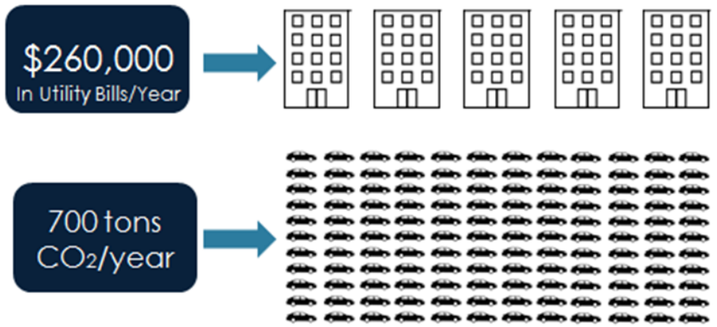
A cost benefit analysis assessed the program's financial feasibility on a campus wide scale, and for a campus wide program to be financially beneficial, a 2.5% energy reduction is needed. If a financial incentive is not used, only a 1.3% reduction is required have a positive net present value. Given the average 4% reduction we saw in our pilot, a campus wide program would reduce utility costs by $260,000 and would reduce CO_2 emissions associated with energy use by about 700 tons of CO_2/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.



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Conclusions

During the pilot program, we observed energy reductions in all three buildings and significant increases in energy efficient behavior. Overall, this 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.

BREN SCHOOL OF ENVIRONMENTAL SCIENCE & MANAGEMENT
UNIVERSITY OF CALIFORNIA, SANTA BARBARA

Group Project Brief

UCSB Operational Effectiveness: Energy Management Initiative

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Background & Significance

At the University of California, Santa Barbara, sustainability is at the core of campus operations and management. Reducing greenhouse gas emissions (GHG) on campus is increasingly important as UCSB is tasked with meeting the UC Office of the President's (UCOP) 2025 Carbon Neutrality Goal. This ambitious goal will be even more difficult to meet due to the yearly 1% growth the campus is expecting through 2025. In most buildings on campus, departments don't pay their electricity bill, creating a disconnect between the users of the building and the cost of electricity, leading to campus utility costs of around $800,000 per month. Although UCSB has invested in many energy efficiency projects, there is currently not a program to incentivize behavioral change. This energy management plan will provide a framework that UCSB Utility and Energy Services can use to reduce campus energy consumption.

Pilot Program

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:

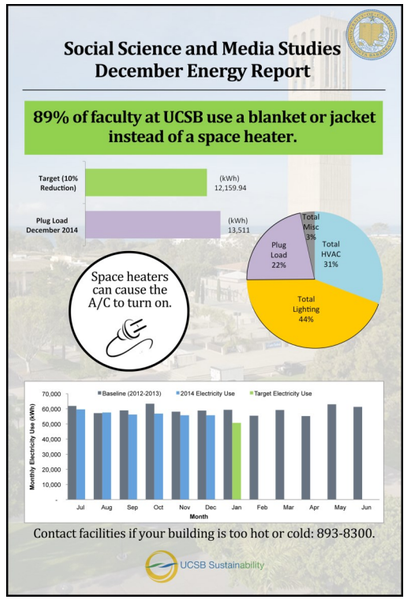
- Reduce occupant energy consumption in all buildings on campus.
- Develop an Energy Management Initiative utilizing a financial incentive and strategic messaging campaign to target occupant behavior.
- Pilot the messaging campaign to determine which messaging strategies are effective in reducing energy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

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.

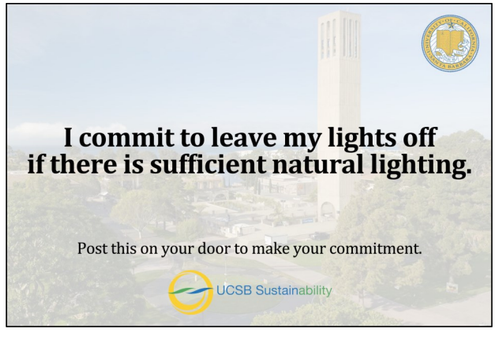
Offices
- Keep lights off in offices with sufficient natural lighting
- Use computer power saving settings
- Not using space heaters

Lab
- 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

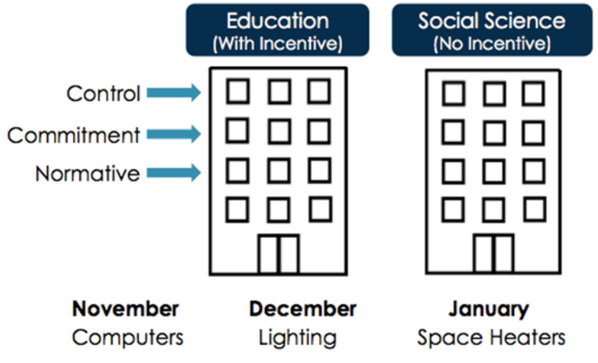


2. Which strategies can effectively influence behavior to reduce energy use?

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.

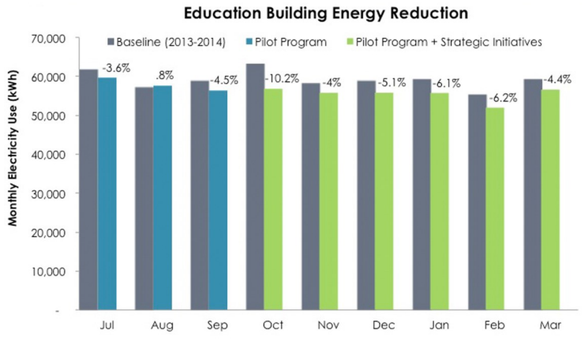


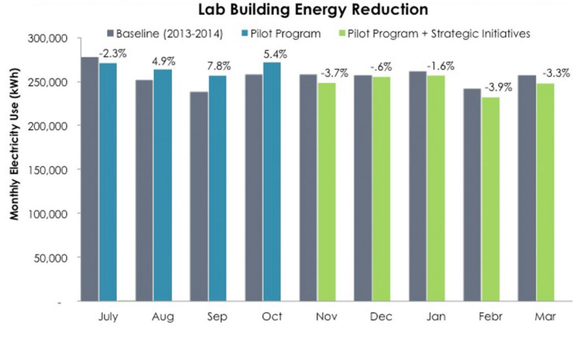
The building approach focused on building inefficiencies that were identified through occupant engagement. Building system changes included turning off outside lights during the day and adjusting fume hood airflows to function at a more efficient rate.

Results

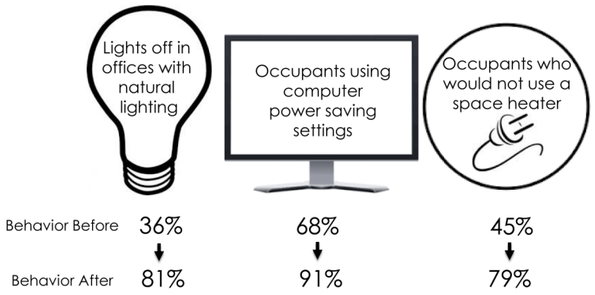
3. How to scale strategies for a campus wide rollout?

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.

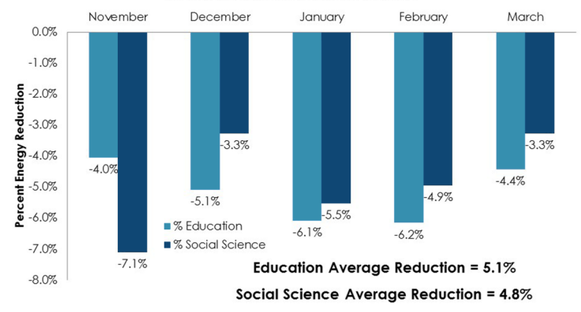




Furthermore, surveys and walkthroughs conducted in GGSE prior to the rollout of the pilot program (June 2014) and again during the pilot program (January 2015) indicated increased energy efficient behaviors in the key areas that were messaged: lights off in rooms with sufficient ambient light, use of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



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



Pilot Energy Reductions

	Meter	Model
Education	-6.0%	-6.2%
Social	-4.8%	- 4.1%
Lab	-2.6%	- 2.7%
Average	**-4.5%**	**-4.3%**