Leveraging the engagement of games to change energy behavior

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Abstract

In this paper we present an ongoing research project that seeks to improve home energy behavior by connecting it to gameplay within an online multiplayer game. Overall, the project seeks to examine how the engagement mechanisms common in popular games may be leveraged to promote desired real-world energy behaviors among players. By inputting real world home energy data into a compelling social game, such information may be transformed into a more palatable and relevant form of feedback. Further, by tying energy-friendly real-world behaviors to in-game rewards, users may be incentivized to complete them. A completed game prototype, *Power House*, is described, and will be available for play during the workshop.

Keywords

games, engagement, feedback, energy behavior, choices

ACM Classification Keywords

H5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

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General Terms

games, engagement, feedback, energy behavior, choices

Introduction

Recent estimates are that 22% of home energy use could be eliminated if people were more discerning with their energy behaviors – for example, electing to use energy efficient light bulbs or remembering to adjust thermostats and turn off lights when not in use [1]. Further, consumption reductions may be substantially more effective than many supply side solutions. Recent research suggests that a 10% reduction in energy use could decrease fossil fuel consumption by an amount approximately equal to a 25-fold increase in wind & solar power or a 100% increase in nuclear power [2].

To this end, billions of dollars have been spent on smart grid and smart meter technologies, based on the idea that people will use new energy information to make wiser energy decisions. However, despite the availability of rich mines of data, there is still a problem: the process by which consumers interact with this data is not engaging. The information is dull, the interfaces are complex, and the feedback is temporally distanced from behavior (Figure 1.). As a result, incentives for the users are unclear.

Further, because it is dull and time-delayed, energy information stands little chance in competition with richer, livelier media. Indeed, the delivery, presentation, and context of energy information has much to learn from television, movies, and social network and particularly game applications.



Figure 1. A sample of current interfaces for displaying home energy data

Games as Engaging Interfaces

Popular game environments offer insight for energy applications. Games engage people with <u>elements</u> like self-representation, timely feedback, community connections, ranks and levels, teams, virtual economies, and compelling narratives [3]. A multiplayer game that connects such elements to the information gathered by home smart meters could prove more engaging than current UIs. Indeed, many previous attempts to apply games to serious contexts – health, business productivity, learning – have proven successful for firms such as IBM, Cisco and the U.S. military.

The game mechanics listed above can be leveraged to structure and incentivize energy efficient behaviors. Such a game would track home energy use, then input that data into game interactions. Such a media experience would mix the real and the virtual, allowing a player's home, and actual behaviors in the home, to function as a joystick for gameplay. Further, game play can include established real world social networks.

Power House: The Energy Game

To test this idea we constructed a commercial-quality multiplayer game experience *- Power House -* based upon ongoing research conducted at Stanford University in the areas of psychophysiology, neuroscience, and game mechanics [4].¹

Power House is an online game that connects home smart meters to a game that is grounded in real world social networks. Player energy use is tracked via personal accounts with local energy providers. This information is then inputted into the game environment, where it influences the player's in-game abilities, and has consequences for player options, rewards, and reputation. Real world energy behaviors produce particular in-game advantages and disadvantages, transforming otherwise dull and distant information into feedback that is palatable, timely and relevant.

Dashboard

The Dashboard functions as the main informational display for players (Figure 3.). Similar to many current energy information UIs, the Dashboard allows players



Figure 2. The title screen from the multiplayer energy game *Power House*

to view a graph of the last 24 hours of their home energy data, as well as compare the current consumption level to saved historical data. Unlike common UIs, the *Power House* Dashboard also contains a full summary of the player's in-game status.

In addition to setting a profile icon, players can view current scores, the results of competitions with other players and teams, and the number of virtual credits earned (a synthetic currency that can be spent either on virtual items or real world rewards provided by energy-minded companies and foundations).

Several other components of *Power House* are accessible from the Dashboard. Players can open the Chat Forum to make comments or answer questions posed by the player community. Additionally, players are able to view a visual display of their friends in the

¹ The Power House game was initially developed at Stanford University by Byron Reeves and was funded by the ARPAe Program in the Department of Energy. The design and commercial production of the game is part of a collaboration with Seriosity, Inc. (<u>www.seriositycom</u>) and Kuma Reality Games (<u>www.kumagames.com</u>).



Figure 3. The player Dashboard in Power House, from which users can access personal energy data, in-game performance leaderboards, and a chat forum. From the Dashboard players can also issue energy challenges to friends and report real world energy achievements.

virtual *Neighborhood* (Figure 4.). This screen presents player achievements, as indicated through in-game items such as solar panels or windmills on their ingame houses.

Further, players can access the *Leaderboard* display in order to compare rankings of their individual or team performances to those of their online friends. (Indeed, *Power House* permits players to invite members of their social network to play using *Facebook Connect*.) Additional features of the Dashboard allow players to



Figure 4. Players can view their virtual Neighborhood, which displays the virtual homes and accomplishments of their social network of friends.

cash in virtual credits, challenge friends to real life energy competitions, and to also report the completion of real life energy challenges for further points and rewards.

Gameplay

The *Power House* game experience is comprised of multiple online mini-games. In one such game, the player helps members of an onscreen family navigate through their house and complete common daily activities including cooking dinner, washing laundry,

exercising, watching television, and surfing the web. To do this, the player must turn on (and more importantly, turn off) lights and appliances, all the while observing the amount of electricity each action requires. The gameplay increases in difficulty as each additional member of the virtual family arrives home and the player must keep track of the actions and desires of each. Players learn about energy requirements of different actions as they play. Periodically, play is interrupted and players are offered an opportunity to learn more about energy and to challenge other players to save energy.

The objective of play is to satisfactorily track and assist each virtual family member for as long as possible. Scoring is based on the player's ability to minimize the amount of energy consumed by the family. Notably, the information provided about the virtual energy consumed (including the amount needed per appliance, the amount needed based on time of day, and crediting for swapping out old appliances for Energy Star replacements) accurately reflects real world levels.

Research Experiment & Schedule

Research trials designed to evaluate the relative impact of *Power House* on home energy behavior (as compared to more customary energy information interfaces) are set for spring, 2011. Trials are anticipated in both the U.S. and Europe. Participant sample populations will be matched across treatments on factors including socio-economic level, geography, and family size to control for variations in weather and baseline energy consumption levels.

Preliminary results should be available by the CHI workshop date. This will mark the first presentation of

the game at an industry-academic venue. A public URL will be made available at the conference workshop.



Figure 5. One of the online mini-games found in *Power House*. Players must help a virtual family minimize energy consumption as they go about their daily household routines.

Citations

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