Smart Water Auditing Project

IWRA Smart Water Management webinar

25 September 2019
Focus: Domestic water-use composition

Singapore (2016/2017)

- Water usage areas at home:
  - Shower: 27%
  - Kitchen: 16%
  - Flushing: 18%
  - Laundry: 15%
  - Others: 6%
  - Basin: 6%
  - Bathroom Tap: 12%

Hong Kong
Research gap: Lack of valid domestic water-use data

- Gold Coast (2008, n=151):
  - Kitchen tap: 13%
  - Bathroom tap: 17.2%
  - Shower: 31.6%
  - Clothes washer: 19.1%
  - Leak: 4.1%
  - Other uses: 11.8%

- Singapore (2016, n=500):
  - Kitchen tap: 18%
  - Bathroom tap: 27%
  - Shower: 15%
  - Clothes washer: 6%
  - Leak: 5%

- Auckland (2008, n=51):
  - Kitchen tap: 19%
  - Bathroom tap: 16%
  - Shower: 30%
  - Clothes washer: 24%
  - Leak: 7%

- USA (2016, n=762):
  - Kitchen tap: 24%
  - Bathroom tap: 18.9%
  - Shower: 18.9%
  - Clothes washer: 16.4%
  - Leak: 13.5%
  - Other uses: 4.3%

- Hong Kong (2011, n=1028):
  - Kitchen tap: 43%
  - Bathroom tap: 26.5%
  - Shower: 24.6%
  - Clothes washer: 5.1%

Legend:
- Flushing
- Faucets
- Shower
- Clothes washer
- Bathtub
- Dishwasher
- Basin
- Leak
- Other uses
Project objectives:

1. To collect data on domestic water use pattern in Hong Kong
2. To test feedback mechanism on water consumption patterns to empower water users to experiment with and embrace habit-changing water conservation practices
3. To facilitate the formulation of well-targeted water conservation measures and to evaluate the efficacy of such measures
4. To optimize public infrastructure investment in Hong Kong’s water supply system
Data collection by smart meters at each household

Data transmitted to a cloud system through a wireless network

Cloud System

Data are stored and analyzed in a cloud system

Behavioral changes in water use habits as reflected by ex post water usage pattern

After data analysis, users will be able to access their usage details through their mobile devices
**SWAS**: Require **high-resolution** water-use data
Machine learning: To **disaggregate** each water end use event
Smart meter & data transmission device: Option 1

Elster mechanical meter with an electronic register (WRAS*)

*Water Regulations Advisory Scheme (UK)
Huizhong NB-IoT
Ultrasonic meter
(Australian & EU standards)

NB-IoT
Smart meter & data transmission device: Option 3

Sensus EM Meter  
(WRAS)  

Drive-by data collection
Tap-based flow sensor

- Verify & calibrate data collected by smart water meter
- Materials: plastic
- Connected to external power banks
- Send data through participant’s wifi network

Diagram:
- Flow sensor
- Smart meter
- Flush counter
Tap-based flow sensor
Technical Issues:

1. Where is a good location to install a smart meter?

2. Do we need a letter to certify that the flow sensors and smart water meters comply with standards for contact with potable water?

3. Risk management measures required:
   - Contractors All Risks / Third Party Liability Insurance Policy
   - Home insurance

4. Data security & data ownership?
Research design: Issues for discussion

- Sampling strategy
  - What are the constraints posed by available technologies?
  - What are the site constraints?

- Data
  - What is the minimum resolution of data?
  - Are we going to collect empirical data on seawater usage?
  - How to ensure privacy and cyber security?

- Feedback mechanism
  - How frequent should the feedback interval be?
  - How to provide feedback to users (app vs mobile webpage)?