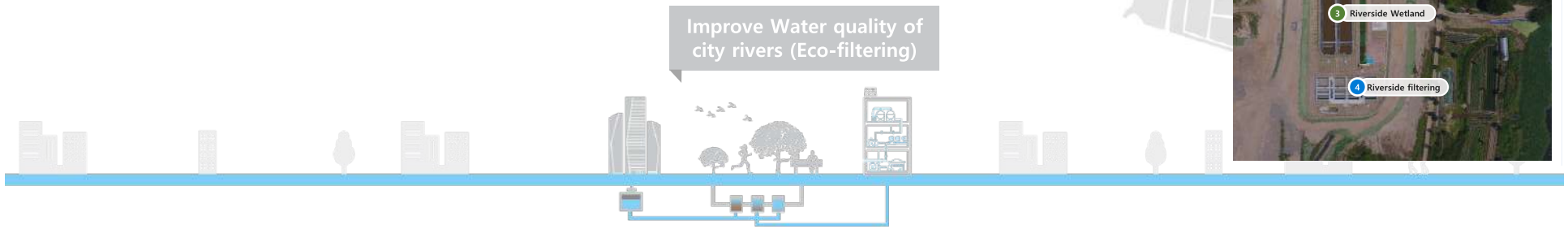
03 City stream quality improvement(Eco-filtering)

Consistently clean water & safe interaction with nature

* (Area / capacity) 5,700㎡ / 1,000㎥ / day, (applied technology) algae mat, ecological wetland, natural filtration

Eco-filtering system

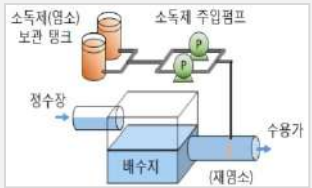




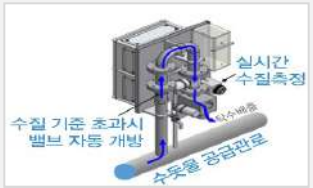
04 SWM (Smart Water Management)

ICT application in water supply process from source to tap for live monitoring and remote control water quality and quantity

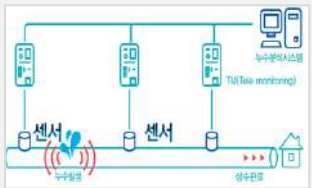
Thoroughly manages water supply process



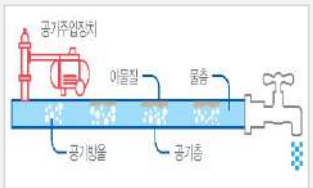
Equalization of residual chlorine



Automatic drainage



Water leakage detection system



Pipe cleaning

Supply secures and healthy tap water
Leakage reduction, Energy saving

Paju City Pilot Project

3% → 36%

Tap water drinking ratio

81% → 94%

satisfaction

User-centric Services


Indoor pipe diagnosis

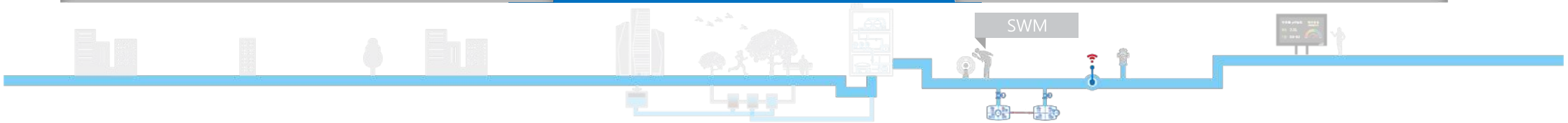

Water quality inspection visit

Total Care Service


Old age indoor pipe cleaning

Tap water insurance

Providing water quality information
Improve drinking water environment

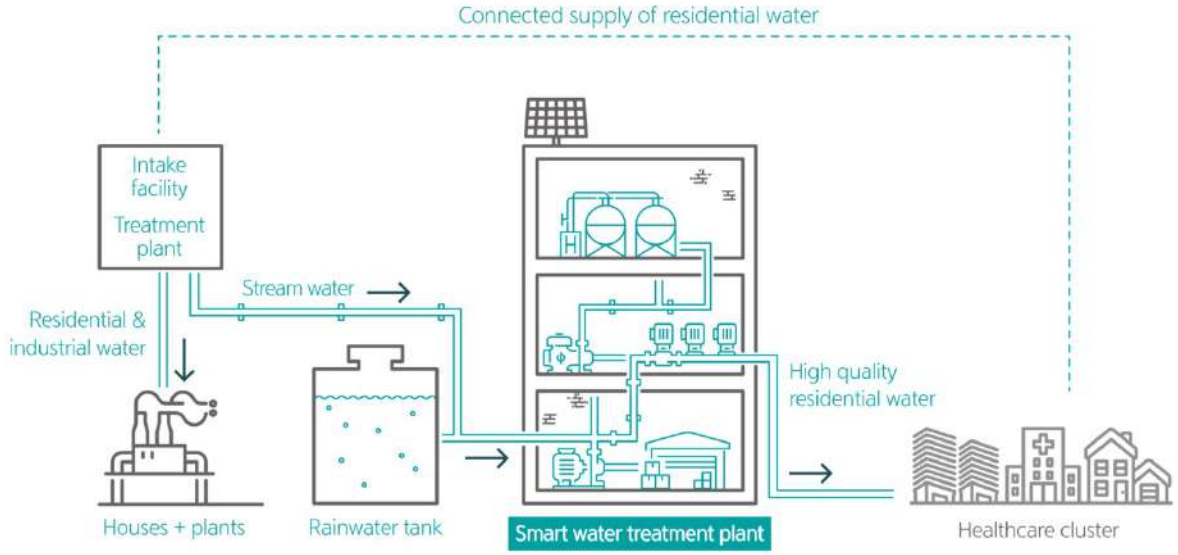


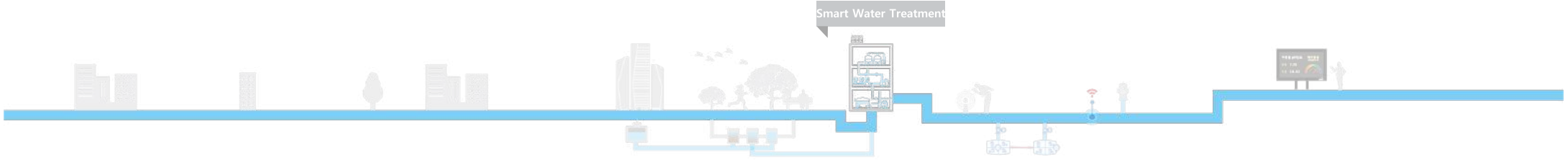
05 Smart water treatment plant(pilot)

Small-sized treatment plants around the city supplying top quality water

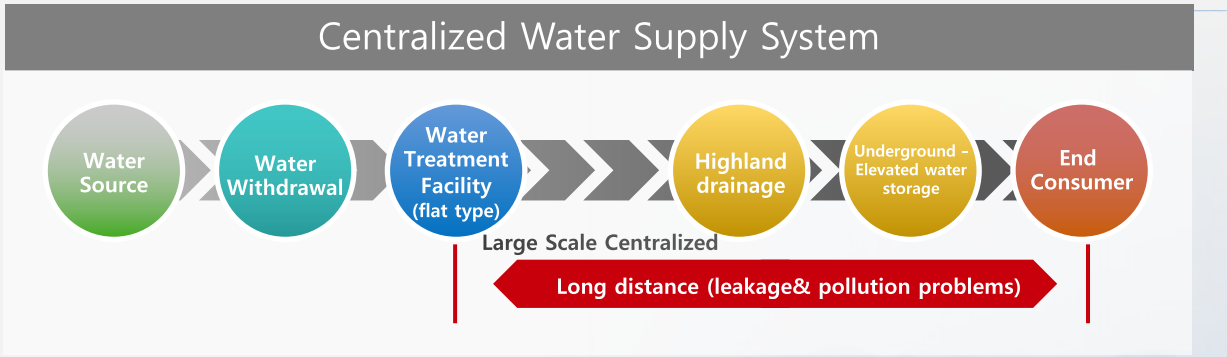
Multi-story building type water treatment plant

Advanced small-scale treatment facilities will be built in the city, minimizing the distance and ensure the quality of drinking water



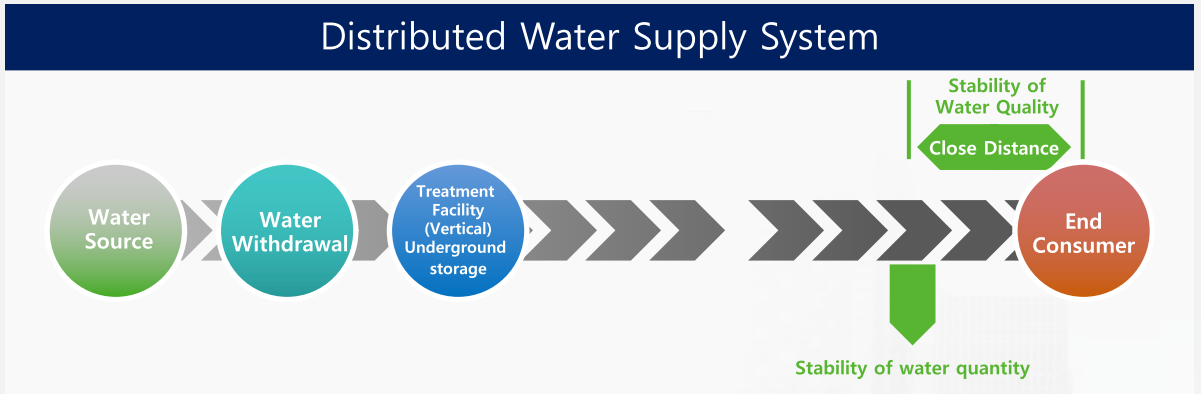


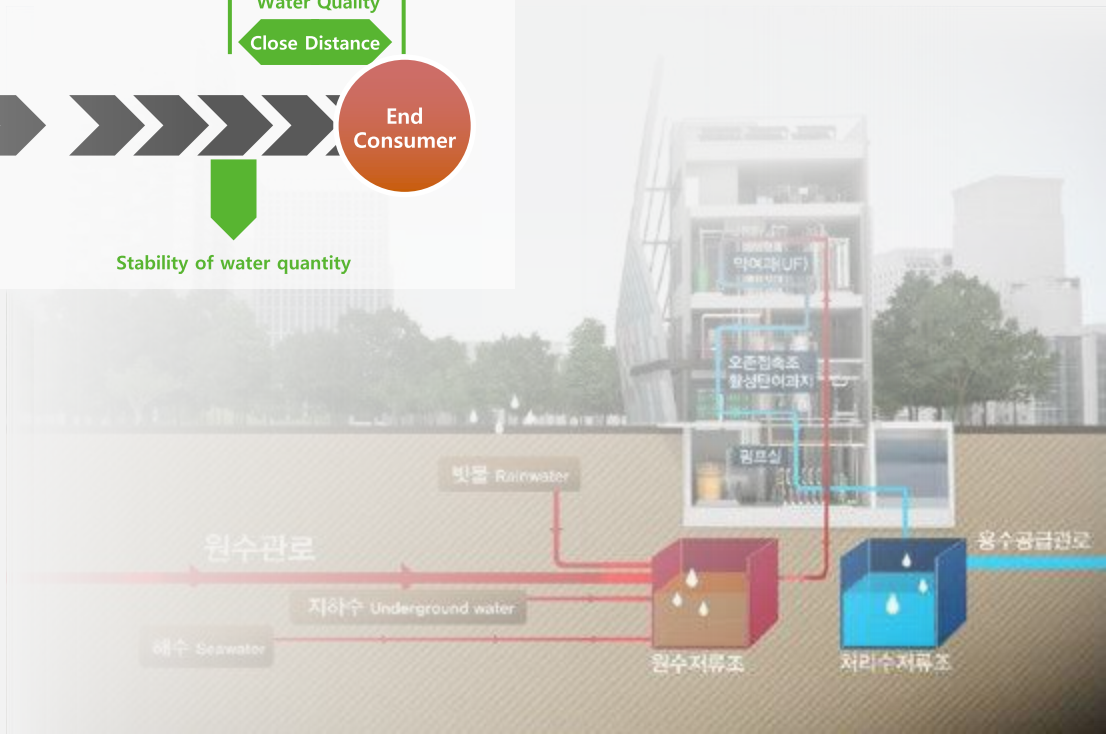
The current water supply system, purified water is delivered to the final consumer from a large water treatment facility near the water source



To solve these problems, the government developed a small water treatment facility near the consumer

* (R&D) Development of Distributed Water Supply system With Vertical Water Treatment (2010~2014)





Decentralized Vertical Water treatment facility Case Study (Cheongju Water Treatment Facility)

Construction process

Major water treatment facilities

Membrane filtration
- ✓Type : UF(Dow)
- ✓ Flux : 1.4 m/day (25 ℃)
- ✓Recovery ratio : 91.9 %

Ozone contactor
- ✓Dosage : 2 gO3/m3
- ✓Type : Side stream

Activated carbon adsorption
- ✓Size : 12 x 40 mesh
- ✓EBCT : 15.4 min
- ✓Material : coal
- ✓backwashing : water + air

Ultraviolet irradiation
- ✓Dosage : 43,600 μW-sec/㎠
- ✓Transmission(%) : 70% or above

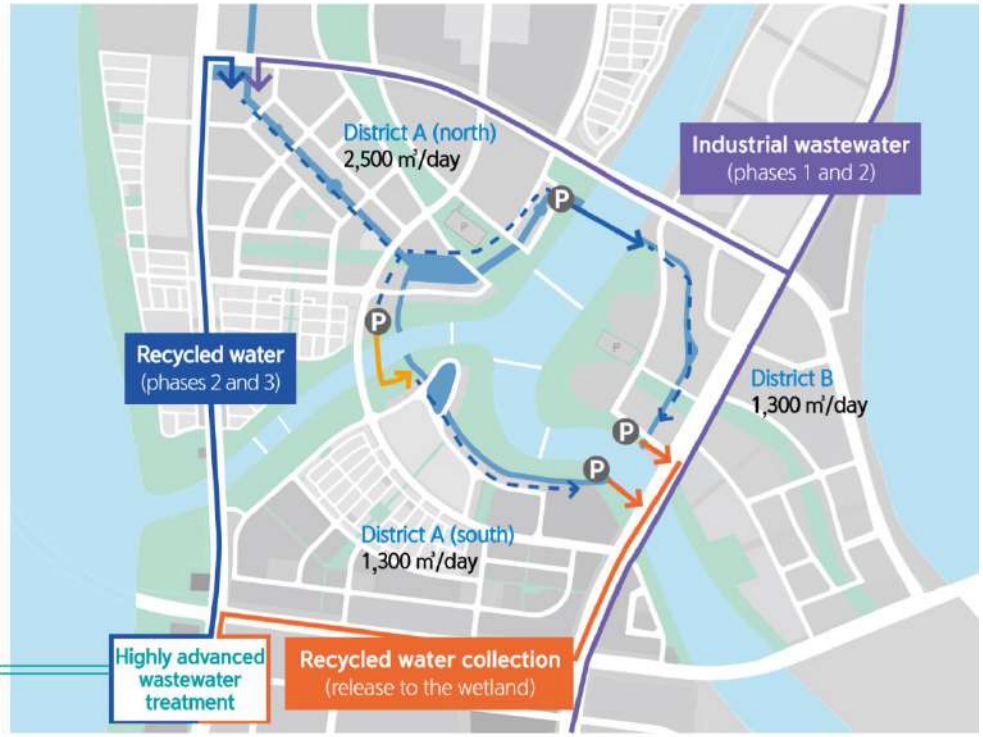
06 Water reuse system

Using water in all part of the city more than once
Waste water is reused for cleaning, to fill the waterway, and to water parks

Plants
100 ㎥/day

Waterway
District A (north)
2,500 ㎥/day
District A (south)
1,300 ㎥/day
District B
1,300 ㎥/day

City cleaning
400 ㎥/day



Development of Water recycling system

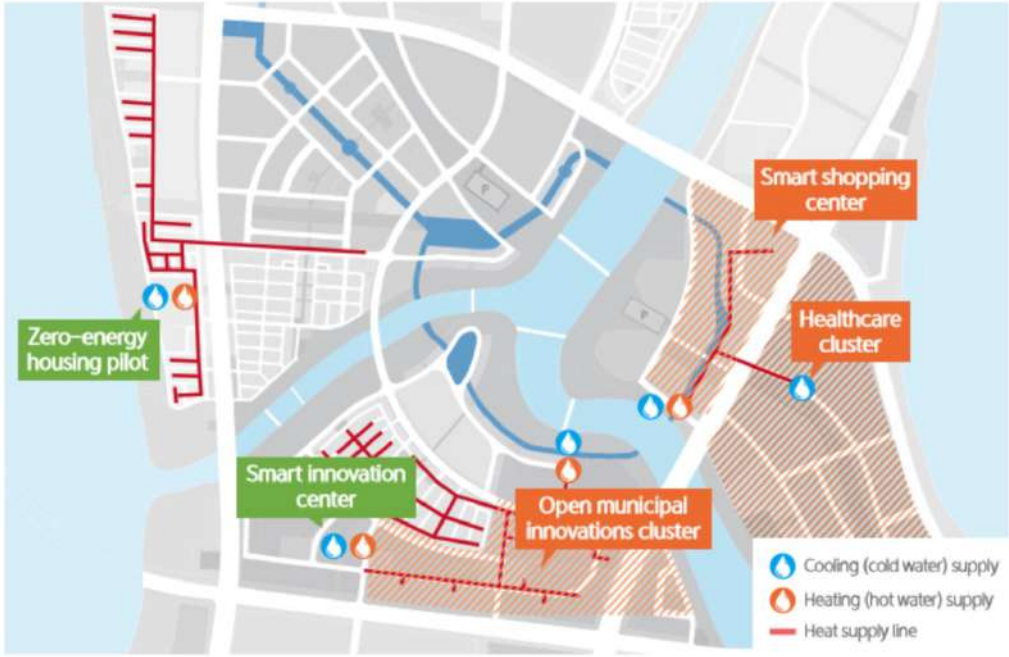
07 Hydrothermal Energy

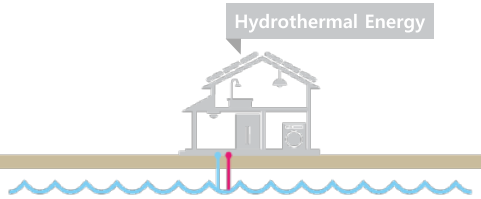
Recover the heat source of river, lake, and sea water directly or with a heat pump and use it for heating/cooling or as a hot water supply to buildings.

Concept Diagram of Hydrothermal Energy

1st phase (~2021)
Open Innovation cluster,
Zero energy housing district

2nd phase (~2023)
Public Innovation Cluster
Healthcare cluster, Smart Shopping centers

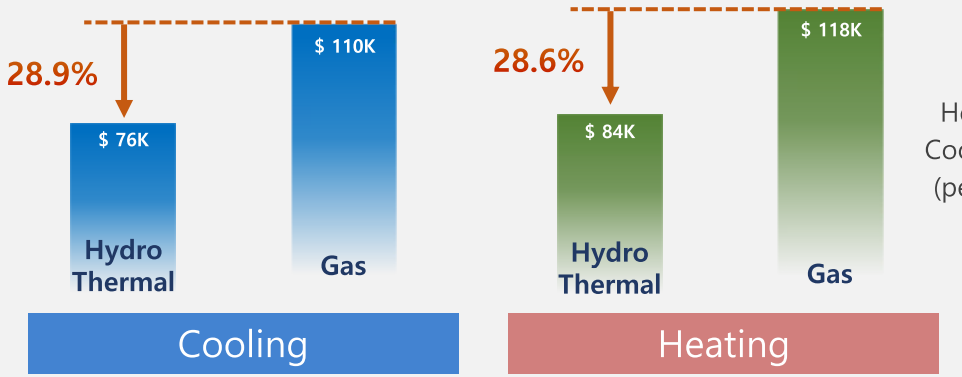




Heating and Cooling cost of Lotte World Tower has reduced about 30% utilizing hydrothermal energy

Water Source	Metropolitan treated water (50,000㎥/day)
Heating & Cooling load	3,000RT (10% of whole building load)
Construction period	March 2011 ~ October 2014 (Including test run)

* RT (Refrigeration ton) Freezing capacity required to make 1 ton of pure water at 0°C into ice for 24 hours



Heating & Cooling Cost (per 500RT)

08 Busan Eco-Delta Smart Village

The First residential complex of The National Pilot Project of the Smart City

A living lab where people meet the Future living and advanced technologies
That will be implemented in Busan Eco Delta Smart City.
An Experimental housing complex where residents can experience and give feedback on the implementing cutting-edge technologies.

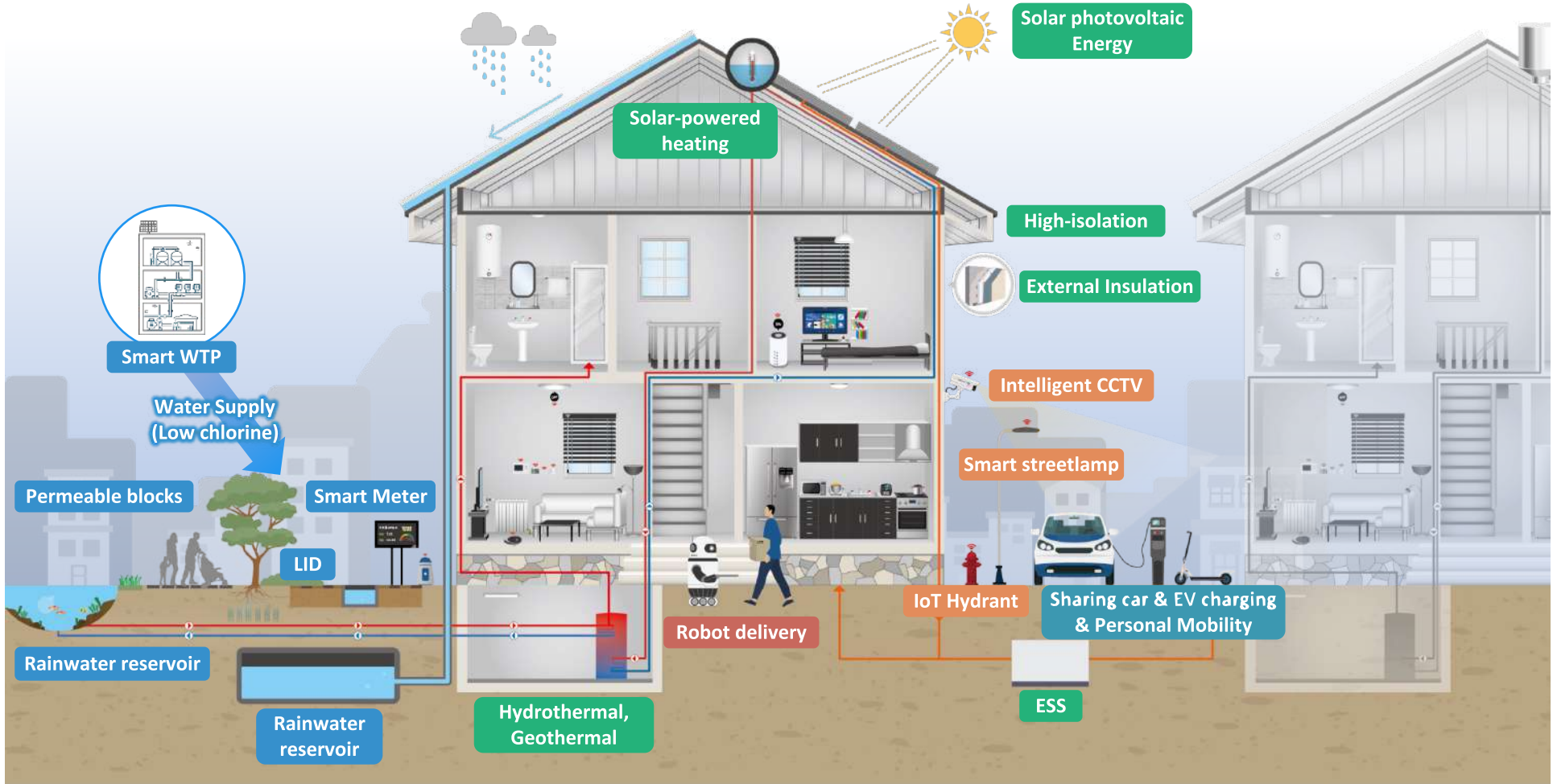

CITIES FOR TOMORROW

A city built on data takes shape

<New York Times Report>

Busan Eco-Delta Smart Village

As a detached house(56 households) to demonstrate the technology to be applied to the smart city, participant in smart village living lab moved in Smart Village by January, 2022.



Expected benefits

Reduce unnecessary water usage!

Underground wiring pipe

Install a water saver

Leakage Detection monitoring

Increase the available water usage!

LID Implementation

Rainwater Storage

Sewage reuse

The Critical Issues of Smart city

1. Personal Data Collection
2. Regulation in Innovation
3. Cost of City Management

IV-1. Personal Data Collection

Privacy Concerns Surrounding Smart Cities

Because of this constant data collection, people fear the loss of privacy

Privacy issues and ethics in the smart city

9th December 2021

Share

IV-1. Personal Data Collection

Privacy Concerns Surrounding Smart Cities

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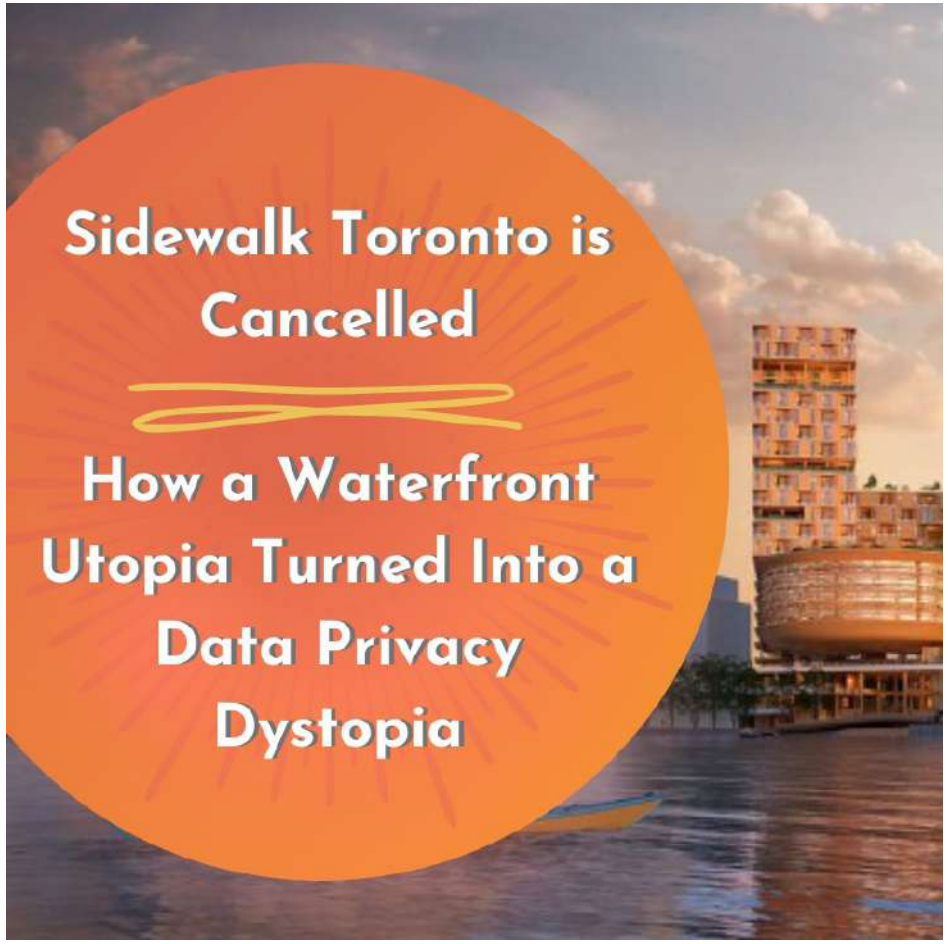
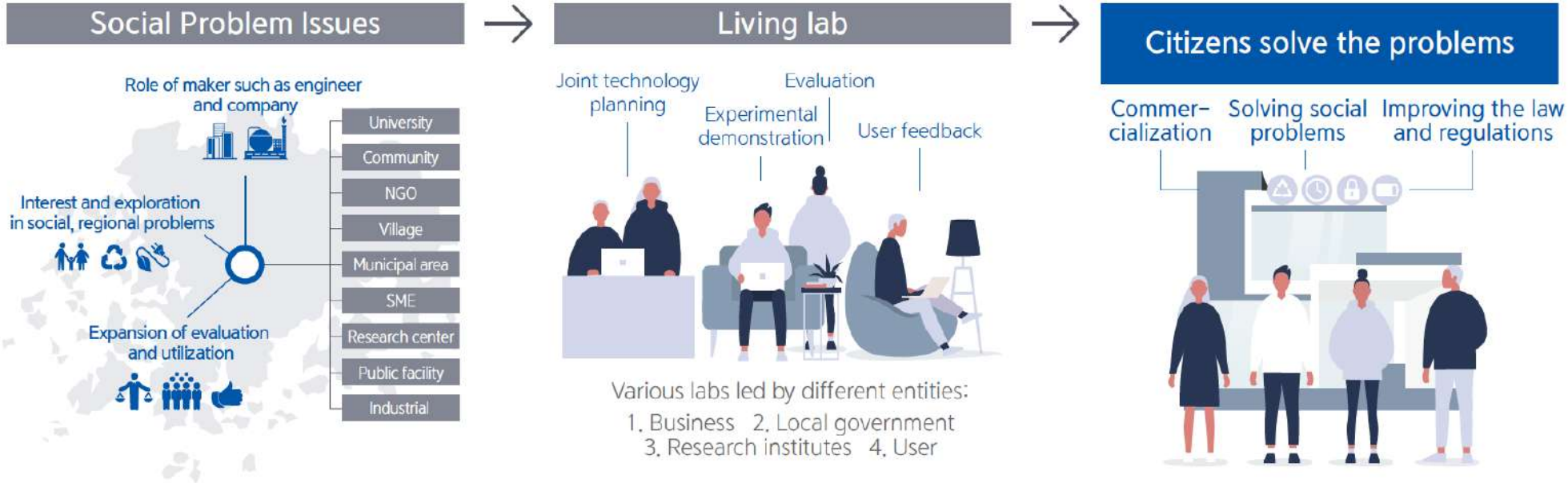


Ⅳ-1. Personal Data Collection

Living lab for Personal Data Collection

: Build up Smart Village(first Residents) for personal data collection



Ⅳ-1. Personal Data Collection

Test Bed : Busan Eco Delta Smart Village

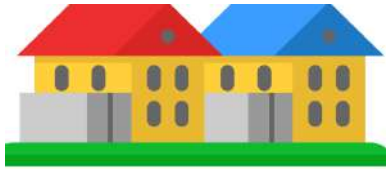
Residents in the 54 households in the smart village, which range from single-person units to three-bedroom homes, are living rent-free (they pay only for electricity and water) for five years

Ⅳ-1. Personal Data Collection

Busan Eco Delta Smart Village Data Platform

Testbed for personal data collection

Smart Village



Agreed data

Personal data
(Residents)

Open Data

Expand

IV-2. Regulation in Innovation

Regulatory sandbox

: Implementation of a regulatory sandbox in the smart city pilot zone
to allow active application and testing of innovations and new businesses

<table>
<tr><th>Status</th><th>For validation/testing (zone/period/scale limitations)</th><th>For commercialization (mild to no zone/scale related limitations)</th></tr>
<tr><td>When unclear</td><td colspan="2">①Quick access to legal news and status
· Applicable regulations and requirements for permits, etc.
· Application ➜ Minister of Land, Infrastructure and Transport ➜ 30-day reply from the relevant department</td></tr>
<tr><td>When there is no applicable law</td><td rowspan="2">②Special case regulations for validation
· Exemption to allow testing and validation for safety, etc. (for up to 2 years / can be extended once)
· Application ➜ Minister of Land, Infrastructure and Transport ➜ Determined by the deliberation committee (government and private members)</td><td>③Temporary permit
· Temporary permit for market release (for up to 2 years / can be extended once / considered extended until the revision is complete)
· Application ➜ Minister of Land, Infrastructure and Transport ➜ Determined by the deliberation committee (government and private members)</td></tr>
<tr><td>When the law restricts or prohibits</td><td>New legislation or revision is required</td></tr>
</table>

Ⅳ-3. Cost of City Management

Need to low-cost Innovations

Conflict between state and local government

Characteristics of Smart City

Smart City
as a platform for urban solutions
and growing innovations

Requires collective efforts of all parties involved in financing, knowledge, technology, etc.

Requires continuous upgrade and investment to adopt and utilize emerging innovations

Challenges for each party

Municipal government

- Burden of operational and maintenance costs while lacking expertise
- Limited budget: not enough for continuous innovations

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- Burden of massive early stage investment and operation costs (municipal government) limiting implementation of innovations and make them available for every citizen

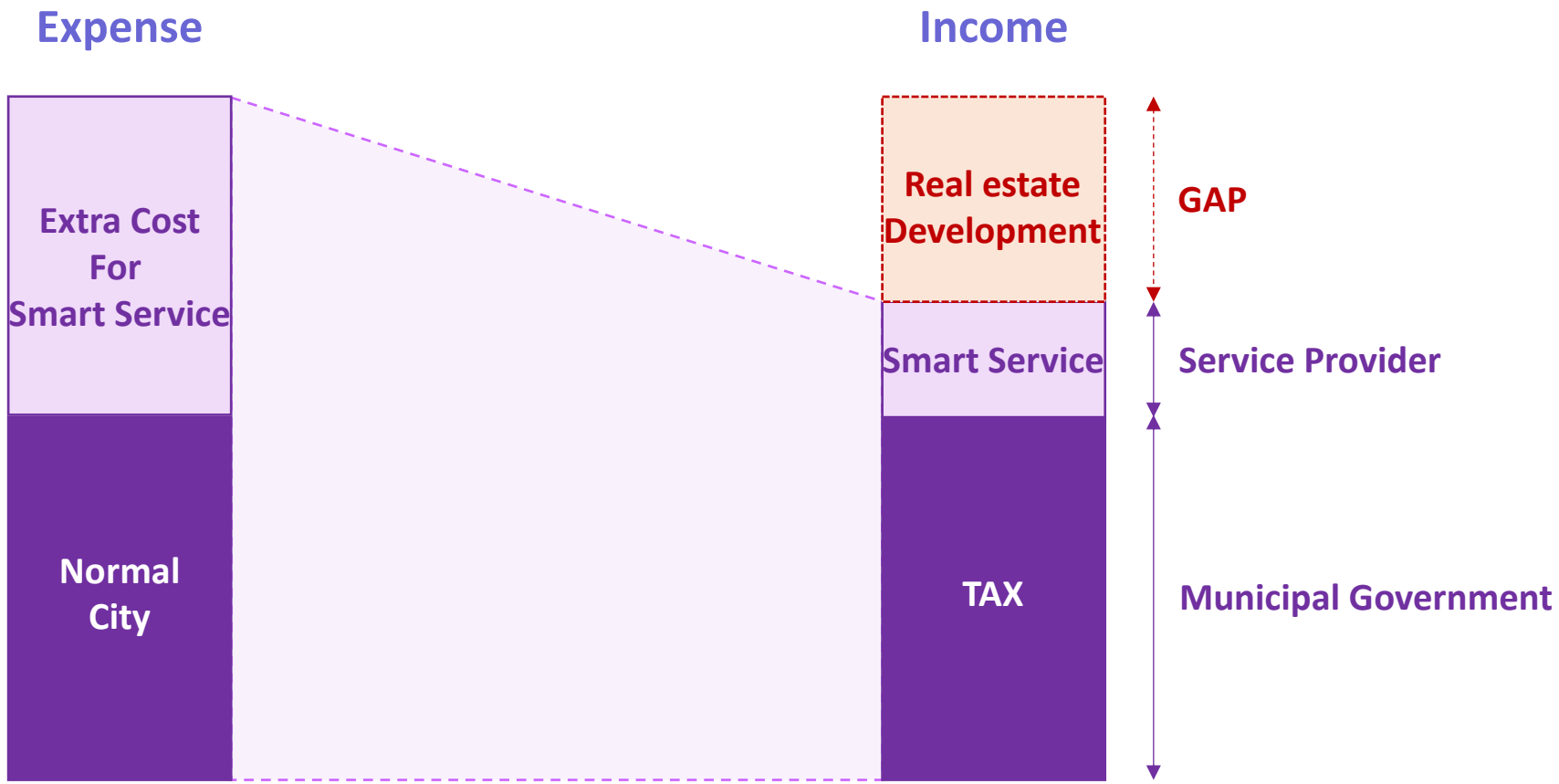
Private

- Lack of experience in applying specialized technologies, investing capital, operating facilities and providing services
- Tend to avoid committing big scale investment due to fear of sudden policy changes

IV-3. Cost of City Management

Need to low-cost Innovations

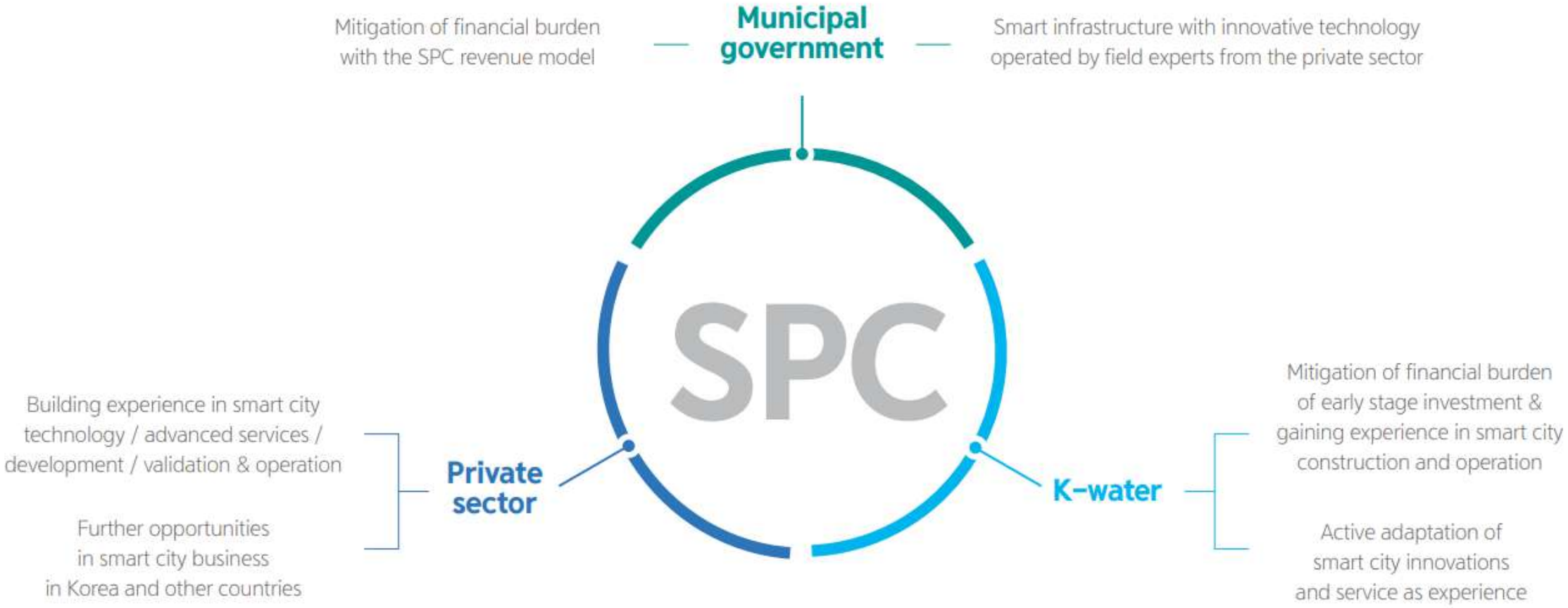
The gap between expense and income in smart city



Ⅳ-3. Cost of City Management

SPC

: For sustainable development, establishing SPC(Special Purpose Company)
ensures securing the necessary expertise for smart infrastructure operation



K water

100 Years of K-water's Future
Please applaud our Efforts.

THANK YOU