# Sustainable Water Management Based on Smart Water Management

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- Key Technologies
- Benefits and enablers
- Policy recommendation
- International collaboration- on going projects
- Challenges and opportunity in Indonesia
- Institutional arrangement for SWM implementation

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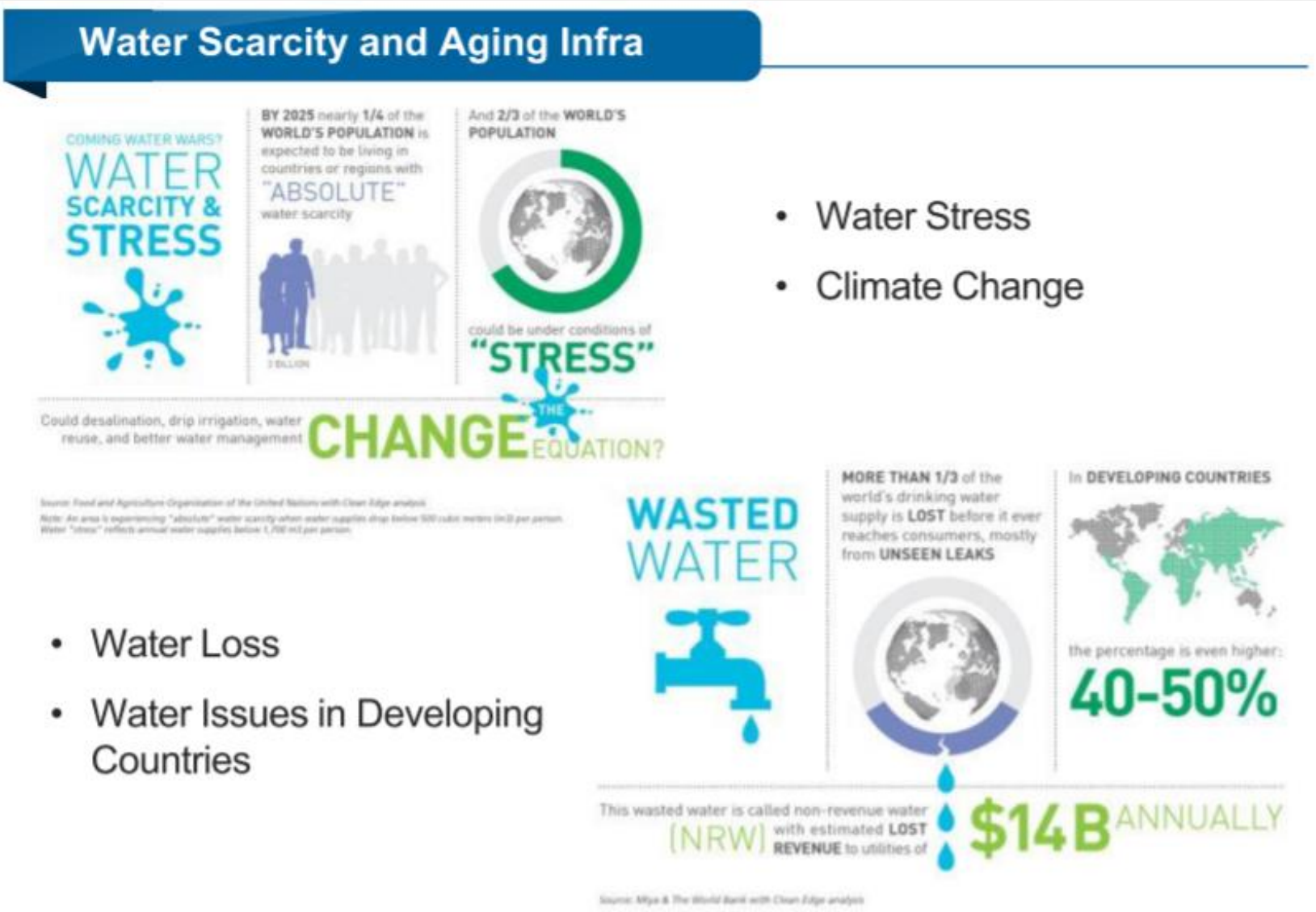
# Issues for Sustainable Water Management




- Water Stress
- Climate Change

- Water Loss
- Water Issues in Developing Countries

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# Background and Necessity


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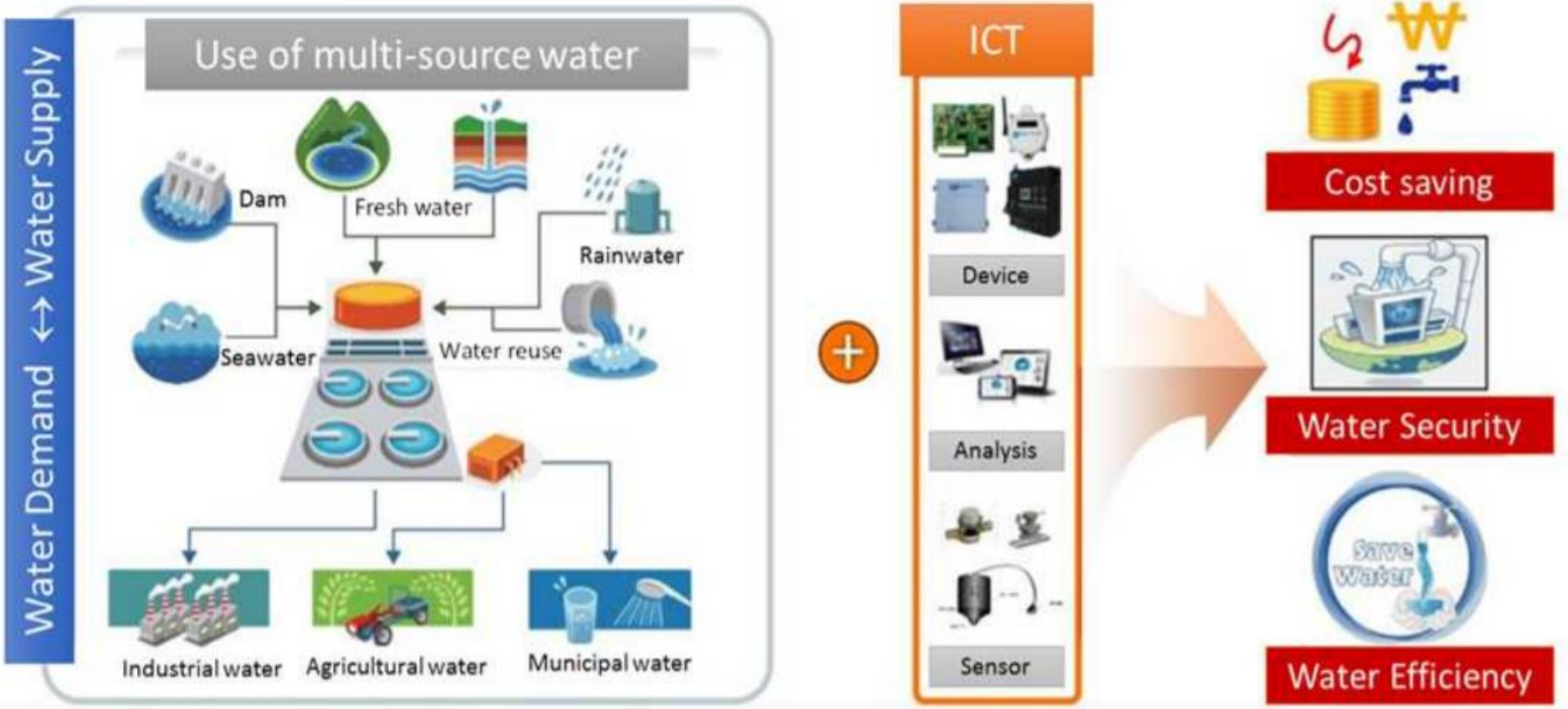
# Definition of Smart Water Grid

- "Smart Water Grid" is a new platform for intelligent and integrated water management. It allows high reliability, diversification of water sources for sustainability, save NRW & energy and real time monitoring.

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# Issues and SWG Solution Management

## Two Major Issues to Be Addressed

### Water Shortage

Use of multi-source water

- Fresh water
  - river, dam, lake, ground water, surface water
- Non-conventional water
  - seawater, brackish water, rainwater, and reclaimed water

### Non Revenue Water (NRW)

Advanced metering infrastructure for water(AMI)

- Automated, two-way communication between a smart water meter and a utility company


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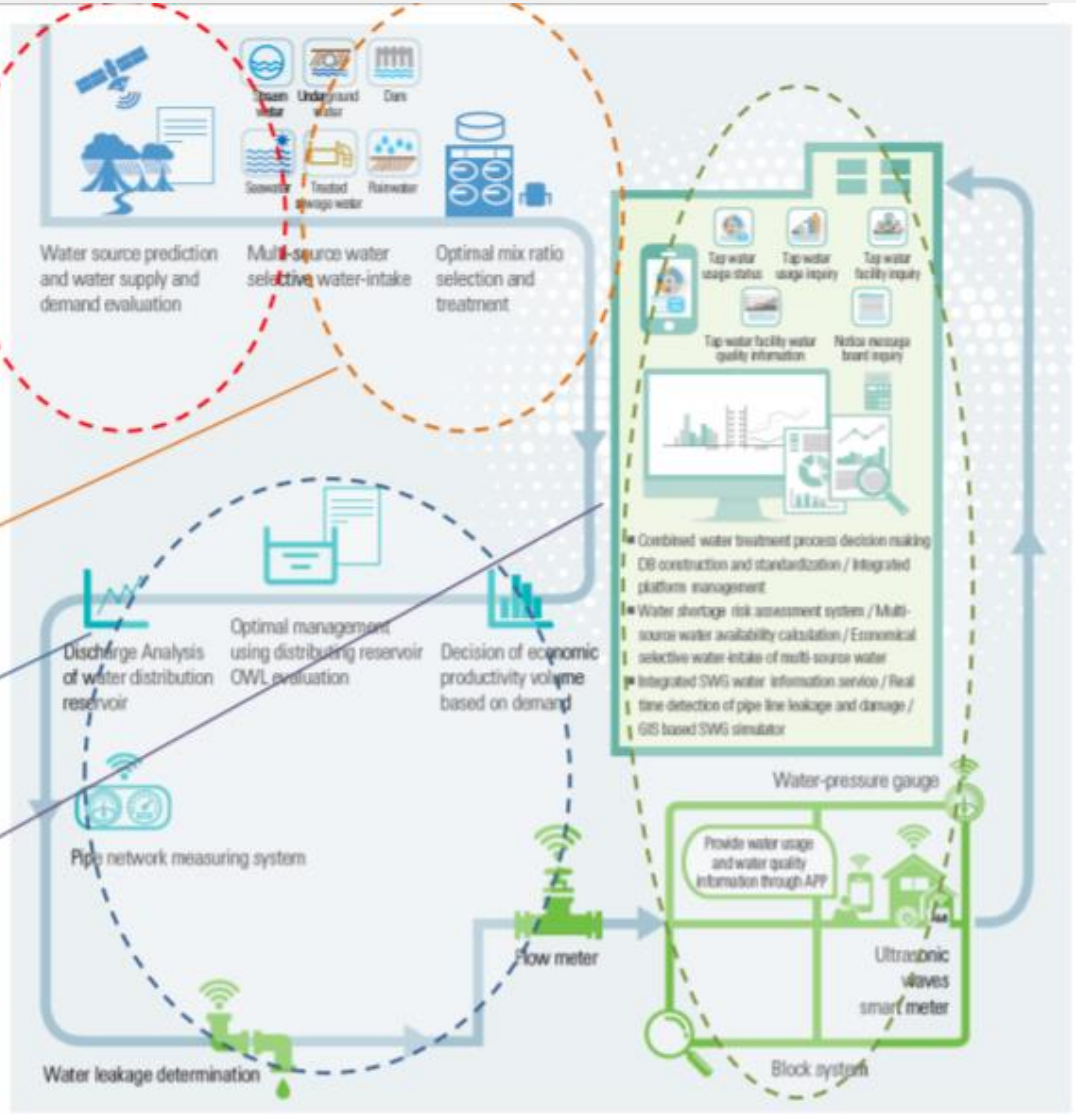
# Key Technologies SWG

## SWG Research Group: Key Technologies

- Water resource prediction and water shortage evaluation
- Multi-source water intake and treatment
- Smart water network management
- AMI based real time intelligent water supply and app based water information governance

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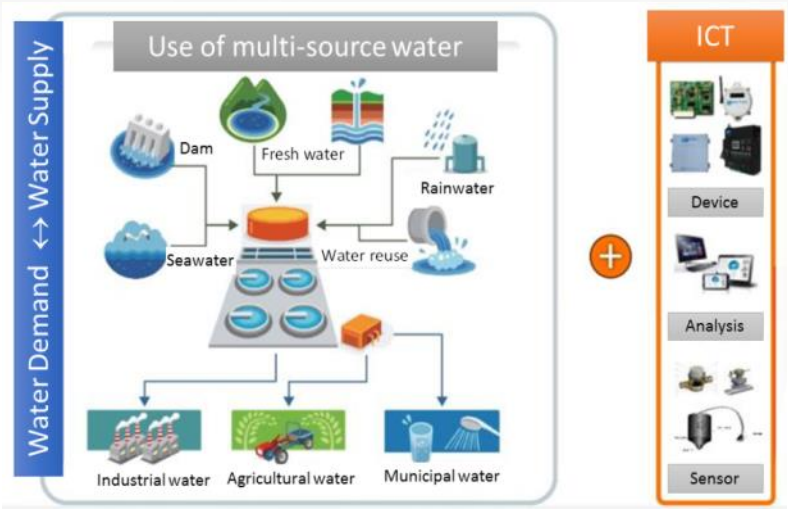
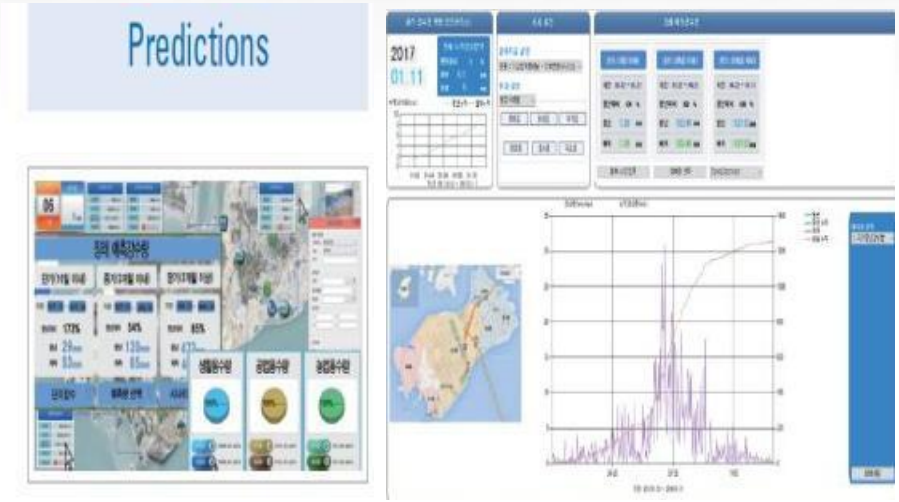
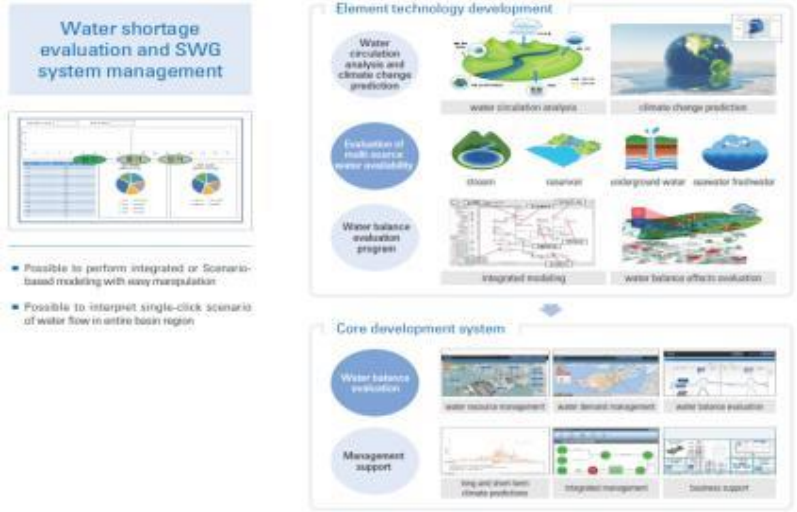
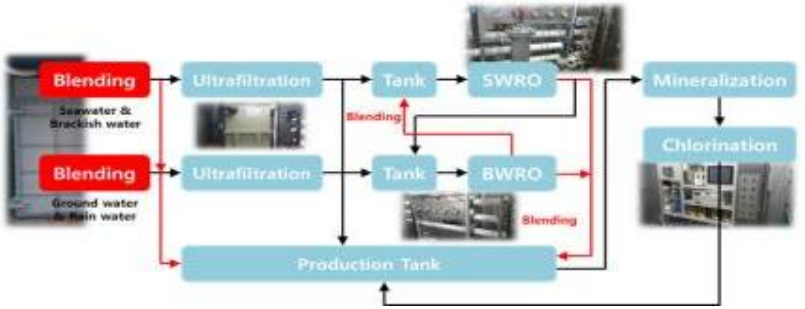
# Water resource prediction and water shortage evaluation

## In-depth Analysis of Water Demand and Water Resources




**Pre Blending** : Recovery rate improvement and treatment load decrease through high TDS, NTU reduction

**Inter-Blending** : SWRO inflow, TDS reduction and BWRO concentrated treatment

**Post Blending** : Mineral supply and economical securing of necessary quantity

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# Multi-resource water management and treatment


Hybrid water treatment technologies for multi-source water


Selective water intake program of multi-source water

Decision making support program for water treatment combination process

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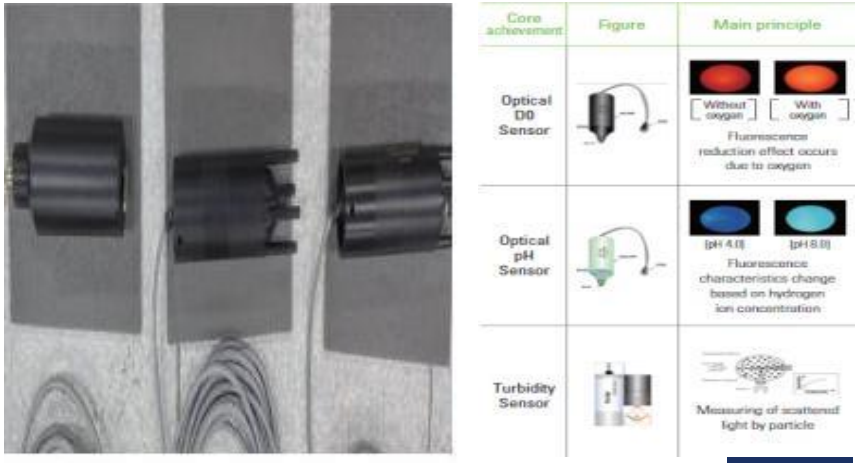
# Advanced Metering Infrastructure (AMI) for Real Time Intelligent Water Supply and Monitoring

## AMI network device with Certification conformance


## Smart Water Meter for multi-resource


## MSWG pipe network gauge / Leak detection sensor

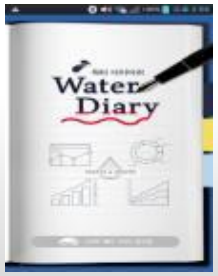

## Optical Sensor for Water Quality



# AMI based real time intelligent water supply and app based water information governance

## Smart phone apps for bidirectional and better customer services

**Water usage management**




**Statistics on water use**

**Real time Lookup**

<Water diary>

**Water-related contents**


**Water information**

**Alerts**

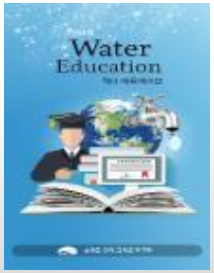
<Water community>

**Water quality information**

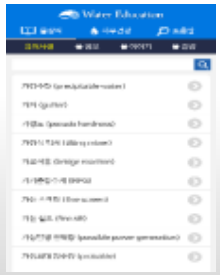

**Real time Lookup**

<Water care>

**Education on Water**

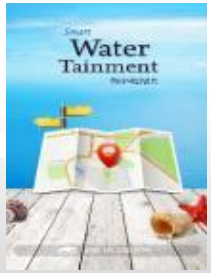



**Useful water information**



<Water education>

**Support on Recreation**




**Lookup on water quality**

<Water Tainment>

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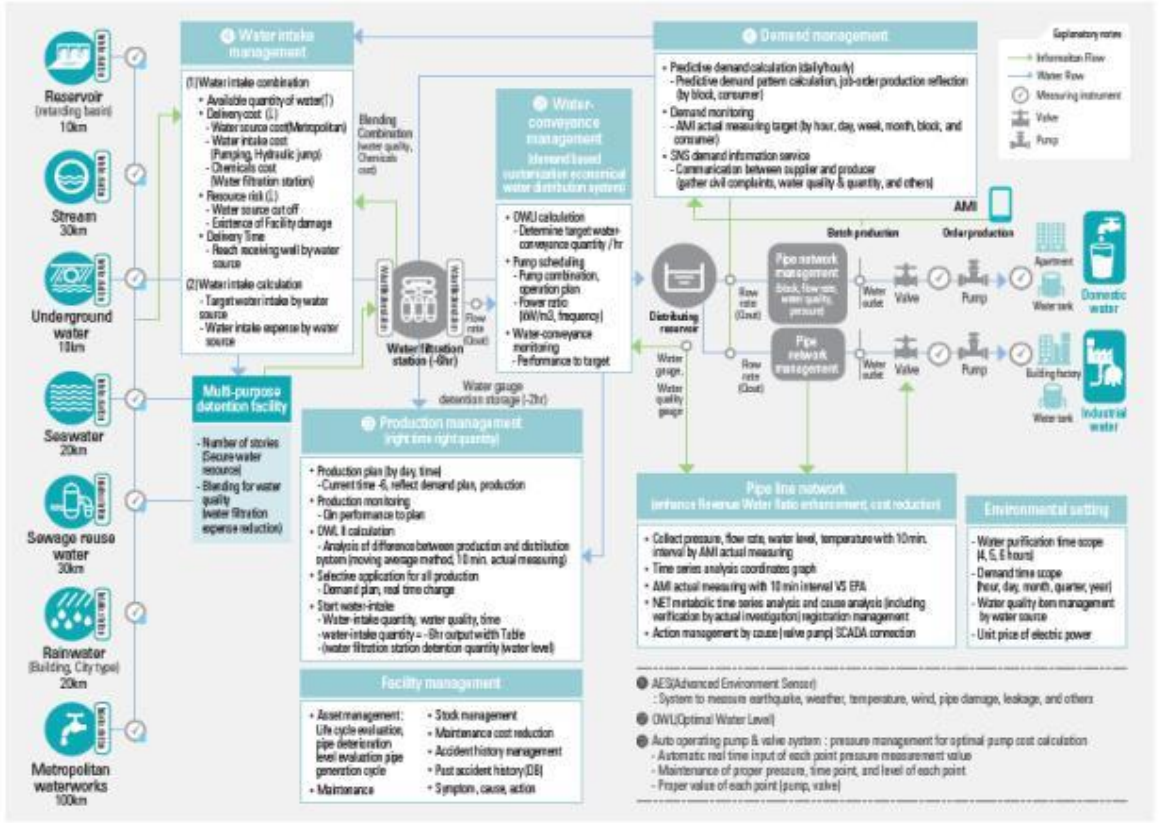
# Smart water network management

## Integrated and Intelligent Management of Water Supply




Smart Water Management System

Decision Supporting System


Integrated Database for Smart Water Management

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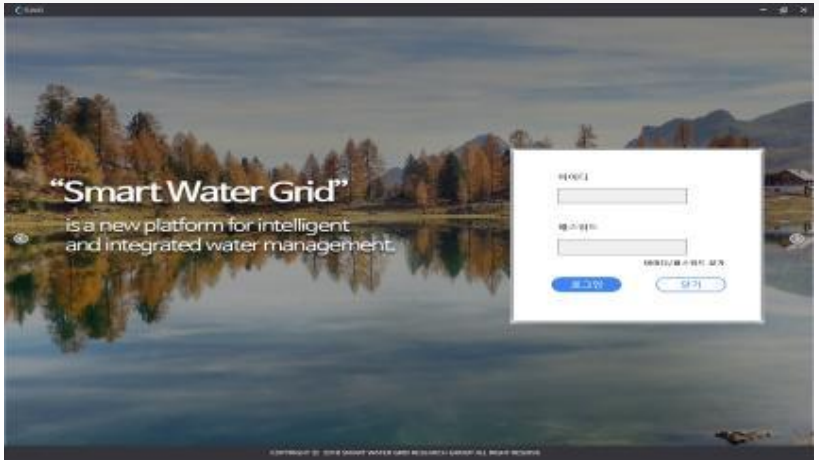
# Integrated water management system (1/2)

- **Operation Platform of Smart Water Grid**




Login screen

Smart water statistics information (SWT-STAT) Measurement instrument status DATA

Smart water statistics (SWT-STAT) supply - Flow meter (reservoir)

Smart Water Statistics Information (SWT-STAT) Usage - usage by usage

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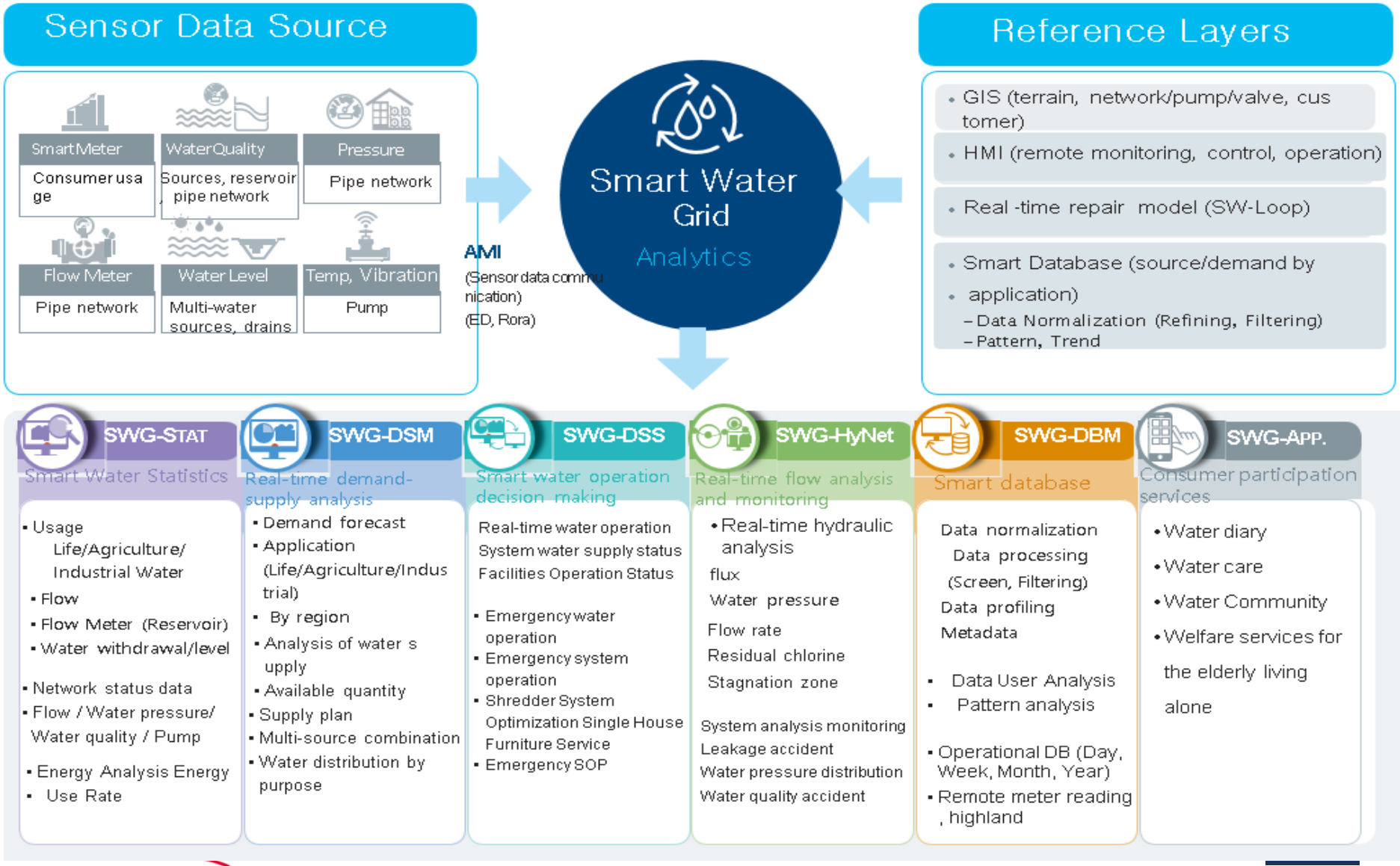
# Integrated water management system (2/2)

- **Integration of functions for integrated decision making**



# Summary

## Smart Water Grid : *Smart Solution for Smart Future*

- Many problems that **Asian countries** are currently facing with can be solved by applying SWG technologies.
- **NSWGRG** in Korea is willing to collaborate by sharing the experiences and solutions.
- Depending on the situations in different countries, **SWG technologies can be fully customized** to provide a cost-effective way to solve various water-related problems.


*** Source: Prof. S. Lee and Prof. KT Yum, 2018 Indonesia-Korea One-day Workshop on Smart Urban Water Works Management**

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# Benefits and Enablers of Smart Water Management: Focusing on SWM Case Study

## 2. What is Smart Water Management?

### Box 1. Definition of Smart Water Management

*Smart Water Management (SWM) is the use of Information and Communication Technology (ICT) to provide real-time, automated data for use in resolving water challenges through IWRM.*

SWM can be used for planning and operational purposes, from daily use to organisational and policy planning at a range of scales, across contexts and regions.

* Source: https://www.iwra.org/swmreport/

** Source: Dr. Jinsuhk Suh, 2019 SWG Int' l Conf., K-water Institute

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# Summary of the Case Studies

✓10 case studies, 29 countries, over 40 organizations

| Case study location | Project Name | SWM Solution |
|---|---|---|
| South Korea (national) | K-HIT | Flood and drought integrated network |
| Paju, South Korea | Paju Smart City | Water quality real-time monitoring for drinking water |
| Seosan, South Korea | Seosan Smart City | Smart sensors and real-time display increased leak detection and community satisfaction |
| Paris, France | SIAAP | Integrated network for improved real-time water quality in sanitation |
| China, Guantao County | Handan Pilot | Groundwater monitoring and modelling to reduce over abstraction |
| Mexico, Mexico City | PUMAGUA, UNAM | Smart sensors for drinking and wastewater quality and leak detection |
| Thailand, Tanzania, Kenya, Uganda, Rwanda, Burundi, Benin, Burkina Faso, Cote d'Ivoire, Ghana, Mali and Togo | Flood and Drought Monitoring Tools (FDMT) | Flood and drought monitoring and planning using satellite data |
| Zimbabwe, Mozambique, Tanzania | Small-scale agriculture productivity and efficient irrigation in Southern Africa | Efficient irrigation using real-time soil monitors and an Agricultural Innovation Platform (AIP) |
| Spain, The Netherlands, United Kingdom and France (SW4EU) | Smart Water for Europe (SW4EU) | Four demonstration sites addressing leak detection, water quality, community satisfaction and energy optimization using smart sensors and DMAs |
| Canada | Stormwater SmartGrid | Real-time rainwater collection and monitoring for household stormwater management |

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# Key barriers

**Factors limiting successful SWM implementation**

- Lack of initial support/investment
- Access to skills/capacity to use SWM solutions
- Access to infrastructure or resources (e.g. electricity)
- Evolving technology/upgrades (high costs)
- Lack of compatibility across SWM solutions
- Hesitation to replace traditional infrastructure
- Lack of policy incentives

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# Key enablers

**Factors for successful SWM implementation**

- **Political commitment at all levels**
- **Policy, legislation and regulation support**
- **Combining the use of SWM tools with other methods**
- **Strong stakeholder engagement from the beginning**
- **Multidisciplinary approach**
- **Long-term investment for ongoing R&D**
- **Capacity development, training and education**

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# Benefits of SWM implementation

## (Social Aspect)

- **Access to clean water and sanitation** through water treatment and monitoring
- **Health improvements** through increased access to clean, safe water
- **Improved livelihoods** through job creation, greater opportunity for further education, higher productivity and other opportunities
- **Increased training and capacity building** for the local community and staff
- **Increased sharing of solutions** to support sustainable development
- **Increased decision-making opportunities** through increased engagement and knowledge-sharing
- **Greater collaboration with community** through engaging with local stakeholders at the beginning of the project
- **Greater security** by improving water security and increased resilience to climate change
- **Increased trust** in water suppliers and the safety of water sources
- **Improved access to data and information** through real-time data sharing with all water users
- **Increased gender equality** through increased opportunities for capacity building and further education
- **Reduced conflict over water access** leading to increased trust and willingness to engage in collective action

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# Benefits of SWM implementation

## (Economic Aspect)

- **Increased efficiency** in irrigation systems and wastewater treatment systems
- **Reduced waste** by the reduction of water loss through leakages
- **Job and opportunity growth** through job creation through SWM project research, design, development and implementation
- **Improved capacity** in water systems improving their capacity to manage flows and reduce damage during storms/floods
- **Reduction in future infrastructure costs** by integrating smart technology tools to improve capacity/efficiency, resulting in less need for additional infrastructure
- **Mobilisation of funds** from public and private sources, as well as international funding sources

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# Benefits of SWM implementation

## (Environmental Aspect)

- **Improved water quality** through reduced pollution and contamination in waterways
- **Improved ecosystem health and protection** through improved water quality and quantity
- **Reduction in groundwater depletion** through reduced over abstraction
- **Reduced land degradation** through flood and drought management and reduced nutrient loss in the soil
- **Reductions in $CO^2$ emissions** through energy optimisation and reduced energy consumption
- **Reduced water consumption** through leak detection and reduced demand and increased reuse

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# Benefits of SWM implementation

## (Governance Aspect)

- **Improved management and knowledge**, as measurement is critical for effective management
- **Improved accuracy of data**, as real-time data should also be SMART (specific, measurable, actionable, relevant and time-bound) data
- **Increased community-led decision-making opportunities** as water users can make decisions based on real-time water use and information
- **Improved transparency** as water users have access to water use and quality in real-time

## (Technology Aspect)

- **The opportunity to test and develop** new and innovative tools for water management
- **Innovative technologies created** with the potential for commercialization
- **Identification of the remaining gaps** in technology adoption (e.g. standardisation of software and tools to make it easier to adopt the 'right' mix of tools for each situation
- **Showing the potential for SWM tools** to deliver successful outcomes and in turn lead to significant social, environmental, governance and financial impacts

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# Policy Recommendations

| Strategies | Policy direction |
|---|---|
| SWM for an improved quality of life (Society) | **1.** Facilitate adoption of SWM tools, especially in developing countries, to support access to basic services, and to support equality for poverty reduction, public health and quality of life. Include capacity development, technology sharing, collaborative business models and community governance and decision-making opportunities. |
| | **2.** Build trust and community engagement using SWM tools in areas where the community feel unsafe using the local water sources. |
| | **3.** Empower people in developing countries with smart tools to reduce the time spent on water management and increase farm income and time available for other activities (e.g. further schooling, and additional work opportunities). |
| Investment in SWM for improved resilience and sustainable development (Economy) | **4.** Strengthen collaboration across and within sectors to provide opportunities for networks to share information and data to assist with effective and efficient water management. |
| | **5.** Value non-financial benefits (e.g. environmental, social, governance and technical benefits) as equally important as financial benefits for SWM implementation, as they contribute to building resilience to the effects of climate change and increasing populations. |
| | **6.** Support long-term investments for SWM implementation to enable adequate research, development and testing. |

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# Policy Recommendations (Cont.)

| | |
|---|---|
| SWM for protecting and conserving water resources and ecosystems (Environment) | **7.** Introduce policies, regulations and incentives to drive environmental and ecosystem protection through use of SWM. |
| | **8.** Encourage SWM solutions to increase water quality, manage demand and use, water reuse, reducing groundwater depletion and increase energy efficiency, etc. |
| | **9.** Introduce SWM solutions for climate adaptation plans for flood and drought planning and management and major storm events. |
| Support evolving smart technology development and adoption (Technology) | **10.** Develop standards to ensure all SWM technologies are compatible (can communicate) with each other to enable tools to be purchased across various suppliers to enable those implementing SWM to create the right set of tools for each context. |
| | **11.** Support on-going research, testing and development of SWM tools to advance them to a point where they are robust and require minimum maintenance and are ready to be commercialized (Government policies that support taking SWM tools from R&D to market). |
| | **12.** Support technology to assist in regions without built infrastructure or the adequate resources (e.g. electricity), as currently SWM infrastructure is (almost always) reliant on built infrastructure |
| Building capacity and networks for increased resilience and collaboration (Governance) | **13.** Empower people, especially those in developing countries, by providing them with SWM tools, data and capacity development and education to enhance/ support local decision-making. |
| | **14.** Strengthen the capacity to adapt to climate change by adopting SWM planning and operational technology. |
| | **15.** Plan for water disasters in advance by creating proactive policies instead of reactive policies. |

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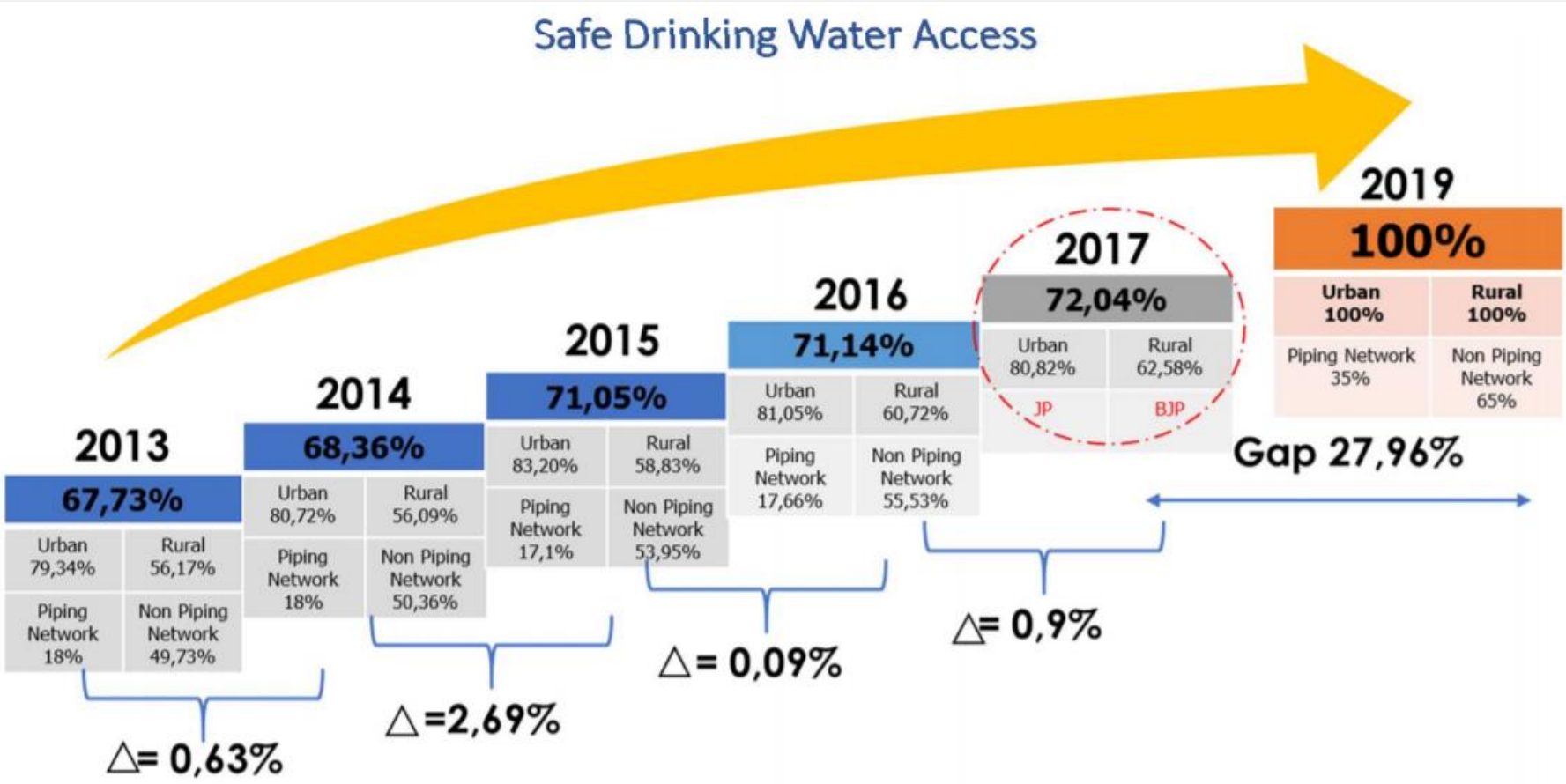
# National Target Toward Safe Drinking Water Access




Annual Average increase = ±1,07%

*Source: BPS Triwulan I, 2018*

# Challenges Toward SWM Application in Indonesia

**Lack of digitization/data,** heavy at the start to implements ICT on low performance PDAM.

**Indonesia's decentralised market** means that each local government is responsible for policy decision making and enforcement, needs understanding the regulatory framework that will affect how you do business in the Indonesian water market.

**Security Issues**, Several cybersecurity issues should be taken into account, particularly about consumer protection of personal data.

**Unequal internet access,** especially outside of Java Island.

**Manpower and Institutional Constraint,** classical issues where the placement of employees does not match their expertise. NRW (non-physical).

**Regulations** are always behind technological advancement. It should be designed in such a way that it will not hamper creativity and innovation in tackling societal challenges.

* **Source: Directorate of Water Supply Development, DGHS, MPWH, 2019**

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# Opportunity Toward SWM Application in Indonesia

**Technological advancement.** Technological advancements have helped businesses save time and cost of production, they manage these advancements to gain competitive advantage. Right now, we can easily find a high-quality smartphone, sensors (IoT devices) with an affordable price. As a result, ICT things is not a luxury good anymore.

**Increase coverage of a mobile network**. There is a fierce competition among operators to become the best in the country through massive infrastructure deployment. As a result, more and more people now have an access to the internet.

**Good level of awareness.** Most PDAMs interesting about the idea about optimization using ICT things. The level of implementation of ICT things is various, depends on size of PDAM.

**Social media and instant messaging as "killer apps"**. The introduction of Whatsapp, Facebook and Twitter in Indonesia played a key role in boosting data penetration in the country. Its creates new habits.

**Players in this industry are still few** in Indonesia, especially in water supply sector.

**Vendors,** can be easily found through the marketplace.

* **Source: Directorate of Water Supply Development, DGHS, MPWH, 2019**

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# Institutional Arrangement for Implementation

**Cipta Karya**
- Master plan of SWM in national level
- National Standard for SWM implementation
- Financial arrangement

**Balai**
-Master plan of SWM in local level
-Pilot Demonstration Project

**PDAM**
- Implementation of SWM
- Capacity building
- Operation and Monitoring

**Development Partners**
-ADB, EDCF etc.
-K-water
-Smart Water Grid Research Group
-Private sectors

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# International Cooperation: On-going Project

## Vietnam – Hai Duong

Status of Vietnam

**Hải Dương**

Overview
- Administrative unit : Province
- Location : Near Hanoi (51km)
- Province name : Hai Duong
- Area : 1,664km²
- Population : 1,670,800

- Has rich water resources but 40% of underground water contains arsenic
- Surface (stream) water shows frequent variability of seasonal turbidity
- High level of nitrate nitrogen in element due to domestic sewage inflow
- Infrastructure investment for public drinking water estimated at 400 million dollars by 2018; Investment for waste water treatment to rise to 350 million USD (GWI, 2014)


Visited NAWAPI organization


Concluded MOU with waterworks company in Hai Duong


Toured Hai Duong purification plant


Interviewed deputy governor of Hai Duong

**Project procedure**

| | |
|---|---|
| Oct. 27, 2015 | MOU concluded between NAWAPI and SWG research group |
| Jan. 4~8, 2016 | Discuss SWG demonstration with governor of newly designated province of Hung Yen |
| Jan. 28, 2016 | Publication of first joint research report |
| | (Study on application of Korea SWG technology to ASEAN country by K-water economic policy think tank, NAWAPI) |
| April 2016 | Joint research agreement on business model development for entering Vietnamese market |
| July 2016 | Specific agreement on phased application of SWG technology and system |
| August 2016 | Midterm examination announcement of joint research results (4th SWGC invitation) |
| Oct. 2016 | VACI, SWG keynote address at Vietnam government hosted International Water Conference |
| Dec. 12~16, 2016 | Concluded MOU on demo application of SWG technology after each expert including managing director visited site (SWG research group and waterworks company in Hai Duong province) |
| Dec. 29, 2016 | Received SWG, IWRM letter of business intent from NAWAPI |


**Project results**

- Vietnam urgently needs an efficient and scientific system for smart water management in line with the country's spectacular economic development. Accordingly, cooperation is required at the government level.
- Promotion of the project is carried out as a phased joint research venture by examining Vietnam's LOI along with the SWG research project.

**2017**

**Pilot Testing**
- 1~5 m³/day
- Simple feasibility study
- Biz Model for SWG Application

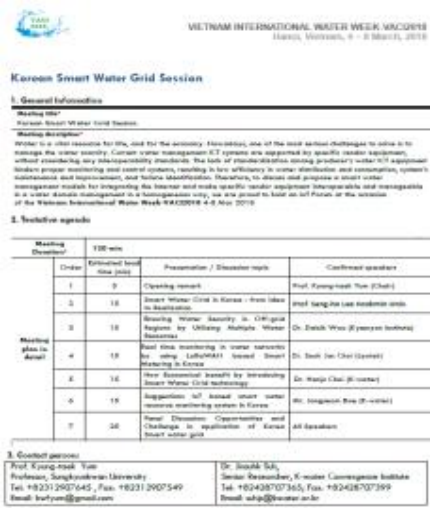
**2018**

**Demonstration**
- > 500 m3/day (T.B.D.)
- Water for more than 1000 people
- Detailed design for full-scale project
- Establishment of MP for Hung Yen Province

**2019~2020**

**Full-scale Project**
- > 10,000 m3/day (T.B.D.)
- Full-scale water supply and management system

### VACI - 2018


VIETNAM INTERNATIONAL WATER WEEK VACI2018

Korean Smart Water Grid Session

1. General Information

2. Tentative agenda

3. Contact person(s)

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# International Cooperation : On-going Project

## Jordan – Karak (FS) and Northern Governorates (MP)

### Jordan

- Absolute shortage of water resources (water supply limited to 32 hours per week)
- Difficulty securing water source autonomy (Israel, Syria)
- Aging water facilities, dependent on foreign aid
- Water problems worsened due to inflow of about 2 million Syrian refugees

➡ Urgent need for SWG technology

**Overview**

- Daily water supply per person : 154L
- Main water source : Yarmuk & Jordan rivers
- Leak ratio : 40–60%
- World No. 2 in water scarcity
- Population : estimated 7 million (no. of refugee on sharp rise)

Jordan's Water Authority Minister hosted conference

Jordan Amman purification plant

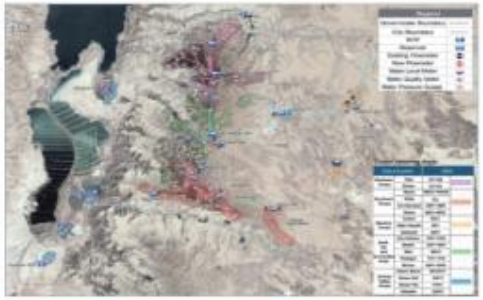
### Project procedure

| | |
|---|---|
| May 2015 | Gave education on SWG technology to Jordan public servants (KOICA education project) |
| June 2015 | Discussed SWG technology exports with KOTRA Amman trade authority (building) |
| Aug. 2015 – Jan. 2016 | Prepared report on expansion of Jordan's water treatment market |
| April 2016 | Dispatched SWG inspection team and cooperated with relevant organizations |
| May 2016 | Conducted feasibility study on overseas market expansion |
| June 2016 | Concluded LOI with Water Authority of Jordan |
| June 2016 | Overseas construction association presented & evaluated feasibility study (selected) |
| Aug. – Dec. 2016 | Did feasibility study on construction of Smart Water Grid for Jordan's Karak province<br>– July 30–Oct. 15, 2016 : Conducted 1st & 2nd field study<br>– Nov.28–Dec. 26, 2016 : 3rd field study & final reporting session |

### Project results

**Construction planning for Smart Water Grid**

- Devise facility planning considering efficiency-enhancing measures when applying Smart Water Grid, and by figuring out water supply system of Karak region and status of management of water sewage operations
- Establish system application and operation plan by classifying project area as 40 small blocks
- Formulate real-time management and suitable plan for water capacity distribution for water and sewage facilities via management of integrated operations
- Set up plans for wastewater and energy reduction through maintenance project after construction of Smart Water Grid completed



| ITEM | FLOW METER | PRESSURE GAUGE | RESERVOIR |
|---|---|---|---|
| QAIR | 4 | 8 | 1 |
| SHIHAN | 3 | 11 | 2 |
| MAZAR | 5 | 22 | 2 |
| TIABA | - | 1 | 1 |
| UM HAMMAD | 3 | 12 | 1 |
| MOHAY | 1 | 2 | 2 |
| SULTANI | - | 2 | 1 |
| WADI ARWADH | 1 | 2 | 1 |
| QTRANEH | 1 | 2 | 2 |
| ABU HMOUR | 1 | 6 | 1 |
| GHWEIR | 1 | 3 | 1 |
| MARI | 1 | 1 | - |
| THALLAYEH | 4 | 11 | 1 |
| MU'ATA | 4 | 14 | 2 |
| GHWAIR NAZARA | 2 | 2 | 1 |
| GHWAIR SAFI | 1 | 2 | 1 |
| GHWAIR FIFA | 1 | 3 | 1 |
| GWEIBEH | 1 | 1 | 1 |

### Northern Jordan SWG Master Plan Establish Business


**Business Overview**

- Project Name : Establishment of a master plan for building a Smart Water Grid in northern Jordan
- Territory : North Jordan Water Related Areas
- Business scale : About 1 billion won

**Purpose of business**

- Reduce wastage and energy consumption due to inefficiency of facilities and operational management
- Measures to increase water demand due to urbanization and inflow of refugees and facility planning
- Scarce water resources and multi-source water supply plan

**Business Information**

- Survey of current situation and analysis of national policy
- Establishment of a master plan for building Smart Water Grid
- Finding cooperative projects with master plan
- First, to form a cooperation project and propose an investment plan
- Establish technology diffusion plan

**Conduct Business**

- Participated in ISAN & SWG research group

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# International Cooperation : On-going Project

## K-water – ADB – Local Gov. partnership for SWM in South Asia


**Title** ····· Promoting Smart Drinking Water Management in South Asia Cities

**Duration** ····· 2016~2020

| Completed(3) | Planning(4) |
|---|---|
| Dhaka, Colombo, Chennai | Khulna, Male, Thimphu, Kolkata |

**Budget** ····· 2.7 million USD

* ADB 1.5 million, e-asia fund 1 million, K-water 0.2 million(in-kind)

**Partnership**

| K-water | Local operator | ADB |
|---|---|---|
| • Technical diagnosis/ local training<br>• Establishing SWM Pilot<br>• Planning for operational efficiency | • Local information<br>• Support K-water & ADB<br>• Implementation of T.A. output | • T.A. Financing<br>• Utility backup for<br>- financial sustainability<br>- private participation |

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4. Smart Water Management Case Study Report: https://www.iwra.org/swmreport/


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# *Terima kasih*

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