Evaluating a Social Media Application for Sustainability in the Workplace

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Abstract
The goal of this research is to investigate the benefits of using a web-based social network to promote energy awareness, and influence energy-saving behavior of typical office workers. We propose that a social network integrated into the workplace environment — allowing people to track their own energy-related activities, to share this information, and to view and react to peers' activities — can take advantage of social influence to positively affect behavior. We are currently developing a prototype of such an application through iterative design. In the final phase of this work we will conduct experiments with a large number of subjects to test the ability of this application to influence attitudes and behaviors of office workers, and for providing a platform for commercial building operators to better communicate with occupants.

Keywords
Sustainability, social media, energy feedback, social networks, eco-behavior, persuasive technology

ACM Classification Keywords
H.5.2. Information interfaces and presentation (e.g., HCI): User Interfaces

General Terms

Design, Theory, Experimentation, Verification

Introduction

The explosive growth of social media in the recent past has created new online destinations for people to engage in social dialogue and interaction, information exchange and collaboration on a variety of topics. Given the current concern with the environment and sustainability, it is not surprising that a number of social media sites have emerged that are devoted solely to conversations on energy conservation and green lifestyles [6]. Despite the growing number of such sites, it is not clear how many of them are successful in mustering the participation that is necessary for societal change. Previous research shows that an important prerequisite to societal change is mobilizing the structures that influence people's attitudes and behavior [7].

The goal of this research is to understand how a social media network integrated into the work environment can be used for promoting energy awareness and energy-saving behavior in the workplace. Our previous research suggests that there are potential uses of such applications in influencing people's energy-related attitudes and behavior, and improving communications to positively impact the operations of commercial buildings. We propose that a social network integrated into the workplace environment — allowing people to track workplace energy-related activities, to share this information, and to view and react to peers' activities — can take advantage of social influence to positively affect behavior. In other words, the social characteristics of our proposed application make it a *persuasive technology* [4] that largely capitalizes on normative social influences to shape participant attitudes and behavior [8][1].

Motivation and Significance

This abstract describes the current phase of work for a multi-year study on visualizing information in commercial buildings. The work is being conducted by UC Berkeley with funding from the California Energy Commission's Public Interest Energy Research (PIER) Program.

In a previous phase of work, our research team conducted surveys, interviews and contextual inquiries to understand the energy information practices, needs and preferences of various categories of users in a commercial building [9]. We studied two broad user groups with diverse information needs and practices: (1) expert users such as building and facility managers, owners, architects and design engineers; and (2) general workplace occupants. Expert users are typically involved in energy monitoring and analysis. For these users, feedback on energy consumption patterns in buildings provides increased opportunities to assess and improve overall energy performance. In contrast, the general workplace occupants are not involved in energy management roles. They are typically consumers of energy and do not have the ability to manage the energy building's usage patterns. While they can affect personal energy use to a certain extent by turning off lights and equipment, or adjusting thermostat and computer energy settings, these users have very limited or no control over the building's overall energy performance. The main findings from our study were:

- While a majority of occupants have access to some building energy information, they view it infrequently

because this feedback is not integrated into their daily lives. Our findings are reinforced by other research [3], which argues that for energy feedback to be effective, it needs to be immediate, easy to act on and interactive.

- A large percentage of workplace occupants report taking actions to conserve energy at work, and that they would make more of an effort if they had information about the amount and associated cost of energy they use. This suggests that information feedback that is both relevant and actionable may have great potential in benefiting people's energy conservation efforts.
- Over 90 percent of the expert users we surveyed express a desire for a more systematic way of communicating with the workplace occupants. The most common ways these expert users get feedback from occupants is through discussions with occupants, email, phone, anecdotal information, and via complaints logged in a building management system. A shortcoming of these communications is that they primarily provide one-way communication from workplace occupants to building managers. Although these sources allow workplace occupants to register their individual feedback, they remain largely unaware of peer concerns.

In response to these findings, we envision a forum where the workplace occupants and managers can collaboratively discuss issues related to the workplace environment, including energy use, problems, and solutions. We hypothesize that a social media network, on the scale of a single office building or corporate campus, can provide such a forum, and may offer multiple benefits to both office workers and building managers, and may be used to encourage sustainable workplace practices. This hypothesis is based on the grounding principle of social media networks — that they provide the structure necessary to support social interactions that can shape attitudes and behavior of a community [7].

This research project, currently underway at UC Berkeley, explores how a social media network may facilitate communication between workplace occupants and building managers. We will investigate how this platform:

- Makes the workplace occupants more inclined to report problems, give feedback on their comfort levels, satisfaction, etc.
- Enables workplace occupants to monitor, share, and compare their personal energy use.
- Encourages energy-conserving behaviors, particularly when social and emotional rewards for eco-behavior are built into its design.
- Provides greater opportunities to building managers to improve buildings' energy performance by offering insights into occupants' attitudes and behaviors.

Design

We are currently proceeding with the design of our social media application, which we have tentatively dubbed the "Green NetWork." We began our design process by creating storyboards that highlight various scenarios of use, and sketches that roughly depict page functionality. We are currently iterating the design of our low-fidelity prototypes based on the results from preliminary expert reviews. The target users for this application are typical occupants of commercial

buildings including; (1) building managers and; (2) the general workplace occupants.

Each workplace occupant may create an account on Green NetWork. A user's account has a newsfeed, profile, and inbox associated with it. The newsfeed featured on the user's homepage highlights relevant activities on the network. The profile includes persona information, a "billboard," groups that the user belongs to, and the "apps" that he or she has added to the profile. A user's persona comprises basic demographic information, likes and interests, and social components such as badges earned on energy-related activities. The billboard displays recent posts, including problems, questions, tips, links, events, and surveys. In addition to making a post, users can comment on posts in their newsfeed, "like" posts and comments, and "answer" or "join" questions and problems.

Each user is able to create and belong to "groups." In general, groups provide a forum for participants with common interests such as "recycling," "sustainability," etc., to participate in related discussions and events. A tag cloud visually depicts all the existing groups to give the users an idea of current trends and popular topics. In addition, the site uses a recommendation system to suggest groups that might be of interest to users.

Users can also use various energy-related features called "apps" to their profiles. For example, the "my energy goals" app allows users to create, search and sign up for various energy-related goals. Users can rate their performance on their goal on a weekly basis, get "green points," and perform normative comparisons of their goals with others in the network. Other apps we have named "my energy use" and "group energy use" will track individual and group energy use by pulling data from external devices such as wattmeters and building energy management systems (BEMSs), and render the results using interactive visualizations. Users have the option of customizing energy graphs by choosing the type of visualization, parameters to be graphed (e.g., cost, energy per person, comparisons to averages and other people, etc.) and the temporal granularity of the display.

figure 1. Working prototype of the home page with newsfeed.

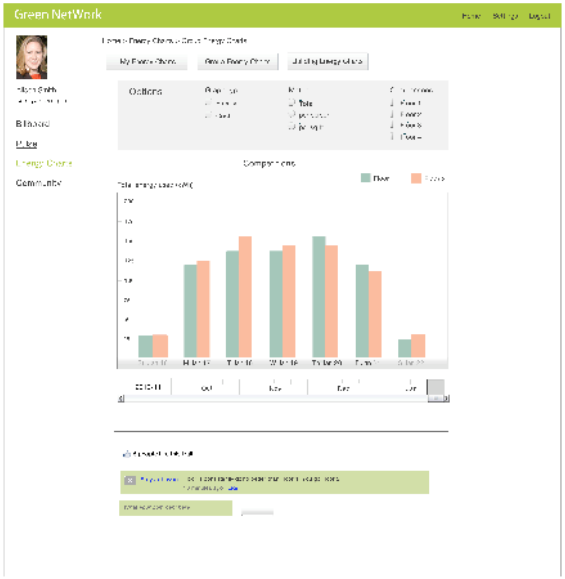

figure 2. Working prototype of the "energy competitions" feature.

Evaluation

The next phase of our research will be to evaluate a clickable prototype of the application by testing it with two sets of users described above, the expert users and typical office workers. We will first conduct usability tests with individual expert users to get feedback about the usefulness of the concept in terms of communicating with office building occupants and tenant representatives. The tests with expert users will be conducted through one-on-one interviews. We will then conduct tests with a larger group of subjects that represent typical office workers, using the resources of the Experimental Social Science Laboratory (X-lab) at UC Berkeley. This group of subjects will be given an introduction to the application, and will have time to browse pages and explore the various features. They will then be asked to respond to a questionnaire with background questions, questions about the usefulness of specific features, and whether they believe that such features would impact their energy-related actions.

Rather than focusing on the usability of the specific design features of the application, the objective of our tests will be to evaluate the value of such an application concept, and its usefulness in promoting energy awareness, energy conserving behavior, and improving communications related to commercial building operations.

Expected Outcomes

A large body of previous research has investigated the value of energy feedback on behavior. While findings from individual studies vary, effective occupant feedback is generally estimated to provide 5-15 percent energy savings in residential buildings [2]. However, these studies did very little in terms of testing various methods for displaying energy information, or for optimizing such displays. In addition, very little research has been done to explore whether occupant feedback and engagement in commercial buildings can reduce energy use. This work also attempts to fill a research gap identified through a comparison of HCI and environmental psychology methodologies [5].

Our work aims to understand how the integration of feedback on energy-related activities with social media applications may affect attitudes and energy-related behavior in the workplace. The proposed occupant engagement application is a *societal interface* [10] in

that it employs social media to address a critical societal problem — energy and sustainability.

Future Work

For future phases of this research we plan to implement a pilot version of an occupant feedback system in several large office buildings, with at least 1000 occupants each. This will allow us to measure the effectiveness of such a system for saving energy, and for helping building managers improve the operations of their buildings.

In the current scope of work, we deliberately chose to design a site that was not linked to popular social networking sites such as Facebook, Myspace, etc., as our goal was to have a single building or campus-scale user group. Looking forward, it might be informative to incorporate some of the features in Green NetWork into business-oriented social networking sites such as LinkedIn. Since one goal of such sites is to promote business relationships, it may be beneficial for a company and/or its employees to enable employees to share activities and results from workplace sustainability programs.

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