

GOING REAL TIME IN WATER CONSERVATION - OUR EXPERIENCE

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ABSTRACT

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.

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

KEYWORDS

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

PRESENTER PROFILE

Sean Cohen, Senior Manager Smart Water for SUEZ Australia & New Zealand specialises in the application of intelligent systems to fixed infrastructure and the transformation of raw data into actionable intelligence. He has built power, water, and industrial infrastructure across the country including electrical distribution networks, wastewater recycling and re-use projects, and advanced technology for drinking water treatment. His areas of expertise include technology development and deployment across energy, waste, water, communication systems and medical devices.

1 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.

2 AMI WATERGOWHERE PROJECT

PUB collaborated with SUEZ using their long-range smart metering and smart water technologies in a two year pilot project. Smart meters fitted with VHF transmitters were deployed to 525 residential households (five blocks) in Punggol in March 2016. With the data collected, a gamified mobile application called 'WaterGoWhere' (Figure 1) was created to motivate and increase awareness on residents' water usage. A 6-month field trial was conducted to assess acceptability and feasibility. The trial ended in Dec 2017.



Figure 1: WaterGoWhere App and Branding

The WaterGoWhere app uses smart metering, analytics and an innovative gamification concept to engage the residents toward water conservation (Figure 2). Beside leak notification, usage monitoring, the residents also receive daily, weekly and monthly challenges to help them reduce their consumption.

Using the data collected from AMI (Advanced Metering Infrastructure), this customer-oriented programme:

- Provided residents with daily and hourly information regarding their water usage patterns through an innovative mobile application. This helped raise awareness on water wastage and how to better manage their consumption,
- Provided PUB with maintenance and operational information of the AMI as well as metering data computed by in-house Data Analytics tools (forecast, patterns, savings, residual volumes, etc.). With these data, PUB can customise engagement strategies to help customers toward water conservation.

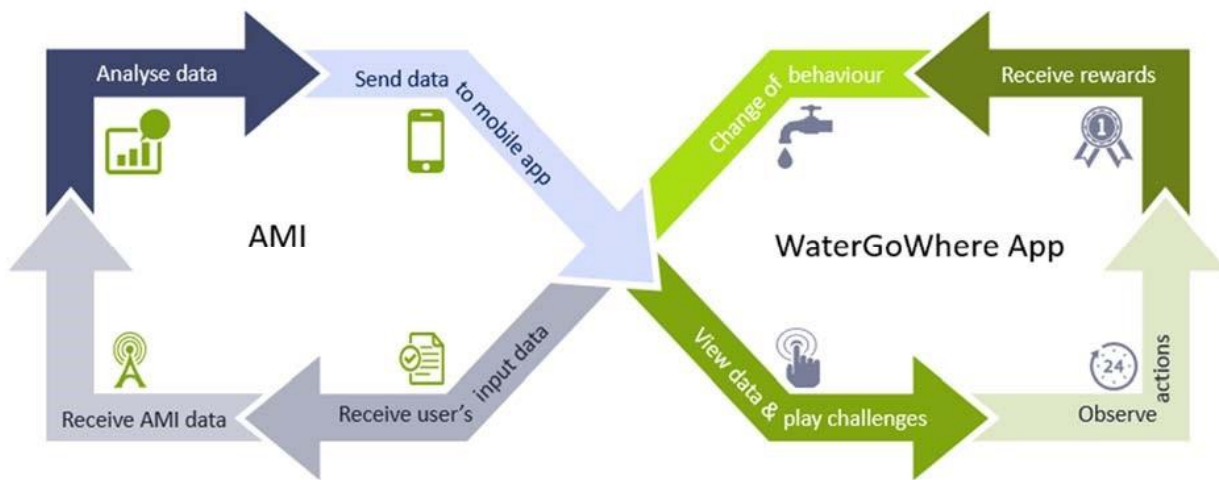


Figure 2: WaterGoWhere Engagement Framework

2.1 GAMIFICATION, LEAK DETECTION AND NOTIFICATION



Figure 3: WaterGoWhere App Detail

The app provided a gamified, engaging and rewarding experience for the residents. By using smart meters and data analytics, the system can detect consumption patterns in the household and push customised challenges to each household. The algorithms also detected the peak periods of consumption during the week or the day, send high consumption alarms or challenges at a specific time.

The use of leak alerts in the app has also enabled the customers to reduce the time to be aware of a leak. Customers were able to detect leaks on their own via the information that were provided to them. This has also reduced the man power required to visit households and inform them to fix their leaks. Leak volume has also significantly reduced since the introduction of WaterGoWhere programme.

Gamification elements included:

- Usage reports and trends,
- Challenges (daily, weekly, monthly),

- Competitions between residents,
- Peak period notices and challenges,
- High consumption alarms,
- Rewards: "Points," "Status," "Prizes".

The app rewarded residents with points and level status for their participation in water saving challenges, application login and their water reduction efforts. The top teams and players win rewards and a grand prize at the end of the program. These points serve as a virtual currency to raise the residents' awareness on their water consumption.

The "Offline" group (i.e. households who did not sign up via the app or website) is also actively engaged via the monthly reports. We observed that the offline groups tend to be those with no smart phones and limited English.

Preliminary study has shown:

- 52% of households were interested in the programme and downloaded the mobile app – this unexpected favourable result was due to the customer engagement strategies deployed,
- 34% of households (who have signed up an account) viewed their usage and participate in challenges on a regular basis (at least once a week),
- Positive feedbacks from residents (as can be seen from their comments at the Facebook and email). We have even received requests from residents in other estates to join the programme,
- Engagement via the app is able to deal with 'tough customers with leaks' where traditional methods had not worked,
- Total water savings in the five selected blocks was above 5% with leak alarms and customer engagement efforts contributing at least 6.9 litres saved per day per capita.

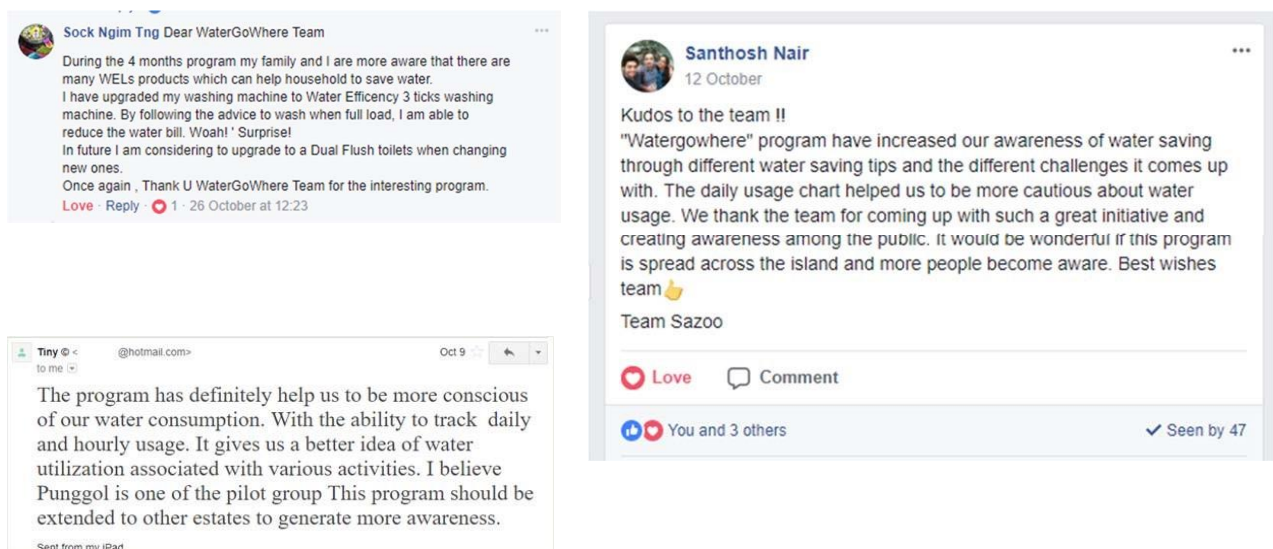


Figure 3: Positive Resident Feedback

2.2 DESIGN CONCEPT OF WATERGOWHERE APP

The design of the app aims to allow the customers to actively communicate and interact with the mobile device, while learning about their water consumption, retaining them to login again for new information.

The first prototype interface was designed based on industry best practices and the initial feedback from employees in both SUEZ and PUB. It was then presented to the focus groups to gather feedback for further enhancement

After developing the user interfaces, we have come up with the following key learning points:

- The colours chosen are related to the subject matter. Blue represents water and white provides space for visual rest,
- To guide user on next steps, all interactive buttons were themed in green or pink. These colours were specifically reserved only for call-to-actions (CTAs) so users are able to easily navigate the app,
- Complex, data-heavy, scientific graphs are simplified to make the app friendly for users as young as 10 years old.

2.3 CUSTOMER INSIGHT

A total of 267 households signed up for an online account by the end of November 2017. 52% of households were successfully recruited as online users. Part of the online users, 60% were recruited through door-to-door engagement while 40% signed up after receiving invitation letters or monthly reports.

After careful observation and analysis of the data, majority of the customers were between 30-39 years old, in line with Punggol's age demographic. 45% of the players that were actively engaged with the app (by logging in once a week) were above 50 years old. This finding proves that the programme could appeal to an older generation, despite Punggol being a young estate. However, the opposite could happen to a mature estate (i.e programme may be more appealing to a younger generation in a more mature estate).

The online customers were also segmented into 4 different types based on the analysis of their login frequency, water savings and challenges participation. All online customers had shown interest in the programme through winning various challenges in the app. 96% of these customers had won points at least once because of a lower weekly water usage at home.

- **Devoted Players (55%)** were customers who participated in all challenges and as a result reduced their water usage. These customers have played the challenges and realised how effective they were in water saving. These customers consistently get what they perceive to be a great experience, triggering them to login again. They also progressively have higher expectations of the programme as they earn points and rewards. Adding on, they have the most reduction in their per capita household usage, making them the best in class customers that we need for the advancement and improvisation of the programme. The focus is to continue to engage and reward them for their water saving efforts. We were able to attain these customers after thorough engagement and consistent customer service.

- **Delighted Players (31%)** were customers who participated in water saving challenges but not the weekly quiz challenges and Facebook discussion. They found the water saving challenges sufficient for them in saving water and do not feel the need to devote more time on quizzes or discussion. These customers prefer to just use the app for self-monitoring and were not interested in winning rewards. Another reason could also be the lack of knowledge on how to play the quizzes or participate in discussion. A solution to provide more in-depth engagement with the app needs to be developed. It can be noted that the most active engagement period of these customers was in the morning - this information is useful to target content update, trigger challenges and avoid for server maintenance.
- **Detached Players (4%)** were customers who login to participate in quiz and monthly water saving challenges but not winning any points for weekly water saving. These customers were detached from the objectives of the programme. They were the users who were only keen to play specific challenges to win points but did not put in more effort to reduce their usage. They have won monthly water saving challenges due to the specific instructions to reduce their usage on a certain period, however, there was no water reduction in the family overall. For example, the player's monthly water saving challenge was to reduce his usage on Sunday. So instead of doing his laundry on Sundays, he did his laundry on other days just to win points. This group of players made up the least number.
- **Dormant Players (10%)** were customers who login only once during registration and did not login anymore. There was no per capita household reduction. Even though they did not login after the first time, leak alerts and monthly usage reports were consistently given to them via email for notification. However, these notifications were ineffective in persuading them to save water. Interestingly the age group for these players were older too. This could be due to the customer's challenge in accepting new technology or their inability to comprehend the purpose of the programme. The team needs to understand the obstacles for these customers and find out if it was due to the difficulties in logging in to the app, insufficient information in the monthly report or their disinterest in playing the challenges.

2.4 OFFLINE CUSTOMERS

Customers who did not sign up for an online account would continue to receive a monthly report with information on their monthly usage, leaks and high usage information. In each report, there was also a CTA - 'sign up an online account to view more details of your usage and participate in challenges to win vouchers.' The challenge in converting the offline customers to online was their low occupancy rate. Since they are hardly at home, it proved to be difficult to promote the programme to them through door to door engagement or monthly reports. However, we still successfully converted 60 offline customers to online customers through the monthly reports.

Information regarding the effectiveness of the reports towards water saving were not conclusive due to the limitation in feedback from offline customers. However, the reports can be concluded to be an effective channel to promote the app.

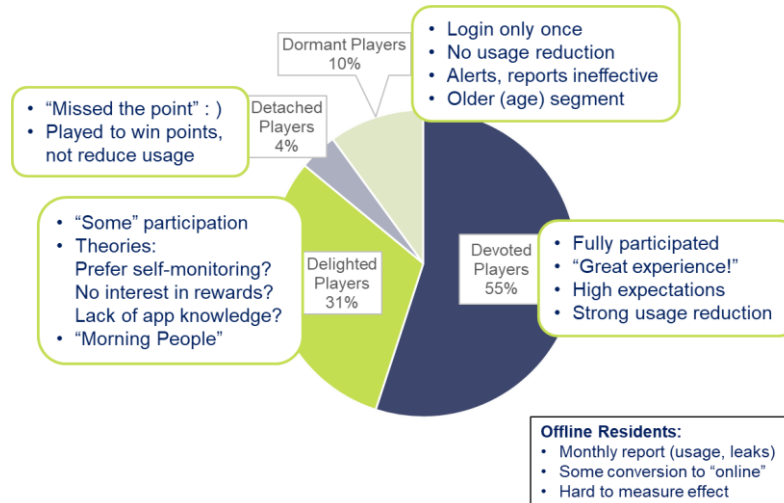


Figure 4: Resident Behavioural Response

2.5 EFFECTIVE FEATURES OF THE PROGRAMME

Feedback was collected from customers during face to face meetup, emails, Facebook discussion and event. The following are features of the app that was deemed to be effective by the participants of the programme:

- Neighbours and block comparison (customers like to compare their usage with those around them)
- Positive messages, rewards and encouragement (customers are motivated by positive reinforcement)
- Daily usage trend information with hourly and weekly information
- Monthly face-to-face meetup to help customers with challenges in using app and saving water
- Offer service for free
- Monthly reports send out to offline customers

2.6 RECOMMENDATIONS

Building on the success of the pilot trial, the programme will be launched in a second estate, Yuhua, in mid 2018. The households in Punggol will also continue to access the app. It is also important to note this AMI programme can easily be adaptable to energy and waste management sectors.

Based on reports and block observations, it is noted that Yuhua is an estate that is highly populated by the elderly. The Yuhua estate is vastly different from the Punggol estate, which is a younger estate, as it is a mature one. The estate is also predominantly Chinese, based on observations and feedback from the residents' committee. Therefore, necessary changes were made to ensure that the programme will be effective in achieving its goals in this estate.

- **Digital Clinics** - Conduct classes on how to use WaterGoWhere app, sessions will also be available in Chinese.
- **WaterGoWhere Ambassadors** - Recruit ambassadors (RC Volunteers) to aid in engagement
- **Home Visits** - The team will also make home visits to customers who need help in using the app. Home visits give the team the opportunity to talk face to face and build trust on the product and services.



Figure 5: Ambassador Graduation Ceremony



Figure 6: Home Visit & Digital Clinic

3 CONCLUSIONS

Before the launch of the smart shower and AMI Watergowhere programmes, residents in general were not aware of their water usage or ways to reduce their usage. By providing the residents with real time data of their shower usage, household usage and water saving tips, it addressed these knowledge gaps.

AMI has also allowed the collection of richer information for a customised experience for each household. Using visually appealing graphs and charts to represent these complex data has also helped to engage residents to better understand their usage. The innovative and unique feature of this programme was its provision of water usage data in gamification context that also provide the 'fun and reward' element. This has not been tested out in previous research in Singapore. Through playing various challenges and monitoring their own usage, these residents were equipped with better knowledge on how to change their behaviour to effectively manage water resources at home.

The engagement with the 30-39 age group was expected as it aligned with the overall Punggol's demographic. There was also an unexpected good engagement with those above 50 years old.

The challenge remained for user retention in using the smart shower devices, the mobile app and how to keep users engaged and ensure repeat usage.

Concluding the report, this trial has proven that the programmes have been a successful medium in changing the behavioural attitudes and habits of the 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 programme. This programme has also shown effectiveness of using gamification to encourage customers in efficient use of water in their households.