

Science for Environment Policy

Combining behavioural change and game-like incentive models encourages consumers to save water

Domestic water saving is important – not only to address water scarcity and drought, but also to save energy and tackle climate change. Water-management strategies are needed to prevent these shortages, and include incentives to change consumers' behaviour concerning water use. This study examines the design of a behaviour-change system and a linked incentive model to stimulate a sustainable change in water-consumption behaviour.

Conventional attempts to elicit a change in consumers' water-saving behaviour have involved awareness campaigns and financial incentives, but behaviour change can drop off after a short period of time. More recently, the focus has been on 'gamified' incentive models – systems that resemble games and offer incentives and rewards to users – and visualising water consumption using information and communication technology (ICT), but these approaches do not consider long-term behavioural-change motivators.

The EU has several ongoing research projects that aim to instigate water-saving behaviour using ICT smart metering, which helps customers to visualise their water use. The [Smart H₂O project](#)¹, provides household users with daily feedback and has a gamified incentive model that uses visualisation, saving tips, and personal, social, virtual, and physical rewards. Similar EU FP7 research projects using ICT are the [WATERNOMICS project](#), which provides personal feedback using dashboards to aid decision-making, and the [WISDOM project](#), which provides real-time consumption feedback on a display with a digital game.

These last two projects have published promising results on their impact on water consumption. Shower systems with alarms and visualisation displays showed consumption reductions of 27% and 22% respectively over a short trial period. This is promising – but so far, smart-meter feedback alone has not provided long-lasting behaviour change. This study examines ICT systems through the lens of changing habits in the long term, by providing motivators to encourage people to make the leap across the intention-behaviour gap.

The incentive model for water saving was designed within the Smart H₂O project to help municipalities and utilities achieve their infrastructure and environmental targets. Two theoretical models were applied to the content of instigating water saving behaviour in households: the 'theory of planned behaviour' (TPB) model (which approaches behaviour change by influencing underlying psychological factors that determine our behaviour) and the 'transtheoretical' model (which focuses on the process of behaviour change in five consecutive phases – from raising awareness to eventually creating new habits).

The game was designed to be both functional and enjoyable to encourage user engagement. It included rewards as an incentive – virtual points earned virtual badges, but were collected over time and cashed in periodically for a limited number of physical rewards: a card game, water-saving shower heads, tablets, and museum tickets. A leader board encouraged competition between users in a household, and neighbourhood statistics provided societal pressure and competition amongst households. The gamified portal was deployed in two settings – a small-scale trial in Switzerland, and a larger-scale trial in Spain. The results of the small-scale Swiss trial are presented in this study.

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The Smart H₂O system was deployed in Switzerland from July 2015 to February 2016. The basic portal was available initially, with uptake in 40 households. An update to the basic version was introduced in October 2015, followed by the gamified version in December 2015. The first evaluation looked at water-consumption data and feedback on the basic portal over the first three months. The water consumption of users in households within the Smart H₂O project reduced water consumption by 27%, compared with only 8% in households not using the system. The gamified portal had greater user interaction and engagement than the more basic portal; users also collected badges, looked at leadership boards, and viewed water-saving tips. The observed average frequency of monthly logins — after excluding the lead users, whose interaction was much higher than average — is 6.8, which compares favourably with similar systems in the energy domain that had an average of 1–3 logins per month.

The preliminary results from the small-scale Swiss pilot of the gamified incentive system, using the Smart H₂O system, are encouraging, as there was a significant reduction in water consumption relative to non-users (27.5% versus 8%). The consumption visualisation and water-saving tips were reported to raise awareness amongst users and the rewards, coupled with the gamified approach, maintained engagement. The range of reward types and the functional, as well as fun, aspects of the game enabled all types of users to find a level of engagement that suited them. For utilities companies, this type of system is a useful counterpoint to introducing price increases for consumers' increasing use of water. Article 9 of the EU Water Framework Directive² requires Member States to take account of the cost of recovery of water services – including environmental and resource costs – and the type of gamified incentive system presented in this study may help to achieve these objectives if implemented on a larger scale.

The researchers note that this study was conducted over a short time period using a relatively small sample size. The gaming approach, therefore, is producing good results in the short term, but it is unclear how long these will last³.

In addition, the researchers suggest a need to more closely analyse how specific types or patterns of user interaction with the system may be related to observed patterns of consumption reduction. The ongoing larger-scale trial in Spain will provide further data.



2. EU Water Framework Directive: <https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX:02000L0060-20141120>

3. Previous studies of awareness campaigns (e.g. Fielding, K.S. *et al.*, 2012. Determinants of household water conservation: the role of demographic, infrastructure, behavior, and psychosocial variables. *Water Resour. Res.* 48 (10)) have found water savings of 5-10%, but there are issues in maintaining the behavioural change.

