

# Favouring behavioural change of households' energy consumption through social media and cooperative play

Roberta Castri<sup>1</sup>, Vanessa De Luca<sup>1</sup>, Evelyn Lobsiger-Kägi<sup>2</sup>, Corinne Moser<sup>2</sup>, Vicente Carabias<sup>2</sup>

<sup>1</sup>SUPSI University of Applied Sciences and Arts of Southern Switzerland,  
CH - 6952 Canobbio, Switzerland, [roberta.castri@supsi.ch](mailto:roberta.castri@supsi.ch), [vanessa.deluca@supsi.ch](mailto:vanessa.deluca@supsi.ch), [www.supsi.ch](http://www.supsi.ch).

<sup>2</sup>ZHAW Zurich University of Applied Sciences, Institute of Sustainable Development,  
CH - 8401 Winterthur, Switzerland, [cahu@zhaw.ch](mailto:cahu@zhaw.ch), [kaev@zhaw.ch](mailto:kaev@zhaw.ch), [mosc@zhaw.ch](mailto:mosc@zhaw.ch), [www.ine.zhaw.ch](http://www.ine.zhaw.ch).

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## Abstract

A change in how individuals consume energy is a key step in fighting climate change since it represents a crucial contribution to a more collective and sustainable lifestyle adoption.

To carry out such process, designers and scientists are seeking new ways to increase public discussion and social involvement in energy reduction issues. In relation to this, the emphasis is on raising collective awareness to enable behavioural change and to inspire people in making sustainable decisions on energy consumption. This article draws on techniques and approaches from social science, gameful design and sustainability. It defines and discusses cooperative play as a privileged path for developing energy-related mobile applications. We present here an overview of multiple perspectives, in terms of content and methodology, to contribute to elaborating design methodologies that can favour behavioural change on households' energy consumption.

## 1. Introduction

In order to better manage energy consumption in the residential building sector, energy utilities are increasingly starting to integrate information and communication technology (ICT) into their demand-side management (DSM) programs. As a result, social media and games are becoming an emergent form of end-user involvement to raise energy consumption awareness.

Recent advances in smart meter technology allow for a range of new functions such as remote meter reading, time-of-day tariffs and real-time data usage information. However, interactive social media coupled with mobile connectivity create unprecedented opportunities for a participative, action-oriented approach that includes the end-user in the energy management process. This is an aspect of fundamental importance considering that individuals make decisions not only according to their state of environmental awareness and concern, but also according to their social environment (see chapter 3), their willingness to act, and a belief that their action will be effective and beneficial (Stern, 2000).

Furthermore, thanks to the possibility of sharing contents through an easy-to-use mechanism, social media act as a persuasive technology (Fogg, 2009; Botsman & Rogers 2011; Cho 2013) capable of creating a collaborative information consumption model fostering virtual communities and social cohesion at a time when customers are increasingly aware of the cost and environmental impact of their energy usage (Petkov, 2011; Grevet, 2010). Against the backdrop of growth of social networks, well consolidated today in industrial and marketing practices, gamification approaches are being pursued in energy products and services more and more using social pressure to change people's consumption behaviour (Behavioural Insights Team, 2011). Both social networks and gamified interfaces are currently used as communication tools that are now beginning to influence one another. They offer a base for encouraging social interaction as well as interaction with other community-based organizations (i.e. energy companies and public actors). Considerations on the current landscape of gamified energy services draw their bases on studies on the effectiveness of different feedback mechanisms on individual behavioural change (Abrahamse et al, 2005; Darby, 2006; Fischer 2007; Vine et al, 2013). It is interesting to notice that feedback systems and social connectivity constitute the essential elements that motivate player participation and engagement (McGonigal, 2011).

Taking into account these lines of research we might re-examine the role of design as a powerful aspect in shaping motivations, intentions and activities focused on the interaction between people and data.

In this paper we present an overview of our interdisciplinary pilot project: the 'Social Power' merging design, energy, society and web sciences, in order to develop a new energy mobile service based on social mediated interactions. Through the discussion of the theoretical and methodological concerns that have motivated the project, we present an implementation methodology of social engagement through gameful design. While feedback rewards and social competition are two of the main driving forces already being used in other field studies to encourage participation in energy saving, our research project explores the role of collaborative and competitive social interaction dynamics to actively trigger participation over time. Therefore,

this project represents a starting point for understanding how to reshape energy consumer society in the direction of a more participative arena.

The purpose of this paper is to provide multiple perspectives for highlighting the main aspects that might contribute to enhancing the design of energy services for behavioural changes.

## **2 Connecting multiple perspectives**

Demand-side management programmes run by energy utilities are increasingly trying to customize the electrical network through the development of interfaces visualising energy consumption and production data as well as the elaboration of more and more intelligent algorithms to reveal end-user behaviour. Although this ability to monitor and control usage may contribute substantially to the adjustment of the timing and the quantity of electricity used by customers (i.e. load shifting during peak periods; overall energy conservation), current technology hasn't yet been able to properly permeate into people's daily life.

This is probably due to the fact that the information delivered is still not able to link energy consumption data (and its related environmental impact) to everyday life dynamics and behaviour in an effective, user-friendly way. Not to forget that next to technical challenges, also societal ones arise due to many issues such as privacy for example (Verbong, Beemsterboer, & Sengers, 2013). As a consequence, energy flows (at home as well as in urban contexts) are not yet clearly perceived as legible information for consumers and consumer networks. In light of this, design provides a fruitful approach to make energy more visible, trigger social interaction and to generate social change as a driver for social innovation research (Mortati & Villari, 2014). In particular, we have started a collaborative work exploring and integrating multiple perspectives in a field experiment using the Social Power project. Different areas characterize this pilot:

- *The Interaction Design perspective* seeks to place consumers and communities at the centre of a comparative energy-saving process to trigger more sustainable daily consumption habits;
- *Gamification perspective as a privileged path to favouring behavioural change* that provides the user a motivational system in which he/she can learn about decisions and their consequences;
- *Mobile media as cross-cultural tools for interacting with private and social environments at all times and therefore also at the very moment energy is actually consumed;*
- *Energy studies and sustainability research perspective* for fostering efficient and sustainable consumption;
- *Social and environmental psychological perspective* aims to explore determinants of private energy consumption and energy-related decisions.

Our proposed research consists in applying a comprehensive investigation of the challenges and the opportunities stemming from these different approaches, both theoretical as well as experimental, to design a playful interaction platform for energy consumption. The proposed methodology is based on a Swiss comparative pilot project that involves two energy companies, citizens in two cantons and an interdisciplinary research group composed of designer, psychologists, environmental social scientists, engineers and biologists.

## **3. Social influence on energy consumption**

Various studies in the energy domain have shown that energy-related behaviour and decisions are socially embedded (Welsch & Kuhling, 2009). With respect to electricity consumption, a classical experiment in California has shown that social norms influence individual consumption (Schultz et al., 2007). This means that households that had an above-average consumption of electricity reduced consumption after feedback was given. This powerful, social effect has been shown to be robust over several months (Ayres et al., 2013). A similar feedback effect could be shown at the workplace level where group-level feedback lead to a reduction in energy consumption of 8% (Carrico & Riemer, 2011). Also, Abrahamse et al.(2005) conclude in their review on interventions to reduce household energy consumption that energy consumption feedback, including a social, competition-like situation, seems to be quite effective in reducing individual consumption. Furthermore, vivid, personalized, concrete, and tailored information from trusted sources are preferred and more effective compared to more abstract, impersonalized information (Costanzo et al., 1986; Breukers et al., 2013). One reason for the social embedding of energy consumption is that the related services fulfil both personal but also social needs such as relatedness, competence and belonging (Senbel et al., 2014).

A crucial question regarding social influence is whether cooperation or competition is more powerful in motivating households to reduce their energy consumption. A study with two units in a company suggests that comparative feedback is more effective in saving energy compared to a situation where participants set their own targets and only receive feedback about their own consumption (Siero, Bakker, Dekker, & van den Burg, 1996). However, today's social media offer more possibilities to share knowledge, experiences, and insights and to participate in collective processes. This indicates that social media in combination with game design might offer tools to foster group identity, which is a powerful motivator for behaviour change.

#### **4. Gameful design for social engagement**

Beside inclusive and collaborative researches there are concrete design practices that use competences in communication, interaction and user experience to actively trigger behavioural changes (Manzini, 2011; Sovacool 2014). Creative communities and social networks are specialized laboratories that actively involve users as players, co-designers and co-producers. In fact, providing challenges that work towards meeting common goals is thought to constitute the core of collaborative organisations as well as the most successful social gaming practices. Design processes operating in this field are defined today as gameful design and gamification as they make use of game mechanics in non-gaming systems to improve user experience (Detering et al, 2011). While gameful design uses deeply satisfying properties of games (agency, emotion, immediate feedback) to help people reaching their goals, gamification differentiates using a service-marketing point of view and adding game elements (badge, rewards, tokens) to incentive user engagement (Groh, 2012). In both approaches, social connection is a viral mechanism that fosters and strengthens social relationships connecting a network of players to act/fight for the same cause. As collaborative game mechanics merge personal interests with community and environmental goals, they represent a promising approach for the development of social energy-related platforms. Looking at cases of gameful design in the energy-saving communication field (e.g., Opower, MyEnergy, Sample Energy) we can observe that points, badges, rankings, and neighbourhood comparisons are commonly used to motivate people interaction in a short-term. However, in spite of competitive game mechanics and an individual meritocratic system, designers can also respond to the demand of a behavioural change by providing social collaborative and cooperative mechanics that can build collective understanding and trigger a more positive social experience (McGonigal, 2011) also in a long-term. This opportunity to shift from competitive to cooperative interaction designing energy-related platforms arises from two elements: the increasing connectivity through social environments (increasing social presence in community-based platforms) and the use of social media and technology in terms of services for sharing activities.

However the effectiveness of mediated social interaction mechanics - both competitive and cooperative - need to be further framed. The call is for tools that can evaluate the impact on people behaviour in the short and long-term while considering cultural diversities. Social media (and other forms of community-based platforms) seem to be particularly appropriate since energy saving is itself a social purpose that impacts our environment. On this basis, discussions on how to use energy in a more sustainable way could be an important piece of information worth sharing. Furthermore energy production, provision and consumption - especially the decentralized ones - are more and more managed in networks with several relationships among users, producers and energy providers. This underlines the importance of thinking in socio-technical networks that can be supported by social media and gamification. There are some positive indications on the effect of game-like mechanics in motivating energy saving at the social level due to the constant process of learning of shared goals, constructive strategies and commonly solved complexities (Whitson, 2011; Järvinen 2009).

In particular, in cooperative game mechanics (typical of role playing games), players are trained to act in favour of a common goal by practicing together while sharing knowledge and strategies. Given its ability to increase social consensus, cooperation could be a powerful structure for social involvement in energy-saving issues: it promotes positive attitudes and supports the achievement of individual goals and fuels peer-to-peer systems.

#### **5. Social Power Project**

For a more practical approach to behaviour change, we started a design-led project "Social Power", a mobile application that integrates social media and gameful design in the fields of demand-side management of energy utilities in order to maximize potentials and benefits. The Social Power project aims at encouraging energy-saving by providing a digital social space of interaction where people can collaborate and cooperate in order to build a collective understanding on how to save energy (De Luca, Castri, 2014). Households can interact socially thanks to different configurations moving from cooperative play mechanics to team competition. Measuring households power consumption over time and analysing user mediated activities, the pilot project will study the effectiveness of social networks and social gaming in driving people towards change. The project concept is based on interdisciplinary research conducted with the University of Applied Sciences and Arts of Southern Switzerland (SUPSI) and the Zurich University of Applied Sciences (ZHAW) in collaboration with two Swiss energy utilities: Azienda Elettrica di Massagno SA (Canton Ticino) and Stadtwerk Winterthur (Canton Zurich). Since social cooperation can be a powerful motivational tool, in this project, different test groups will engage in a social cooperative dynamic game. Although they will all share a common primary goal, one group will aim at a set target, supplied by the game system. Instead, the other group will compete against a peer group, thus the target will be dynamic and defined by the competitor's result. The evaluation of the impact of these dynamics in the long-term will contribute to enrich research on current energy management services supplied through social media.

## 6. Methodology: an empirical test in regional Swiss case-studies

In the Social Power project, we suggest an experimental approach to test different design options and games (cooperative vs. competitive) for their effectiveness. They will be conducted as field studies in the two case regions (Massagno and Winterthur) to further strengthen the applicability of the study.

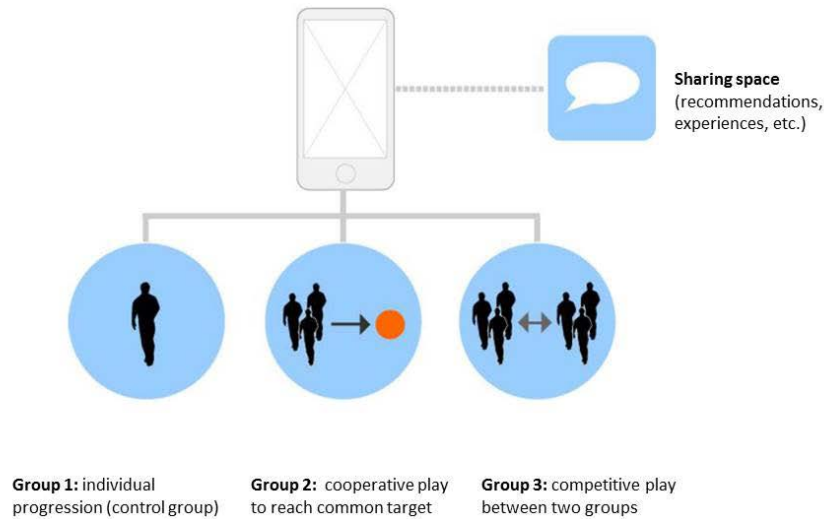


Figure 1: The three experimental manipulations.

*Procedure:* First, the base line electricity consumption of each and every household is measured. Participants (who should all have access to a smart phone) are randomly assigned to one of three groups. Members of group 1 only receive feedback about their own individual progression, members of group 2 define a goal together and engage in cooperative play to reach it, and members of group 3 in one city compete against members of group 3 in the partner city (Massagno against Winterthur). All groups have access to a game environment where they i) receive feedback about their consumption and ii) can exchange knowledge, experiences, and electricity-saving tips with each other. After the interventions, electricity consumption of each household is again measured and compared to the initial base line. This measurement may be repeated after some time to check for long-term behavioural changes. The experimental design, hence, may look like this:

- *Independent (manipulated) variable:* Group membership (group 1 (control group) vs. group 2 (cooperation) vs. group 3 (competition)), as displayed in Figure 1; further independent variables may be manipulated, such as different design options of the game, in order to explore the influence of different types of designs and games on electricity consumption.
- *Dependent variable:* Measurement of a household electricity consumption at different points in time.
- *Further measured variables:* Socio-demographic and spatial variables, households variables (e.g., household size, number of rooms), use of game environment (e.g., number of contributions published and read, number of readers), behavioural variables on energy consumption, etc.

Similar field studies may be applied to other energy services such as private leisure mobility, use of hot water, commuting, etc.

## 7. Conclusions

This paper has briefly outlined different perspectives that the design of energy management tools may take into account when investigating behavioral change. The use of social media and gameful design should be considered an added value for energy services, especially if aiming at a continuative participation of people in energy-saving activities.

However, the debate on design for behavioral change is on-going. Looking at cooperation and collaboration as key terms for energy services innovation, the authors have described the polarities contributing to the advancement of the field: social perspective, energy research and gameful design.

As this is an on-going research project, we present here some initial findings:

- Cooperation and collaboration mechanisms are not yet very often applied nor evaluated and actual practices focus more on competition and individual merits. For a step forward, design solutions should invest more in understanding social playing dynamics for actively involving people and supporting behavioural changes;

- It is important to conduct mixed-methods research in order to maximize potentials and benefits in integrating social and cultural technologies such as social media, games and mobile lifestyles with demand-side management and interactive feedback mechanisms for a sustainable use of energy;
- The connection between collective awareness on energy consumption and its visualization implies a certain adaptation of devices and energy-related services into existing daily routines and communication patterns mostly pervaded by mobile and social media;
- The design methodology should properly emphasize different scenarios and frameworks to develop and evaluate the effectiveness of social mediated interaction on households' consumption behaviors in both short and long terms.

We think that the mentioned concepts have the potential to extend demand-side management interfaces by integrating energy information into daily life patterns. The idea that interaction and communication design could be applied to enhancing energy feedback and triggering behavioral change, presents a process through which the design of new (social) technologies contributes to interdisciplinary research. In this way, by taking advantage of gameful design, a larger body of practical experiences could build further advancement in bridging the gap between societal goals and individual actions. As future work, an appropriate framework could be implemented in energy services and platforms to promote interest in sustainable energy consumption and corresponding behavioral changes (e.g., Scheutle et al., 2005).

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