UCSB Operational Effectiveness: Energy Management Initiative

To determine how to effectively change user behavior, we asked three questions:

1. Which behaviors can be changed to reduce energy use?
2. Which strategies can effectively influence behavior to reduce energy use?
3. How to scale strategies for a campus-wide rollout?

To answer the questions above, a pilot project was conducted from July 2014 to July 2015 in three buildings on campus: the Gevirtz Graduate School of Education (GGSE), the Social Sciences and Media Studies building (SSMS), and the Physical Sciences Building North (PSBN). The program includes a financial incentive where the buildings receive 50% of their annual energy savings and a strategic messaging campaign to encourage efficient behavior. The project objectives include:

- Reduce occupant energy consumption in all buildings on campus.
- Develop an Energy Management Initiative utilizing a financial incentive and strategic messaging campaign to target occupant behavior.
- Pilot the messaging campaign to determine which messaging strategies are effective in reducing energy consumption.
- Present UCSB Utility and Energy Services with a timeline and detailed framework of how to administer the program campus wide.

During the pilot program, we observed energy reductions in all three buildings and significant increases in energy efficient behavior. Overall, the program has shown to be a relatively inexpensive and cost effective way to reduce building energy use. Based on the success of the pilot, we expect a campus wide program to save a significant amount of energy, decrease utility costs, and reduce carbon emissions. This will move the campus closer to reaching the 2025 Carbon Neutrality Goal. By providing UCSB Utility and Energy Services with the necessary information and framework, we hope to see this program rolled out campus wide to keep UCSB at the forefront of campus sustainability.

A cost benefit analysis assessed the program’s financial feasibility on a campus wide scale, and for a campus wide program to be financially beneficial, a 2.5% energy reduction is needed. If a financial incentive is not used, only a 1.3% reduction is required to have a positive net present value. Given the average 4% reduction we saw in our pilot, a campus wide program would reduce utility costs by $260,000 and would reduce CO₂ emissions associated with energy use by about 700 tons of CO₂/year. This savings is enough to equip the hallways of five campus buildings with LED lights and motion sensors, and is equivalent to removing 134 passenger vehicles off the road for a year.

We would like to thank our project advisor Dr. Sarah Anderson (Bren) and our client representative Jordan Sager (UCSB LEED Program Manager) for the countless hours they spent providing us advice and direction in our project. We would also like to thank the following individuals for the time and knowledge they contributed to our project: Patrick Callery (PhD Candidate), Dr. Allison Horst (Visiting Faculty), LabRATS, PowerSave UCSB, and The Green Initiative Fund; Perrin Pellegrin (Managing Partner, Innovative Workshop, Consulting), Dave Auston (Director, Institute for Energy Efficiency), Phil Ebert (PhD Candidate, Psychological and Brain Sciences), Cabe Fletcher (Chemistry Department, Building Manager), Amorette Getty (Postdoctoral Researcher; Staff Advisor, LabRATS), Dave McHale (Associate Director, Utility & Energy Services), and Alex Moretto (Department of Chemistry, Chemical Laboratory Safety Officer).

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1. Which behaviors can be changed to reduce energy use?

The group used circuit sub-metering, a literature review, surveys, and walkthroughs to determine which behaviors to target. These behaviors were targeted because they are relatively easy to change and would save substantial amounts of energy.

- Keep lights off in offices with sufficient natural lighting
- Use computer power-saving settings
- Not using space heaters
- Turn lights off in offices and labs when you leave the room
- Turn off lab equipment when not in use
- Time of use of energy-intensive equipment

2. Which strategies can effectively influence behavior to reduce energy use?

The group developed a range of strategies to influence occupant energy use that were tailored specifically to the type of building (i.e., lab, offices, etc.) and the type of user (more receptive or less receptive). Two types of approaches were utilized: an occupant-based approach and a building approach. In the occupant-based approach, messages were disseminated in the form of posters, e-mails, and handouts to reach as many occupants as possible. These messages provided occupants with information on their energy use and included strategic components. The group used two types of strategic messages, normative and commitment, because they are shown to be the most effective.

In order to test if one messaging strategy was more effective at influencing behavior, each floor was given a different type of message, and different behaviors were targeted each month. We also tested the financial incentive by not informing the social science building of the financial reward and comparing energy use between the education and social science buildings.

Moreover, the financial incentive did not significantly increase the effectiveness of the messaging program, perhaps because GGSE has yet to receive the financial reward.

3. How to scale strategies for a campus wide rollout?

The combination of both occupant and building approaches has reduced overall energy use in our pilot buildings by 4.5%. These reductions were measured in two ways: 1) comparison of monthly energy use during the pilot program to a baseline. The baseline was calculated from the average of the prior two years energy use for that month from building energy meters. Compared to the metered baseline, there was an average energy reduction of 4.5% and 2) using a linear regression to account for factors such as daylight, temperature, weekends, holidays, and breaks to model daily energy use in the buildings. Compared to the modeled baseline, average energy reduction was 4.3%. The images below show monthly energy reductions compared to the metered two-year baseline for GGSE and PSBN, respectively.

Furthermore, surveys and walkthroughs conducted in GGSE prior to the rollout of the pilot program (June 2014) and again during the pilot program (January 2015) indicated increased energy efficient behaviors in the key areas that were messaged: lights off in rooms with sufficient ambient light, use of computer power saving settings and not using space heaters.