

# Dynamic Messaging to Increase Use of Light Switches

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## Introduction

A team from Rensselaer Polytechnic Institute's Department of Cognitive Science and Lighting Research Center plan to investigate the effectiveness of using dynamic message displays to encourage lighting energy savings. The changing messages will be presented on small LCD screens adjacent to light switches in commercial offices. The anticipated energy savings will be a result of office occupants manually switching off lights when they leave the office or when sufficient daylighting is present, at an increased rate compared with offices without dynamic message presentation.

## Planned Experiment

The experiment will consist of measuring the occupancy and light conditions inside commercial offices at Rensselaer Polytechnic Institute (RPI).

In all of the offices, a room occupancy sensor/light logger will be installed to measure and record when the lights are on and when the room is occupied. All of the rooms will be monitored for two weeks without any interventions. Each of the rooms will be randomly assigned to one of three groups:

- The first group of rooms will serve as controls, and no interventions besides the data logger will be made for the duration of the experiment.
- The second group of rooms will have a display unit installed after the initial two-week period, but the unit will display only a static message such as "Turn off the light every time you leave this room," for the remaining duration of the experimental period.
- The third group of rooms will have a display unit installed after the initial two-week period, and these units will display dynamic messages for the duration of the experimental period.

Before and after the experimental period, user surveys will be conducted.

The hypothesis is that both the rooms with the static and dynamic messages will initially show reduced lighting energy use, but the energy reduction in the offices with dynamic messages will be greater and sustained throughout the experimental period.



Figure 1. A microcontroller such as an Arduino (left) and an LCD display will be used to display varying messages to building occupants to encourage them to turn off the lights when appropriate.

## Traditional Switch Plate Messages

Previous experiments have shown that static messages, such as signs or stickers, displayed at switch plates can be effective in reducing energy use. More specific messages to occupants resulted in greater energy reduction than general reminders.

- Rea et al. (1987) provided a general message at the switch plate ("Turn me off"), and observed a 15% reduction in lighting usage in private offices. The reduction occurred even in offices that did not have switch plate messages because occupants encountered labels throughout the building and discussed them with their colleagues.
- Winett (1977-78) used a specific message ("Students and Faculty, Conserve Energy, Turn Out Lights After 5:00 PM or When No Class."), in the fifth week of the study, and this resulted in a 56% reduction in the percent of days that lights remained on in unoccupied rooms.
- Luyben (1980) provided a specific message at the light switch in classrooms in the 11<sup>th</sup> week of the study that "urged classroom users to turn out lights after specified class periods" (in addition to sending a letter to professors who taught in those rooms), and the percentage of time when the lights were turned off rose from 67% during the baseline period to 84% when the message was provided (in addition to the letter), a 17% reduction in lighting use.



Figure 2. An example of a commercially available switch plate sticker (AwarenessIDEAS.com)

## Energy Benefits

The authors estimate that each dynamic message device will use less than 2 kWh of electricity per year to operate.

An average 12' x 10' private office uses 492 kWh/year for lighting. If the device results in a 20% lighting reduction due to the occupant shutting off the light when leaving the room and a 15% reduction due to shutting off the light when there is sufficient daylight, then there will be a 172 kWh per year reduction in electricity use.

Therefore, the net savings is estimated to be at least 170 kWh per year for a small private office.

## Behavioral Science

The planned experiment will make use of several techniques based in behavioral science:

**Dynamic Antecedent Prompts.** To be effective, the message to occupants should be specific, including when and who should turn out the lights. Electronic control over the switch plate message provides the opportunity to be ultra-specific, perhaps even addressing the responsible person or people by name and saying exactly when the lights should be turned out. Also, humorous or whimsical prompts may keep occupants engaged with the dynamic message switch plate.

**Dynamic Feedback Messages.** Winett and Neale (1979) found that feedback techniques were more effective in modifying behavior than antecedent techniques. By monitoring the use of the light switch, the switch plate message can be provided after switching occurs, so it can provide immediate positive feedback to the occupants.

**Variable Reinforcement Schedules.** One issue that has plagued behavioral influence on environmentally related behaviors is a gradual decrease in the desired behavior. This is called response extinction, and it occurs when the response is no longer reinforced by the stimulus. It is likely that traditional switch plate stickers would have some effect on behavior when first posted, but would subsequently be unnoticed by occupants. Ferster and Skinner (1957) discovered a method of overcoming response extinction in rats, called variable reinforcement schedules. The experiment will provide feedback messages not after every time the lights are switched off, but after a variable number of times. It is anticipated that this will keep the occupants engaged with the switch plate message display and will sustain an increased use of the light switch for reducing energy. Variable feedback is a technique that has not yet been applied to persuasion for energy conservation.

## References

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