
Competitive Carbon Counting: Can Social Networking Sites Make Saving Energy More Enjoyable?

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Abstract

This paper reports on the design, deployment and initial evaluation of “Wattsup”, an innovative Facebook application which displays live data from a commercial off-the-shelf energy monitor. The Wattsup application was deployed and trialled in eight homes over an eighteen day period in two conditions - personal energy data viewable and friend’s energy data viewable. A significant reduction in energy was observed in the socially enabled condition. The paper argues that socially-mediated discussion and competition made for a more enjoyable user experience.

Keywords

Energy Saving, Persuasive Technology, Sustainability, Social Networks

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous. J.4. Social and Behavioural Sciences: Psychology

General Terms

Design, Experimentation, Human Factors



figure 1. The Wattson energy monitor from DIY Kyoto

Introduction

It is generally acknowledged that current levels of energy consumption are not sustainable [14]. Domestic households alone are responsible for 30% of the UK's total energy consumption [7] and, since 1970, household energy demands have grown by 32% [16]. Rising energy consumption currently still results in increased CO₂ emissions – hence domestic energy consumption is very much a world problem e.g. [12], [20].

It is increasingly recognised that interaction design can be exploited to address issues of sustainability, e.g.[2], [17], and indeed there has been a good deal of previous work conducted by the HCI community in the past decade on persuasive technology in general e.g. [13],[11]. However Fogg recently noted that persuasive technologies very often fail and urged practitioners to think small in terms of initial behaviour change goals [10]. Monitoring technologies alone (e.g. energy meters) are often not enough to make meaningful changes in behaviour. This paper draws on work on persuasive technologies as well as on the emergent popularity of online social networks (OSNs) in order to address concerns over domestic energy consumption.

Background

Numerous studies have demonstrated that energy usage falls when people know it is being monitored [1]. Research by the environmental psychology community has indeed shown that feedback on energy consumption can achieve behavioural change - though it is not necessarily sustained without timely reminders [6],[9]. The goal of the work described here, therefore, is not just to effect behavioural change but to demonstrate larger reductions in energy

consumption through the addition of a social normative influence [19].

Smart Meters

The Wattson home energy monitor is a standalone monitoring device, see figure 1, which is designed to raise awareness of domestic energy consumption by means of its display and bundled PC software. It is an off the shelf 'smart-meter' technology which takes readings from an electricity meter via a wireless sensor and displays the information as real-time energy usage data.

Facebook

The social networking site Facebook now has over 300 million active users [8]. Studies of Facebook have demonstrated that users read other people's postings, play games, upload comments on photographs and add to their own 'profile' many times daily [15]. These sites provide a powerful means of delivering small, asynchronous applications to peer groups of likeminded real-world friends in a manageable and pleasant way. There may then be potential in leveraging the engaging power of small applications, offering rich social interactive features to help change energy behaviour.

This study aimed to address a gap in current work by embedding live, continuous energy data into a fully interactive socially-enabled energy application. Using the Facebook Developers Kit (FDK), Wattson devices were linked to Facebook allowing us to investigate whether sharing live energy information between friends might make for further reductions in energy consumption.

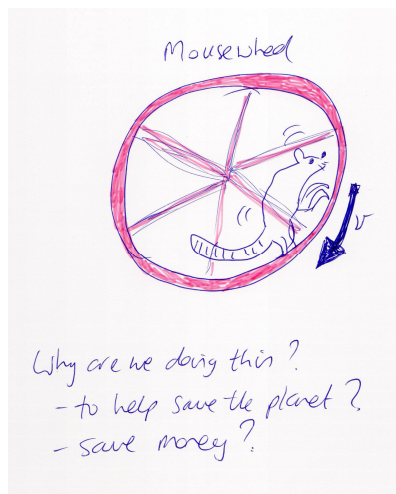


figure 2. Example sketch developed in the focus group

Design Process

Focus groups were conducted with a convenience sample of four Facebook users aged between twenty three and thirty eight. There were three males and one female and all were responsible for paying their energy bills in their own homes. Discussions took place in a custom built responsive home on campus at a university and helped the participants focus on the home as a design space. An example of one of the focus group designs is illustrated in figure 2.

Emoticons were a primary design element derived from the focus group, see figure 3, to convey an injunctive social norm message [19]. These communicated either approval or disapproval of the householder's energy usage based on UK statistical energy averages. The emoticons ranged from good 'green smiling', average 'orange neutral' and bad 'red sad'.

Much of the discussion revolved around the difficulty of relating to the kilowatt as a unit of energy measurement: "Kilowatts, watts, I don't want to see any of that, money yes". It was generally agreed that introducing a competitive element between friends who were free to opt in or out of the group might help drive a reduction in consumption.

Implementation

Following discussions in the focus group the main interface attributes for displaying energy in the WattsUp application would be expressed in Watts and UK £ sterling as well as CO₂ emissions measured by weight. Additionally, the emoticon graphical representations were selected for displaying alongside their numerical counterpart values for energy and CO₂ emissions.

Three core interfaces were developed to provide an engaging user experience: My Energy, Friends and Rankings. The 'My Energy' interface, as shown in figure 3, would show a user's personal energy consumption with a dial visualisation and a seven day history bar chart. The 'Friends' interface would display personal energy consumption against selected friends, introducing social sharing of energy information.



figure 3. My Energy: Workshop sketches and final design

The technical implementation of WattsUp in conjunction with the Wattson energy monitor is shown in figure 4. The diagram illustrates a wireless sensor at the householder's fuse box sending the current energy reading to the Wattson display. The display is physically connected to a PC via a USB cable which transmits energy usage data online via desktop software to the myenergyusage.org web service. Using this online storage method the energy data is available to third party applications such as WattsUp using standard XML.

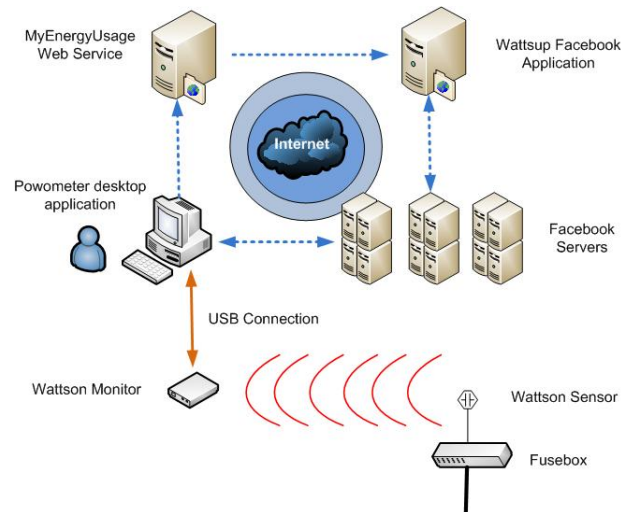


figure 4. Technical Implementation of the Wattsup System.

Experimental Method

Aim

The aim of the study was to see if energy savings could be increased by the addition of a social element to energy monitoring. To this end, we made a socially enabled version of the Wattson energy monitor via Facebook. The hypothesis was that less energy would be used whilst the Wattson was socially enabled than when it was not socially enabled.

Participants

Eight households were recruited to trial Wattsup over 18 days. The lead participant from each household was responsible for paying the electricity bill and was a daily user of the Facebook website. In total the participants belonged to households with 6 couples and 2 families of four, so twenty people in all were involved in this study.

The lead participants had all been regular users of Facebook for at least one year and were all friends who were on one another's Facebook friends list.

Design

The experiment followed a within subjects design [3] due to limitations on participant numbers and available energy monitors with each participant taking part in two conditions or social modes. In condition A the Wattsup application was socially enabled, i.e. users could see their friends' data as well as their own, in condition B the Wattsup application was manipulated so that there were no social features i.e. users could only see their own energy usage. The households were divided into matched groups and the conditions were counter-balanced between the groups to avoid ordering effects [3]. Group 1 started in condition A, group 2 in condition B and switched conditions halfway through. Semi-structured interview data was taken at the end of the study to help gauge the participant's experience.

RESULTS

The energy usage, in kWh, in both conditions for each household is summarised in figure 5. A Wilcoxon test, for comparing repeated measures of non-parametric data, showed that energy consumption was significantly lower when using the socially enabled condition of Wattsup ($Z = -2.1$, $N = 8$, $p = 0.036$).

A total of 130kWh units of energy were saved by the participants in condition A as opposed to condition B. This amount of energy would be expended by leaving a 60W bulb on for 9 days and result in Co2 emissions similar to those produced by driving an average UK petrol car for 399Km.

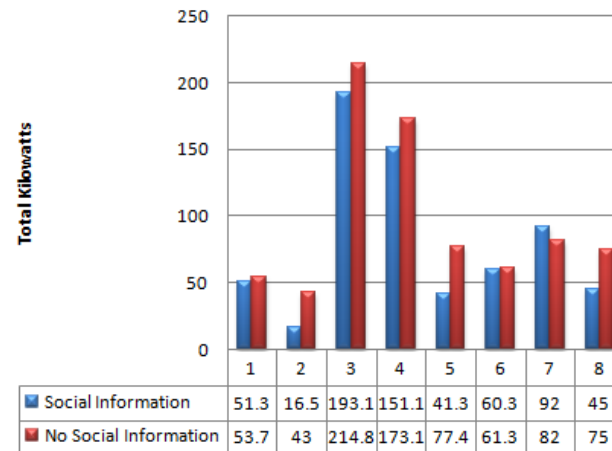


figure 5. Wattsup participant energy usage in each condition

DISCUSSION

One UK study has claimed that sustained behavioural change with domestic energy consumption was unlikely to alter until more than 3 months had elapsed [6]. However, the energy feedback in that study was not delivered within a socially enabled context; therefore it is possible that the claim of 3 months minimum for energy usage behaviour change may not hold when a contemporary online social network is used to deliver the feedback. Due to time constraints and resources available this project could not address the experiment duration issue for sustained behaviour change.

The interview data indicated that all of the participants enjoyed participating in the social condition: *"I preferred the second one (socially) because I am quite competitive, it gave me further incentive. I think putting a bit of fun in it is quite important"*. The competitive attribute was mentioned by several of the

participants as being a motivating factor in reducing their energy usage.

An important issue in the development of energy applications that share information are privacy concerns. A recent US home energy study received feedback from participants regarding privacy issues and how other people, possibly in their own neighbourhood, could make inferences about their lifestyles by their energy consumption [4]. This does raise legitimate ethical and privacy concerns in how the Wattsup application shares information between users and presents a challenge in how to integrate fine grain control over sharing energy data. Interestingly, the issue of privacy when using Wattsup was not highlighted by any of the participants taking part in the experimental part of this study. However, similar to the privacy issues in the aforementioned US study, concerns such as *"The risk of failure in front of your friends."* and *"Not sure if I would want to compare to others"* were discussed in this studies focus group.

CONCLUSION

The paper has described the design, deployment and evaluation of a Facebook application designed to allow friends to compare their domestic energy consumption.

The results of the energy data collected from participants in this study suggests that social networking sites may be able to play a role in reducing energy consumption in the home by making monitoring more enjoyable. This was a small scale study and only a larger investigation could conclusively determine how effective such applications may be. However, these results are encouraging.

Social networking sites like Facebook and Twitter are increasingly being appropriated by users for political and social ends. Facebook is of course primarily for fun but it may be that the enjoyable aspects of the service that make for effective platforms for persuasive technologies.

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