Smart Water City Project
Global Joint Research Project (2020)
### Project Timeline

#### Stage 1
- **Period**: 2021.01~2021.12
- **Goal**: Analysis of global standards frameworks and certification schemes

#### Stage 2
- **Period**: 2022.01~2022.12
- **Goal**: Build up KPI’s of Smart water city and Certification protocols

#### Stage 3
- **Period**: 2023.01~2023.12
- **Goal**: Pilot testing Certification Scheme
1. Definition of Smart Water City

"A Smart Water City is a sustainable city with contactless, intelligent water management for all"

Smart Water City improves the quality of life of citizens by solving existing urban water problems based on various technologies and ICT technologies throughout the urban water cycle. It includes not only individual solutions for conventional water management such as drainage, water treatment, and wastewater treatment, but also it improves comprehensive water management through restoration of urban water cycle, waterfront usage, and intelligent water management.
Smart Water Cities Around World

- New York City (USA)
- Ciudad Juarez (Mexico)
- Heredia (Costa Rica)
- Algarrobo (Spain)
- Ningbo (China)
- Busan Eco Delta city (Republic of Korea)
- Hong Kong (China)
- Mumbai (India)
- Nakuru (Kenya)
<table>
<thead>
<tr>
<th>CITY</th>
<th>Country</th>
<th>Region</th>
<th>Type of city</th>
<th>Population</th>
<th>New or existing urban development</th>
<th>Economic development</th>
<th>Type of challenge addressed</th>
</tr>
</thead>
<tbody>
<tr>
<td>Algarrobo</td>
<td>Spain</td>
<td>Europe</td>
<td>Urban settlement</td>
<td>Existing</td>
<td></td>
<td>High-income economy</td>
<td>Water scarcity</td>
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<tr>
<td>Busan</td>
<td>Republic of Korea</td>
<td>Asia &amp; the Pacific</td>
<td>Medium size city</td>
<td>NEW</td>
<td></td>
<td>High-income economy</td>
<td>Inadequate urban water planning</td>
</tr>
<tr>
<td>Ciudad Juarez</td>
<td>Mexico</td>
<td>North America</td>
<td>Medium size</td>
<td>Existing</td>
<td></td>
<td>Upper middle income</td>
<td>Aging or insufficient infrastructure</td>
</tr>
<tr>
<td>Heredia</td>
<td>Costa Rica</td>
<td>Latin America &amp; the Caribbean</td>
<td>Urban settlement</td>
<td>Existing</td>
<td></td>
<td>Upper middle income</td>
<td>Deficient water quality</td>
</tr>
<tr>
<td>Hong Kong</td>
<td>Hong-Kong</td>
<td>Asia &amp; the Pacific</td>
<td>Large city</td>
<td>Existing</td>
<td></td>
<td>High-income economy</td>
<td>Inadequate urban water planning</td>
</tr>
<tr>
<td>Mumbai</td>
<td>India</td>
<td>Asia &amp; the Pacific</td>
<td>Megacity</td>
<td>Existing</td>
<td></td>
<td>Lower middle income</td>
<td>Aging or insufficient infrastructure</td>
</tr>
<tr>
<td>Nakuru</td>
<td>Kenya</td>
<td>Africa</td>
<td>Small city</td>
<td>Existing</td>
<td></td>
<td>Lower middle income</td>
<td>Water scarcity</td>
</tr>
<tr>
<td>New York</td>
<td>USA</td>
<td>North America</td>
<td>Large city</td>
<td>Existing</td>
<td></td>
<td>High-income economy</td>
<td>Flood risks</td>
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<td>Ningbo</td>
<td>China</td>
<td>Asia &amp; the Pacific</td>
<td>Large city</td>
<td>Existing</td>
<td></td>
<td>Upper middle income</td>
<td>Flood risks</td>
</tr>
</tbody>
</table>
Analysis of Global standards, indicators and Certification schemes
What elements for comparison?

- Standard topic
- Standard categories
- Standard indicators
- Standard metrics
1. UNITED 4 SMART SUSTAINABLE CITIES

- **Economy**
  - ICT
    - Water and Sanitation
    - Drainage
  - Productivity
  - Infrastructure
    - Water and Sanitation

- **Environment**
  - Water and Sanitation
  - Energy

- **Social and Culture**
  - Education Health and Culture
  - Safety, Housing and Social Inclusion
## 2. ISO SUSTAINABLE CITIES AND COMMUNITIES SERIES

![ISO Logo](image)

### Table of Standards Indicators

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>ISO 37120</th>
<th>ISO 37122</th>
<th>ISO 37123</th>
</tr>
</thead>
<tbody>
<tr>
<td>Waste water</td>
<td>Percentage of city population served by wastewater collection (core)</td>
<td>Percentage of treated wastewater being reused</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percentage of city’s wastewater receiving centralized treatment (core)</td>
<td>Percentage of biosolids that are reused (dry matter mass)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Percentage of population with access to improved sanitation (core)</td>
<td>Energy derived from wastewater as a percentage of total energy consumption of the city</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compliance rate of wastewater treatment (supporting)</td>
<td>Percentage of total amount of wastewater in the city that is used to generate energy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Percentage of the wastewater pipeline network monitored by a real-time data-tracking sensor system</td>
<td></td>
</tr>
<tr>
<td>Water</td>
<td>Percentage of city population with potable water supply service (core)</td>
<td>Percentage of drinking water tracked by real-time, water quality monitoring station</td>
<td>Number of different sources providing at least 5% of total water supply capacity</td>
</tr>
<tr>
<td></td>
<td>Percentage of city population with sustainable access to an improved water source (core)</td>
<td>Number of real-time environmental water quality monitoring stations per 100,000 population</td>
<td>Percentage of city population that can be supplied with drinking water by alternative methods for 72 hours</td>
</tr>
<tr>
<td></td>
<td>Total domestic water consumption per capita (litres/day) (core)</td>
<td>Percentage of the city’s water distribution network monitored by a smart water system</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Compliance rate of drinking water quality (core indicator)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total water consumption per capita (litres/day) (supporting)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average annual hours of water service interruption</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
3. OECD SMART CITY MEASUREMENT FRAMEWORK

- Well-being
- Inclusion
- Resilience
- Sustainability

**Governments**

**3rd PILLAR: Smart city performance**

- Energy, Water and waste
- Connectivity
- Mobility
- Jobs and firms
- Housing and built environment

**1st PILLAR: Stakeholder engagement**

- E-government
- Education and skills
- Health and safety

**2nd PILLAR: Smart city tools**

- City residents
- Private sector
## 4. CITYKEYS SMART CITIES INDEX

<table>
<thead>
<tr>
<th>People</th>
<th>Planet</th>
<th>Prosperity</th>
<th>Governance</th>
<th>Propagation</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Health</td>
<td>- Energy &amp; mitigation</td>
<td>- Employment</td>
<td>- Organisation</td>
<td>- Scalability</td>
</tr>
<tr>
<td>- Safety</td>
<td>- Materials, water and land</td>
<td>- Equity</td>
<td>- Community involvement</td>
<td>- Replicability</td>
</tr>
<tr>
<td>- Access to (other) service</td>
<td>- Climate resilience</td>
<td>- Green economy</td>
<td>- Muti-level governance</td>
<td></td>
</tr>
<tr>
<td>- Education</td>
<td>- Pollution &amp; waste</td>
<td>- Economic performance</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Diversity &amp; social cohesion</td>
<td>- Ecosystem</td>
<td>- Innovation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Quality of housing and the built environment</td>
<td></td>
<td>- Attractiveness &amp; competitiveness</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
5. LEED FOR CITIES AND COMMUNITIES

- INTEGRATIVE PROCESS (IP)
- MATERIALS AND RESOURCES (MR)
- NATURAL SYSTEMS AND ECOLOGY (NS)
- QUALITY OF LIFE (QL)
- TRANSPORTATION AND LAND USE (TR)
- INNOVATION (IN)
- WATER EFFICIENCY (WE)
- REGIONAL PRIORITY (RP)
- ENERGY AND GREENHOUSE GAS EMISSIONS (EN)
6. ARCADIS SUSTAINABLE CITIES WATER INDEX

**Water stress**
- Green space
- Water-related disaster risk
- Flood risk
- Water balance
- Reserve water

**Sanitation**
- Drinking water
- Treated wastewater
- Water-related disease
- Threatened freshwater amphibian species
- Raw water pollution
- Drinking water

**Resilience**

**Quality**

**Efficiency**

**Leakage**
- Water charges
- Metered water
- Reused wastewater
- Service continuity
- Sanitation
- Drinking water
7. CITY BLUEPRINT APPROACH

City Blueprint Approach (CBA)

<table>
<thead>
<tr>
<th>Framework</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trends and Pressures Framework (TPF)</td>
<td>What are the city’s main challenges?</td>
</tr>
<tr>
<td>City Blueprint Performance Framework (CBF)</td>
<td>How adequate is water management in the city?</td>
</tr>
<tr>
<td>Governance Capacity Framework (GCF)</td>
<td>Where can the city’s water governance be improved?</td>
</tr>
</tbody>
</table>
8. INTERNATIONAL WATER STEWARDSHIP STANDARD

The AWS Standard Framework is built around five steps:

1. Gather and Understand
2. Commit and Plan
3. Implement
4. Evaluate
5. Communicate and Disclose

Each step consists of a number of criteria to be addressed, each criterion having one or more indicators for compliance. There are ‘core’ indicators, representing the minimum requirement, and ‘advanced’ indicators, to achieve higher levels of water stewardship status and to promote continual improvement. The steps are not required to be followed in strict order and although generally the steps are order-dependent, actions associated with specific criteria and indicators may occur in parallel.

Implementation of the Standard is intended to achieve five main outcomes for the site and its defined physical scope:

- Good Water Governance
- Sustainable Water Balance
- Good Water Quality Status
- Important Water-Related Areas
- Safe Water, Sanitation and Hygiene for All (WASH)

Each criterion in the Standard has the associated symbol or symbols representing the outcome to which fulfilment of the criterion will contribute.
What have we learnt? (I)

On Smart Water Cities:

- Cities are places with singular economic, social, and environmental dynamics that deserve special consideration

- Beyond conventional water management → Urban water cycle

- Smart water cities are sustainable: technologically effective, environmentally sustainable, economically feasible, and socially equitable

- Smart cities is not only about ICTs: Good governance of urban water resources is necessary for smart water cities

- No one size fits all: Smart city solutions need to be tailored to local circumstances.
What have we learnt? (II)

On Standards to measure smart sustainable cities

- Paradox: Water is a key element for cities, but there is a lack of instruments to measure and benchmark smart water cities
  - Global standards: water is one amongst many
  - Focus is on service provision, not urban water cycles
  - Few “smart” indicators
Next Step
Next Step (SWC Certificate framework)
Thanks!