Smart Water Management: Its application and case

May 30th, 2017

Ryu, Mun Hyun
Water Economy Team, K-water
Water & Energy: Indispensable Resources for Human Beings

Water and energy are essential to our daily life in many ways. Accordingly, fundamental infrastructures such as water and power distribution networks are crucial. Without them, there will be no civilization.

Source: J. Kim (2011)
5.3 billion
The number of people - two-thirds of the world's population - who will suffer from water shortages by 2025.

1.1 billion
The number of people worldwide - 1 in every 6 - without access to clean water
Introducing a new paradigm of water management combining advanced technologies such as ICT.
Water and Energy Issues: How to Solve?

The world will need 55 percent more water and 70 percent more energy by 2050 to meet the demands of its growing population. To solve the energy crisis, the concept for “Smart Grid” has been developed. But what about water crisis?
Smart : Main Keyword in the 21th century

- Smart Cities
- Smart Technology
- Smart Infrastructure
- Smart Energy
- Smart Mobility
- Smart Buildings
- Smart Windows
- Smart Clouds
- Smart Materials
- Smart Bandages
- Smart Factory
- Smart Meters

Source: Frost & Sullivan
Rapid changes in water industry paradigm and smart technologies

Present

- Single water source (dam or river)
- Long-distance & centralized management
- Concept of water hunting
- Government led (top-down)
- Stable & safe water supply
- Water source → Water pipe network → Customer
- Unit technology, offline

Future

- Multiple water sources (rainwater, underground water and sea water)
- Short-distance & decentralized management (urban unit, independence ↑)
- Concept of water cultivation
- People led (bottom-up)
- Clean water
- Water source ↔ Water pipe network ↔ Customer
- Fusion/conversion technology/real-time

Need for more scientific & smart water management
A total water management system that combines the qualities of previous systems with high-tech information and communication technologies to intelligently manufacture, distribute and manage water in real time as well as share information with customers.
Status of Water Supply
- Source: Boryeong Dam Water (80,700 m³/day)
- Supply population: 157,000 ppl (Supply rate 91%)
- Supply/day: 50,300 m³/day

Status of Facilities
- Pipelines: 2,041 km
- 10 Reservoir, 23 Booster stations
- 21,429 faucets
  ※ Additional 58 Village Supply Systems
Seosan City Pilot Project (2)

Construct 3~5 sub DMA in 1 DMA & Install smart meters

**As-Is**
- Flow rate & pressure mgmt. by 1 DMA
  (1 Flow™ + general meter for customer)
- 500 ~ 1500 customer/DMA
- Monitoring Only 1 MNF
- NRW mgmt. by month

**To-Be**
- 1 DMA + 3~5 SDMA
  (1 Flow™ +3~5 SM+ SM for every customer)
- about 300 customer/SDMA
- Hourly base monitoring by SDMA
- Daily base NRW mgmt.
A Technology transmitting water usage data of consumers through Digital Metering and Informational Communication Technology on a close to real-time basis instead of manual metering. The system enables remote metering and leakage detection.

- Metering data is collected hourly, sent 4 times a day
- Several options including a paging network can be suggested based on telecommunication conditions
Smart Solution: water-NET, K-water’s key tool to manage water networks

- Network analysis, leakage, NRW, pressure, risk & quality mgmt.
  - based on approx. 110,000 real-time data from SCADA, GIS, Etc.
Smart Services: Mobile Applications

Water Diary

To inform hourly & daily water usage, fares, etc.

Water Care

To show water quality at main points in the water supply network

Water Community

To manage bi-directional notices & a complaint board
Outcomes of SWM (1)

Leakage detection and analysis (Leakage inspection focusing on 3 small DMAs, 7 leakages repaired)

<table>
<thead>
<tr>
<th>Revenue ratio</th>
<th>A1</th>
<th>A2</th>
<th>A3</th>
<th>A4</th>
<th>A5</th>
<th>A6</th>
</tr>
</thead>
<tbody>
<tr>
<td>'16.July</td>
<td>87%</td>
<td>73%</td>
<td>92%</td>
<td>84%</td>
<td>58%</td>
<td>50%</td>
</tr>
<tr>
<td>'16.Aug.</td>
<td>89%</td>
<td>86%</td>
<td>91%</td>
<td>87%</td>
<td>69%</td>
<td>78%</td>
</tr>
<tr>
<td>'16.Sep.</td>
<td>95%</td>
<td>90%</td>
<td>88%</td>
<td>97%</td>
<td>88%</td>
<td>89%</td>
</tr>
<tr>
<td>Effect</td>
<td>↑ 17%</td>
<td>♦ Repair 3/3</td>
<td>♦ Repair 3/3</td>
<td>♦ Repair 2/2</td>
<td>♦ Repair 2/2</td>
<td>♦ Repair 2/2</td>
</tr>
</tbody>
</table>

Minimum flow during night of A5 DMA

Minimum flow during night of A6 DMA
Revenue Water Ratio has been improved to 90% after applying Smart Metering in June, 2016. (Increased by 20% compared to first half of 2016, by 19% compared to the same month of the previous year)

Comparison of the Revenue Water Ratio of Chari region, 2015-2016

<table>
<thead>
<tr>
<th>Ratio</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>59.2%</td>
<td>63.5%</td>
<td>62.2%</td>
<td>71.2%</td>
<td>65.6%</td>
<td>73.8%</td>
<td>71.5%</td>
</tr>
<tr>
<td>2016</td>
<td>62.5%</td>
<td>73.4%</td>
<td>69.4%</td>
<td>73.2%</td>
<td>70.4%</td>
<td>88.4%</td>
<td>90.2%</td>
</tr>
<tr>
<td>Improvement</td>
<td>3.4%</td>
<td>9.9%</td>
<td>7.2%</td>
<td>1.9%</td>
<td>4.8%</td>
<td>↑ 14.6%</td>
<td>↑ 18.7%</td>
</tr>
</tbody>
</table>
Suggesting 3-step Framework for other Countries

1st
Improving network management

2nd
Near-time monitoring system

3rd
Full-time

Smart meter + User Interface
Building Advanced Metering Infrastructure with smart meter and pressure meter

Wireless Sensor + User Interface
Constructing near-time monitoring system with integrated wireless sensors in DMA

Construct DMA
Establishing DMA(District metered area) and digitalize main data of water network with a technical training and support program
Focus on countries operating basic facilities

Improving network management

Establishing DMA and building a water network model and D/B by digitalizing data
Installing minimum meter (logger type) and sensor considering technical and economical issues in local area

Co-work with local engineer with the technical training and support program

Main Objective of 1st Step
Water network analysis, Monthly NRW management (water audit)
Focus on countries requiring operation system for sensors

**Near-time monitoring system**

Upgrade water network with **wireless sensors and meters**
Install more meters and water quality sensors at main pipe and big customer

Operating **monitoring system** based on **near-time** (hour interval) for low power design

**Main Objective of 2nd Step**

Water network analysis, Daily auto leak detection with minimum night flow analysis
Focus on countries requiring SWM with smart meter

Smart water management

Establish Advanced Metering Infrastructure (AMI)
Install Smart Meters on every tap and provide information to customer (smart phone app)

Remote control main valve and upgrade to real-time monitoring system

Main Objective of 3rd Step
Real-time water network analysis, NRW management, auto leak detection with smart meter
Thank you