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# Using Social Network Games to Reduce Energy Consumption

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## ABSTRACT

This research is investigating the potential role of online social network based life simulation computer games as a persuasive tool for encouraging users to reduce their domestic energy consumption. Games such as 'Farmville' which runs on the Facebook platform have attracted millions of users worldwide who create simple virtual worlds where they interact with others and carry out everyday activities to earn tokens to spend within the game. Applying a User Centred Design (UCD) and in particular persona based design approach, this research is investigating why users find these games so enticing, the characteristics of those who play them, and the context in which they are played. Through an iterative UCD process, a life simulation game will be designed with users who represent a number of key 'gamer personas' in order to research how this sort of game could be used to encourage domestic energy saving behaviours.

## Author Keywords

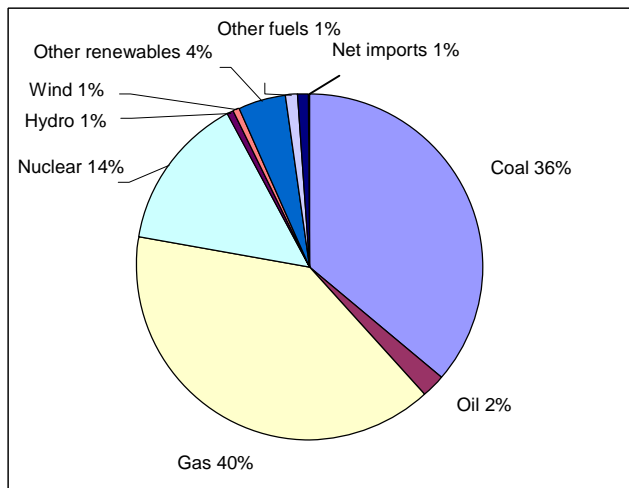
Energy saving, online social networking, persuasive games, behaviour change, user centred design

## BACKGROUND

For long years mankind has been using natural resources, from making a bonfire in order to keep the nomad group warm during the night to recharging a mobile phone battery, a large number of human activities involve the production of CO<sub>2</sub>. The increase of the earth temperature can have different sources, but there is no doubt that the human activity plays an important role in this process. More CO<sub>2</sub> released to the atmosphere means more greenhouse gases, and consequently higher temperatures.

The UK government has, in order to reduce the greenhouse effect, set a self target of 34% reduction on carbon emissions by 2020 (UK Low Carbon Transition Plan 2009). Some suggest that this figure should be at least 42% to have any real impact on climate change (Tyndall Centre for Climate Change Research 2009).

The efforts from the government, companies and communities trying to reduce energy consumption are not showing important changes within the UK, the use of fossil fuels for electricity generation is increasing (DEFRA 2009), and coal, gas, oil and other fuels are already responsible for about 80% of the total energy generation in the UK.



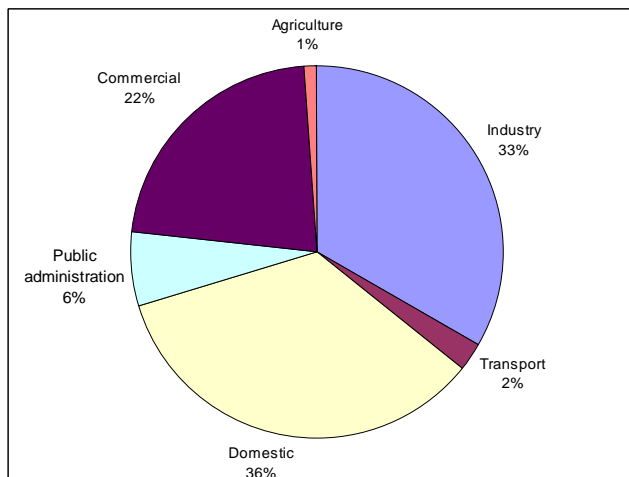
Graph 1: Fuel used in energy generation – (DECC 2009)

The domestic sector electricity consumption share in the UK is about 36% of the total power supply (graph 2). For that reason, any effort that leads to expenditure reduction among households will have an important effect on the overall consumption, helping the whole country to decrease the energy use and consequently reducing CO2 emissions.

Energy use in the domestic sector can be reduced by applying three different measures (Wood, Newborough 2003):

- Making houses more energy efficient;
- replacing appliances by energy saving ones;
- Changing people's behaviours related to energy use.

The energy efficiency of a dwelling can be increased by refurbishing properties, using energy saving measures such as double glazing or cavity wall insulation, or even replacing the houses with more efficient ones. But the refurbishment of a house involves a large expenditure from the owner, and sometimes the house is occupied by a tenant, who is not inclined to such commitment. Some houses do not allow the use of new energy saving measures, specially the old ones, which were built using the not very efficient techniques and materials available at that time.



Graph 2: energy consumption by sector – (DECC 2009)

Regarding home appliances, a study shows that households intend to install less than one third of the energy saving measures recommended by a home information pack, and concentrate just on the less compromising actions such as replacing filament light bulbs for more the efficient compact fluorescent bulbs (Parnell, Popovic Larsen 2005).

For these reasons, people will have to find different ways to save energy in these dwellings. The human aspect of energy use plays an important role on conservation and expenditure. Considering the constraints of the previous items, the third aspect represents an activity that can be less expensive and more feasible, however levels of awareness, commitment to energy saving measures and personal preferences vary enormously from one person to another.

UK households are currently exposed to several campaigns trying to motivate them to spend less. These measures come from various different areas from leaflets to metering systems.

The Energy Performance Certificate (EPC – figure 1), similar to the labels used on fridge doors and on new cars, displays the building energy efficiency and includes a recommendation report, providing information about ways to improve the energy performance of the property. Researches show that this information often fails to persuade householders to adopt energy saving measures (McGilligan, de Wilde et al. 2008) and needs to be improved before it stimulates significant behaviour change (Parnell, Popovic Larsen 2005).

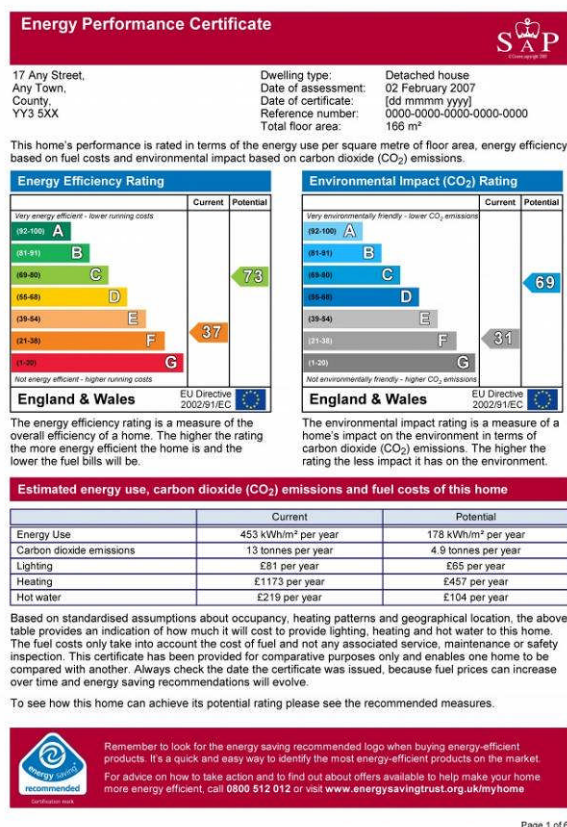


Figure 1: Example of an energy Performance Certificate – EPC – (Communities and Local Government website 2009)

Some energy suppliers provide users with bills containing graphs and even comparisons with past months or years, which can be useful for raising energy use awareness. However, the presence of this information varies from supplier to supplier, the type of metering system, the location and the bill frequency. In addition, some consumers receive their bills quarterly, making it difficult to keep track of the expenditure or relate their behaviour to actual expenditure. Often the supplier does not actually read the meter but simply sends the bill containing an estimated value based on past readings. People therefore may not know what to do to save energy, and feel powerless to act on the information given. They rarely link energy use to specific appliances, services or more importantly, practices.

In an attempt to reduce these problems and make the billings more accurate, the government has promised that every home in the UK will be fitted with a smart meter by 2020. A smart meter can check the consumption automatically and send it to the supplier. This can facilitate data gathering by the suppliers and will reduce the problems that estimated bills cause, but it does not make the consumer more aware of the energy consumption associated with particular appliance or practices.

Several studies show that feedback can play an important role helping people save energy (for example Anderson, White 2009, Darby 2006, Yun 2009). Since most of the time consumers are not aware of how much electricity they are spending, energy monitors are being introduced to show the consumption in real time. These devices, also known as ‘smart displays’, can allow people to view the energy expenditure on a screen. They often consist of a sensor attached to the mains and a wireless display that can be put in a convenient place. One of the problems with those devices is that most of these displays were not designed using a user centred approach, so they lack usability and miss the chance to deliver the information in a meaningful form (Anderson, White 2009). Households may be resistant to installing these devices as there is an initial cost and some require monthly payments. Another issue is that the consumer needs to interact with the smart monitor repeatedly in order to learn how much electricity each appliance uses and consequently discover how consumption can be reduced over time.

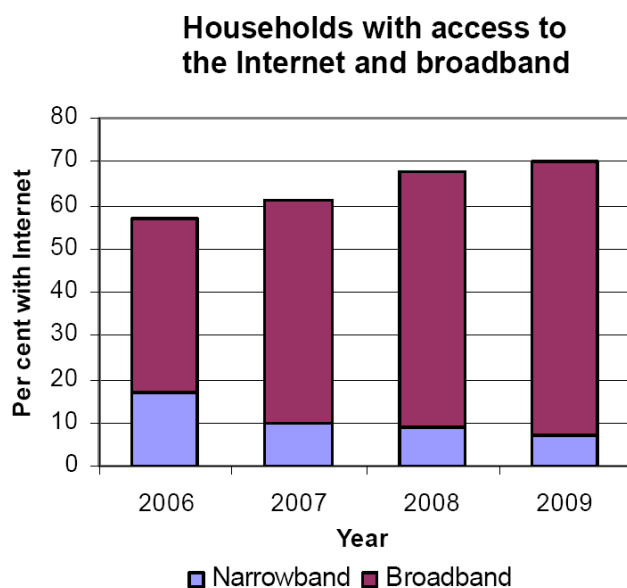


Figure 2: examples of smart displays (Anderson, White 2009).

### INCREASING ENERGY USE AWARENESS

Educational and persuasive technologies can be used to increase energy use awareness, change people’s behaviour and encourage them to commit to more environmental friendly actions.

The use of information and communications technologies (ICT) is proven to be able to influence our actions (Fogg 2003), and a well designed online environment can be effective and at the same time fun. 70% of British homes have Internet access (graph 3). Youngsters are the most connected people, with 96% of the 16-24 age group accessing the Internet recently. Another interesting fact is the rise of Internet use among every age range, especially the 65 plus, which increased by 15% from the previous year (Statistical Bulletin 2009).



Graph 3: Households with access to the Internet and broadband – UK (Statistical Bulletin 2009).

### **Using games to encourage energy saving behaviours**

Frequently videogames are seen as purely leisure activities, time wasters or even a bad influence on teenagers. Research relates exposure to violent video games to violent behaviour (Bartholow, Sestir et al. 2005). On the other hand, video games with prosocial content can lead people to be more helpful after playing (Gentile, Anderson et al. 2009).

Some games exist to specifically teach something to users including military training games, medical virtual models and flight simulators.

“Games-based learning takes advantage of gaming technologies to create a fun, motivating, and interactive virtual learning environment that promotes situated experiential learning.”  
(Tang, Hanneghan et al. 2009)

There is already interest in researching how games can be used to encourage energy saving. The PowerHouse, for example, is a simulated environment that models energy consumption of different activities in a home. The researchers believe that the game has the potential to increase energy use awareness, and the subjects will be tested later regarding their energy use in the real world (Bang, Torstensson et al. 2006).

The widespread use of the Internet enables game playing from virtually any computer connected to the web (Deal 2008). A web browser containing the Flash Player plug-in is present in almost every computer, and this is generally the only software requirement to run an online game. These contemporary developments helped to ease the coupling constraint that once restricted consumption of digital games. Players no longer have to connect a console to the TV, in the living room, to play a game anymore. Play is now likely to take place on work and home PCs, on mobile and handheld devices allowing gaming to be both an intense absorbing activity and a time filler between other activities.

### **Online social networking**

Internet based social networks are places where people share their profiles and are linked by their relations, interests and activities.

Recent research (Mankoff, Matthews et al. 2007) has tried to prove that social networking can be used to motivate individuals to reduce their ecological footprint. Leveraging websites such as Myspace, they created an information display that appears on friends' pages telling about how well they and the people in their social network are reducing their ecological footprint. They believe that both frequent feedback and group membership are important sources of motivation.

### **Facebook game application**

Statistics show that Facebook is the first social network on the top 10 visited websites (Nielsen Netview 2009) and has more than 350 million active users (Facebook 2010).

Most of the popular online social network sites today allow users to communicate using several tools, publish photos, post notes and install applications. Facebook applications are third-part software that run embedded on the website pages. The system notifies its members about the applications their friends install and use. In addition, the applications themselves can prompt the user to publish a note on friend's walls inviting them to install the application too (Gjoka, Sirivianos et al. 2008). These messages can constitute a normative aspect during this interaction online. Research shows that when a message contains a fact or some information telling how some people behave (the normative component), it can have a strong influence on the people who read this message (Goldstein, Cialdini et al. 2008).

One of the fundamental interactive aspects of Facebook is the possibility of building and publishing external applications. There are more than 500,000 active applications currently available on Facebook Platform (Facebook 2010). The user's engagement with these applications can easily be seen by the figures of the top most installed on people's profiles. From the top 25 applications chart, 23 are games (Inside Facebook 2010).

Farmville is a life simulation game where users manage a virtual farm growing vegetables, milking cows and collecting eggs. It has more than 73 million active users. The most successful applications encompass some of the motivations for game playing shown on a recent study, including socializing, relationship, teamwork, discovery, role-playing, customization and escapism (Yee 2006). These games also rely on the long term commitment, as people engage for months or even years playing it repetitively.

## **THE PROPOSED GAME**

The proposal for this study is to design an online life simulation flash game that would run on Facebook. The game will be used to investigate which elements of such games can be used to improve energy saving awareness and reduce domestic energy consumption.

The exact nature of the game will evolve as the research progresses, but the mechanics would be similar to other games freely available on Facebook. The main objective will be to 'level up', and this is likely to be achieved by saving coins and gaining experience. Sharing progress and knowledge with others users within the social network is predicted to be an important and persuasive feature of the game. However, how to most effectively achieve this will emerge from the UCD research.

## **METHODOLOGY**

This research will utilise tools and methods from the human-computer interaction field, including user-centred design and a persona driven approach, divided in three phases as follows:

The first phase of the research will focus on understanding current online game players who regularly play life simulation games on Facebook: who are they, why do they play, when and where do they play, for how long and what elements do they like. This data will be gathered by a combination of face-to-face and online interviews. With this data will be possible to break those users into a set of persona groups, and then optimize the design to meet the needs of particular types of gamers (Canossa, Drachen 2009).

The following phase will involve an iterative, participative design process with prototypes to explore which game elements might motivate users within a number of selected persona groups to play and persuade them to change their domestic energy consumption behaviours.

Later, the final product will be tested among target users. Energy use awareness questionnaires will be administered before and after the interaction, and for a more limited number of participants, changes in actual energy use in their homes will be monitored using a smart metering system.

## **RESEARCH QUESTIONS**

This research is investigating whether online life simulation games embedded within a social network application such as Facebook can be used to raise energy use awareness amongst game players. In particular it addresses the following research questions:

- Why do people play online life simulation games within the context of social networking?
- What elements of these games make them particularly attractive to users?
- Which persona types are most likely to be persuaded to reduce their domestic energy consumption through playing an online life simulation game?
- How can this knowledge of users and why they play be used to inform the design of a game that increases energy use awareness and reduces actual energy consumption in the home?
- To what extent will gamers related to the selected persona groups increase their real life energy use awareness after playing this simulation game?
- Will this increased energy use awareness result in behaviour change in real life?

## **CONCLUSION**

Ways to change people's behaviours regarding domestic energy use must be found in order to reduce CO2 emissions. It is believed that building an online life simulation game which runs on the Facebook platform could provide a good environment to try to increase energy use awareness and lead to behaviour change for selected persona groups. With the understanding of why such games are so appealing and from a UCD perspective, this research aims to create a persuasive social and fun environment for encouraging energy use awareness and ultimately behavioural change.

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