GOING REAL TIME IN WATER CONSERVATION – OUR EXPERIENCE

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KEYWORDS
Smart Shower Device, Water Usage Pattern, Behaviour, AMI, WaterGoWhere, Gamification, Mandatory water efficiency requirements, Smart Nation, technology

EXECUTIVE SUMMARY
In our vision for a Smart Nation people are empowered by technology to improve their lives. Singapore’s National Water Agency PUB is gaining a deeper understanding of household water usage patterns and what motivates water-saving behaviours, in order to design and implement programs in a more targeted manner. With smart devices at the centre of its Smart Shower Programme and Advanced Metering Infrastructure (AMI) WaterGoWhere project, PUB is collecting rich information and creating customised programs to educate, engage and motivate Singapore households to embrace water-conservation in the home.

The program resulted in water savings of 5% or 6.9 litres per capita per day.

INTRODUCTION
Traditionally, mandatory water efficiency requirements have helped us to achieve remarkable reduction in per capital household consumption over the years, including such initiatives as maximum allowable flow rates for taps and showers, and water efficiency labelling for fittings and appliances.

To further boost water conservation efforts and the vision for a Smart Nation, PUB is gaining a deeper understanding of domestic household water usage patterns and habits. Smart devices have presented us with the technological means to modify the user’s attention towards water conservation, and are at the centre of two of our projects: the Smart Shower Programme and the Advanced Metering Infrastructure (AMI) WaterGoWhere Project developed in collaboration with Suez.

HIGHLIGHTS
- We measure impacts of real-time water consumption information in Singapore homes
- We compare effectiveness of different usage goals to discover optimal targets
- We created a gamified mobile application to motivate, educate and engage residents
- The application includes leak notification, usage monitoring and regular challenges
- The application resulted in water savings of 5% or 6.9 litres per capita per day

METHODOLOGY/ PROCESS

Smart Shower Programme
In 2015 PUB embarked on a collaboration project with NUS to explore how we can leverage smart shower devices to modify users’ behaviour towards water conservation. 530 residential households in Singapore were fitted with smart shower devices.

The households were randomly divided into 7 groups, (1 control, 6 treatment). All 6 treatment groups were provided with real-time consumption information while 5 were further assigned targets to achieve per shower, corresponding to “ambitious”, “moderately ambitious”, “moderate”, “moderately easy” and “easy” goals. This allowed us to collect data on which goal was optimal.
During showers, the smart shower devices showed the volume of water used, as well as an indication of 'Very good', 'OK' or 'Too much' depending on the set goal. There was also an accompanying animation showing a polar bear which would melt away into the background if the water consumption goal was exceeded. Water usage data was recorded automatically over 4-6 months.

Advanced Metering Infrastructure (AMI) WaterGoWhere Project

In 2016, PUB collaborated with SUEZ using their long-range smart metering and smart water technologies in a 2-year pilot project. Smart meters fitted with VHF transmitters were deployed to 525 residential households. With the data collected, we developed a gamified mobile application called 'WaterGoWhere', to motivate and increase awareness on residents' water usage. A 6-month field trial was conducted to assess feasibility. The WaterGoWhere app used smart metering, analytics, and an innovative gamification concept to engage residents toward water conservation. As well as leak notification and usage monitoring, residents also received daily, weekly and monthly challenges to help them reduce consumption. The app provided an engaging and rewarding experience for residents. By using smart meters and data analytics the system could detect consumption patterns in the household and use the data to push customised challenges, with points and level status. Data collected from AMI provided us with maintenance and operational information as well as metering data computed in-house Data Analytics tools (forecast, patterns, savings, residual volumes etc). With this data, PUB could further customise engagement strategies to help customers towards water conservation.

RESULTS

Smart Shower Programme

The Smart Shower Programme study concluded that water consumption was reduced by 2.13L or 10% per shower when real time feedback on consumption was provided by the smart meters. It also found that the goal set for the household played a critical role, with a moderately ambitious goal of 15L per shower being optimal to motivate households to reduce water consumption.

AMI WaterGoWhere Project

52% of households were interested in the AMI WaterGoWhere programme and downloaded the app. 34% of those viewed their usage and participated in challenges on a regular basis. Engagement via the app was able to deal with ‘tough customers with leaks’ where traditional methods had not worked. In total, the water savings in the 5 blocks was 5% with leak alarms and customer engagement efforts contributing to 6.9L saved per day per capita.

CONCLUSION

Before the launch of the Smart Shower and AMI WaterGoWhere programmes, residents were generally not aware of their water usage or ways to reduce their usage. By providing residents with real time data of their shower usage, household usage and water saving tips, the programmes addressed these knowledge gaps. AMI has allowed for the collection of richer information for a customised experience for each household. The unique feature of the WaterGoWhere app was the provision of water usage data in a gamification context, which equipped the residents with better knowledge in an engaging and fun way. The programmes have been successful mediums in changing the behavioural attitudes and habits of customers. For AMI, much planning in other aspects of the trial has also allowed for its success, such as the customer engagement efforts and thorough planning and innovation of the program. The program has also shown effectiveness of using gamification to encourage customers in efficient use of water in their households. Given these encouraging findings, PUB has embarked on a Smart Shower Programme in 2017 to install smart shower devices for some 10,000 new homes under a demonstration project in the next 3 years, and the AMI WaterGoWhere programme will be launched in a second estate (Yuhua). If the results from these demonstration projects continue to show promise, PUB will work with the relevant agencies on the feasibility to roll out at a larger scale.
Table 1: Smart Shower Programme household groups

<table>
<thead>
<tr>
<th>No.</th>
<th>Group</th>
<th>Function</th>
<th>Displays</th>
<th>Water savings relative to control group</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Treatment</td>
<td>Ambitious goal (10 litres)</td>
<td>Rating, real-time information and animation</td>
<td>2.87 litres (per shower)</td>
</tr>
<tr>
<td>2</td>
<td>Treatment</td>
<td>Moderately ambitious goal (15 litres)</td>
<td>Rating, real-time information and animation</td>
<td>3.82 litres</td>
</tr>
<tr>
<td>3</td>
<td>Treatment</td>
<td>Moderate goal (20 litres)</td>
<td>Rating, real-time information and animation</td>
<td>3.03 litres</td>
</tr>
<tr>
<td>4</td>
<td>Treatment</td>
<td>Moderately easy goal (25 litres)</td>
<td>Rating, real-time information and animation</td>
<td>2.86 litres</td>
</tr>
<tr>
<td>5</td>
<td>Treatment</td>
<td>Easy goal (35 litres)</td>
<td>Rating, real-time information and animation</td>
<td>1.25 litres</td>
</tr>
<tr>
<td>6</td>
<td>Treatment</td>
<td>Real-time information only</td>
<td>Real-time information only</td>
<td>2.13 litres (~10% savings)</td>
</tr>
<tr>
<td>7</td>
<td>Control</td>
<td>Temperature information only</td>
<td>Temperature information only</td>
<td>-</td>
</tr>
</tbody>
</table>

Figure 1: WaterGoWhere mobile application

Figure 2: WaterGoWhere engagement framework