

## **Investigating Energy Efficiency and Conservation Behavior in UC Berkeley's Residence Halls**

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**Abstract** Global climate change is one of the biggest problems facing the current generation. Anthropogenic emissions of greenhouse gases (GHGs) have been one of the main contributors to climate change and 80% of the total worldwide carbon dioxide emissions are energy-related. At the University of California, Berkeley, 70% of the campus' GHG emissions come from buildings alone, especially from those that are in constant use such as the residence halls. Educating building occupants to save energy can help reduce the campus' GHG emissions. Prior studies have looked into educational campaigns and energy use, but does not identifying the real effectiveness of an educational energy program in college residence halls situated in a larger sample size. This study investigated how educational outreach materials would change student's energy behaviors within UC Berkeley's residence halls. I conducted a two-month energy competition called "Blackout Battles" to motive students to save energy and used outreach materials to educate occupants about energy efficiency and conservation. I analyzed total energy consumption of all the participating units and conducted surveys and interviews in order to assess the effectiveness of the outreach materials. The energy data showed a total decrease in energy use by 2.5% during the competition in 2009 compared to a 2003 baseline. The surveys and interviews revealed that educational outreach materials were not an effective way to drastically increase energy efficient practices in UC Berkeley's residence halls because occupants were already practicing energy efficient behaviors prior to the competition.

**Introduction:**

The Intergovernmental Panel on Climate Change (IPCC) reported in their 2007 assessment, “A global assessment of data since 1970 has shown it is most likely anthropogenic warming has had a discernible influence on many physical and biological systems” (IPCC 2007). We are currently feeling the effects of climate change with changing temperatures, rising sea levels and other various environmental changes through the increase of anthropogenic greenhouse gas (GHG) emissions. Industrialized nations account for over 60% of the world’s total carbon dioxide emissions but only account for 20% of the global population (Thomson Reuters 2003). The United States disproportionately contributes 19% of the world’s greenhouse gas emissions but accounts for only 4% of the world’s population (Parker and Blodgett 2008). Globally, energy-related emissions account for more than 80% of the total carbon dioxide emissions each year (People and Planet 2007). In order to combat climate change, energy issues need to be addressed to reduce GHG emissions.

Buildings in the United States are one of the nation’s largest consumers of energy and emitters of GHG emissions. According to the Whole Building Design Guide Sustainable Committee (2008), buildings in the United States consume 39% of America's energy and 68% of its electricity. Furthermore, buildings generate 38% of the carbon dioxide, 49% of the sulfur dioxide, and 25% of the nitrogen oxides found in the air. These are problems that could potentially be solved by college campuses’ research and innovation. According to Graedel (2002), universities tend to focus on long-term problems and have research and educational goals that are receptive to sustainability issues. The University of California, Berkeley consists of 35,409 students, 2,028 faculty, and over 150 buildings on campus (University of California, Berkeley 2009). These students, faculty, and buildings help contribute to the United States’ total GHG emissions through their consumption behaviors on campus. From 2001-2005, UC Berkeley annually spent an average of almost \$22 million on electricity, steam and natural gas. The campus’ electricity use has also increased by approximately 7.7% from 1998 to 2005 (CACS 2005). In addition, 70% of UC Berkeley’s total GHG emissions come from buildings (U.S. Senate Committee on Environment and Public Works 2008).

Schipper (1989) estimated that occupant’s personal choices could contribute to about 50% of residential energy use. This gives the occupant flexibility to substantially increase or decrease their energy consumption through energy efficient or inefficient behaviors. Personal choices

range from remembering to turn off the lights before leaving a room to the length of time an individual spends on the computer and other electronic devices. A majority of buildings on UC Berkeley's campus does not give occupants a variety of user controls for electricity use. Some buildings do not even give the user access to turn the lights on or off. The residence halls seemed to be the best choice on campus that gave the occupant the greatest flexibility in controlling energy consumption behaviors. UC Berkeley's residence halls contain over 5,000 students and 30 buildings that are constantly using energy all day. From a previously unpublished study, each UC Berkeley students living in the residence halls would pay an average of \$410 a year in utility bills. This could easily solved by residents adopting more energy efficient behaviors and practicing them more frequently. In Sweden, there has been a long tradition in mass school settings of a strong correlation in informational campaigns and the ability to change through learning (Boli 1989). The same concept could be applied to other school settings in other developed nations. Since a typical method of reaching out to students in the residence halls is through the use of publicity and educational materials, educating building occupants to save energy though an educational campaign could help reduce the amount of GHG emissions coming from campus buildings. In addition, UC Berkeley is a very environmentally conscious campus. Schuhwerk and Leekoff-Hagius (1995) found that green consumers or more environmentally conscious individuals were less likely than non-green consumers to be influenced by general environmental claims on advertisements because they are already well aware of environmental issues. This means that students who identify as environmentally conscious would be less affected by outreach materials than those who are not environmentally conscious because they already practice energy efficient behaviors.

Previous research suggests that an energy outreach initiative could potentially be an effective way to reduce the campus' total energy consumption. At Oberlin College in Oberlin, Ohio, Peterson *et al.* (2007) created a two-week energy competition in Oberlin College's residence halls. Peterson *et al.* used an automated real-time data system that students could access over the Internet to see their current energy use. Peterson *et al.* also used education materials consisting of posters and flyers that addressed energy and water use and their impact on the environment and also offered residents incentives for reducing their energy consumption. The two-week competition resulted in a 32% reduction in energy. Incentives such as a raffle for gift certificates were offered to those who participated in the survey. Although Peterson *et al.*'s study was

successful in reducing energy consumed, a two-week competition is too short of a time period that cannot accurately measure average energy use. In addition, the baseline at Oberlin was established three weeks before the competition and does not consider other confounding factors such as seasonal changes, occupant behavior and cannot be used in subsequent competitions during different time frames. Computing valid energy savings data needs a statistically sound average of energy use for a specific period over multiple years to assess different occupants, consumption patterns, and seasonality.

Another study done at Tufts University in Medford, Massachusetts describes a community-based social marketing campaign in residence halls to reduce student energy use (Marcell *et al.* 2004). The study compared two upper classmen residence hall buildings: one received an basic educational program alone, describing energy consumption and saving money, while the other received an educational program with social based marketing methods connecting energy use to climate change. Social marketing is a technique to achieve specific behavioral goals that promote society's well being (Wikipedia 2009). Surveys were taken before the educational program and then afterwards to see if there was a difference between the two programs (Marcell *et al.* 2004). The hall that received the social based marketing methods achieved larger energy savings compared to the hall that received the regular educational program. Although, an understanding of general student behavior trends are needed if environmental education programs were implemented system-wide, two halls is not a large enough sample size to form student behavior trends. Many college campuses have more than two residence halls where the student population and behaviors are different in various buildings. The gap in knowledge I am trying to fill is identifying the real effectiveness of an educational energy program in college residence halls situated in a larger sample size.

This study investigated how educational outreach materials would change student's energy behaviors within UC Berkeley's residence halls by analyzing energy consumption data, surveys, and interviews. My research questions and hypotheses are:

Question 1 (Q1): What is the impact of energy educational outreach materials, such as posters, flyers, incentives and emails, on persuading UC Berkeley students living in the residence halls to conserve energy?

Hypotheses 1 (H1): Energy outreach materials will result in a decrease in total energy use in UC Berkeley's residence halls.

Hypotheses 2 (H2): Energy outreach materials are an effective way to increase students' use of energy efficient practices.

Null Hypotheses 1 (NH1): Energy outreach materials will result in neither an increase or decrease in total energy use.

Null Hypotheses 2 (NH2): Energy outreach materials will not increase or decrease students' use of energy efficient practices.

Question 2 (Q2): What is the impact of energy educational outreach materials on students who identify as environmentally conscious?

Hypotheses 3 (H3): Students who identify as environmentally conscious will have the least change in energy efficient behaviors after being exposed to energy educational outreach materials.

Null Hypotheses 3 (NH3): There will be no change in energy efficient behaviors regardless of a student's environmental consciousness after being exposed to energy educational outreach materials.

### **Methods:**

The study took place in UC Berkeley's residence halls that house approximately 5,000 students situated in "units," which has four to six buildings per unit. The campus has five units, but only units one through four were included within the study because unit five does not have accurate energy data for 2003 to 2004. About a total of 20 buildings participated in this research project. I ran a two-month energy competition, named "Blackout Battles," that occurred within the residence halls from February 1<sup>st</sup> to April 1<sup>st</sup> 2009 to motivate students to save energy. An ice cream party incentive was also offered to the unit that saves the most energy. Energy educational outreach materials informed students about the competition, described incentives, provided energy saving tips, and were distributed before the competition in mid-January. The outreach materials consisted of posters, flyers, mailbox flyers, and e-mails (Appendices A-D). I analyzed energy data to see if there were any changes in energy consumption during the competition to assess the effectiveness of the outreach materials. I also took surveys and interviews after the competition to investigate any changes in resident's energy behaviors after being exposed to outreach materials (Fig. 1).

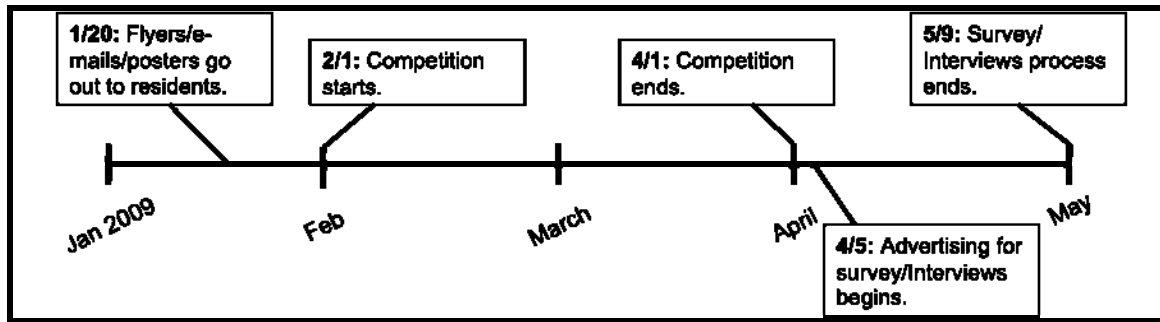


Figure 1. Timeline of events that occurred during the study.

**Energy Consumption** In order to assess the effectiveness of the outreach materials, I analyzed total energy consumption of all the participating units. Energy competitions have taken place within UC Berkeley's residence halls every spring semester since 2005 through the Green Campus Program, so 2003 was chosen as a baseline to compare residential energy consumption without being exposed to any previous outreach materials within the residence halls. Next, I compared energy use during the competition from February 1<sup>st</sup> to April 1<sup>st</sup> from the 2003 baseline to the energy use in 2009. I also looked at energy consumption every year from 2003 to 2009 during the same two months to see if there were any common trends in energy use over the past six years. There were also some discrepancies within the energy data that I attained from Physical Plant and Campus Services (PPCS). Unit 2 constructed two new halls that opened in spring 2005, resulting in an increase in total energy consumption for Unit 2 compared to 2003. The same scenario happened in Unit 1 when two new halls opened up in fall 2005. There was also a broken meter in Unit 4's Stern Hall that also lead to inaccurate energy data in 2004. These three meters were excluded from the study in order to maintain uniformity of the energy data from 2003 to 2009.

**Surveys** I conducted an online survey (Appendix E) of students living in residence hall to attain a better understanding of residents' energy efficient behaviors. To recruit participants, I advertised the online survey and interview process through mailbox flyers, flyers, and e-mails, after the competition ended from April 1<sup>st</sup> to May 9<sup>th</sup> 2009 (Appendices F-H) and offered a raffle for Apple iPod music players as an incentive. The social networking website, Facebook, was also

used to advertise the surveys and interviews to multiple student groups living within the residence halls. In addition, I also tabled at Crossroads, Foothill and Café 3 dining commons to advertise the survey and provided a laptop on which students could complete the online survey. This allowed me to obtain completed surveys from 162 students representing all four units. The survey was conducted through a website called surveymonkey.com.

In order to assess if outreach materials were effective in changing the subject's energy behaviors, I needed to see if there was a correlation between exposure to outreach materials and change in energy efficient practices. I asked the subjects if they recalled seeing a poster, mailbox flyer, and Resident Assistant (RA) e-mail advertising the competition (Appendix E: Questions 17, 20, and 23). Subjects answered "Yes" or "No" (coded as 1 for "yes" and 0 for "no") to recall their exposure to these outreach materials. The subjects' answers were summed into an "exposure value," totaling up to three points. Next, I asked subjects how frequently they practiced energy efficient behaviors; exchanging standard incandescent light bulbs to Compact Fluorescent Light bulbs (CFLs), turning off the lights, turning off their computer or monitor, taking the stairs, and consideration in buying ENERGY STAR options for electronics, before and after the competition (Appendix E: Questions 5-16). Energy behavior questions were based on a four-point scale, 0 being "never" to 3 being "always." I then performed a linear regression using a nonparametric Wilcoxon/Kruskal-Wallis test to see if there was a correlation between "exposure value" and the subject's answers to energy efficient behaviors after the competition. Also, in order to see if the subjects practiced energy efficient practices at the same frequency before and after the competition, I performed a regression using a nonparametric Spearman's Rho test between subject's answers to energy efficient behaviors before and after the competition.

UC Berkeley is also well known to be a very liberal campus and a champion in sustainable efforts. UC Berkeley offers over 300 classes on the environment and consists of over 30 student groups addressing environmentalism and sustainability. Because of this, I feel that UC Berkeley's students are more environmentally conscious than other campuses in the nation, which could lead to skewed results of individuals already practicing energy-conscious behaviors. To see if my assumptions were true, I asked residents indirect questions to assess their "greenness" which is what I would consider an individual to be environmentally conscious or not. These questions asked about frequency of recycling, concern about global warming and frequency of other sustainable behaviors (Appendix E: Questions 2-4). These questions were

based on a four-point scale, 0 being “never” or “not that concerned” to 3 being “always” or “two of my greatest concerns,” for a total possible nine points. The total points scored by each respondent for these questions were averaged by the total possible nine points to give differing levels of “greenness,” being “not green” (0-0.4 average value), “somewhat green” (0.4-0.7 average value), and “very green” (0.7-1 average value). I then performed a regression using a nonparametric Spearman’s Rho test to see if there was a correlation between “greenness” and the subject’s answers to energy efficient behaviors after the competition.

**Interviews** I asked subjects at the end of the online survey if they were interested in an in-person interview (Appendix I), which typically lasted ten to fifteen minutes in their unit courtyard, to attain a more in depth understanding about their energy behaviors and environmental awareness. Another raffle for an Apple iPod music player was offered to respondents that completed the interview process. The questions investigated if subjects had any consistent energy saving habits and the effectiveness of the outreach materials to convince them to keep continuing to save energy after the competition. The interview data was not statically analyzed but was only used qualitatively to strengthen relationships between the subject’s survey answers and their change in energy behaviors. I interviewed 60 residents out of the 162 respondents from the online survey.

## **Results:**

**Energy Use** Compared to the 2003 baseline, Units 1, 3, and 4 reduced their energy consumption in 2009 (Fig.2, Table 1). Unit 2 was the only housing unit that increased its energy consumption in 2009 by 3.5%.



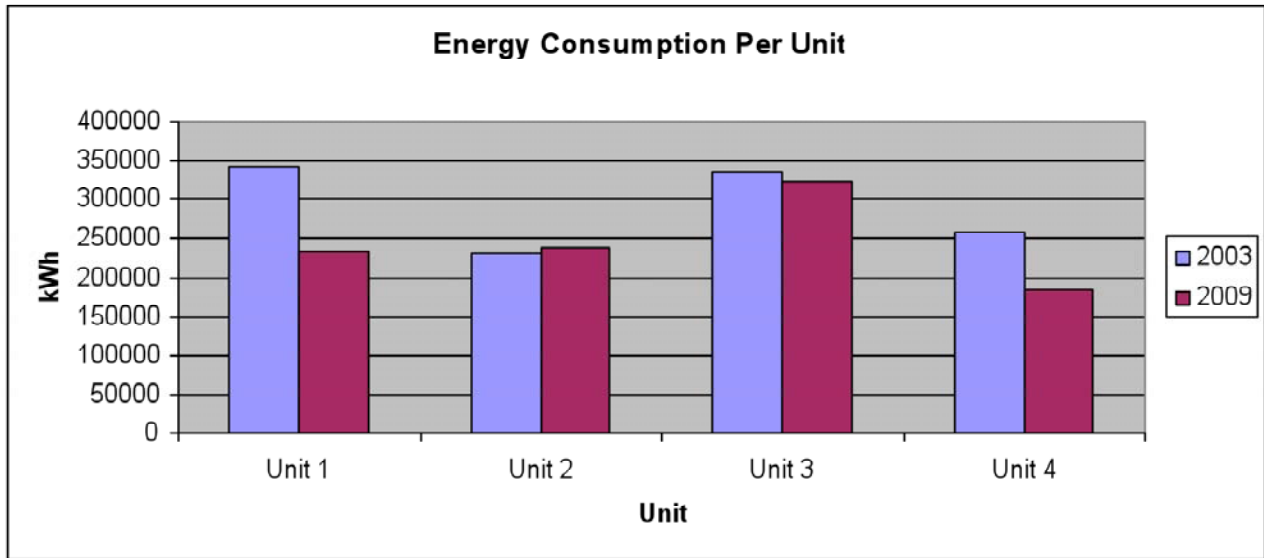


Figure 2. Energy consumption data measured in kilowatt-hours for units 1-4 from 2003 compared to 2009 from Feb 1<sup>st</sup> to April 1<sup>st</sup>.

Table 1. Energy consumption measured in kilowatt-hours and percentage change from 2003 compared to 2009 for units 1-4 during Feb 1<sup>st</sup> to April 1<sup>st</sup>.

	Unit 1:		Unit 2:		Unit 3:		Unit 4:	
Year:	2003	2009	2003	2009	2003	2009	2003	2009
Energy Use (kWh):	342,958	233,720	230,421	238,516	335,914	322,402	259,567	184,387
Change in Consumption (%):		-31.85		3.51		-4.02		-28.96

Total consumption for all participating units from 2003 to 2009 has decreased greatly after the first energy competition in 2004 and has decreased fairly constant between 2005 to 2009 by about 3% a year (Fig. 3, Table 2). Compared to 2003, total energy use for all the units had decreased by 2.5% in 2009.

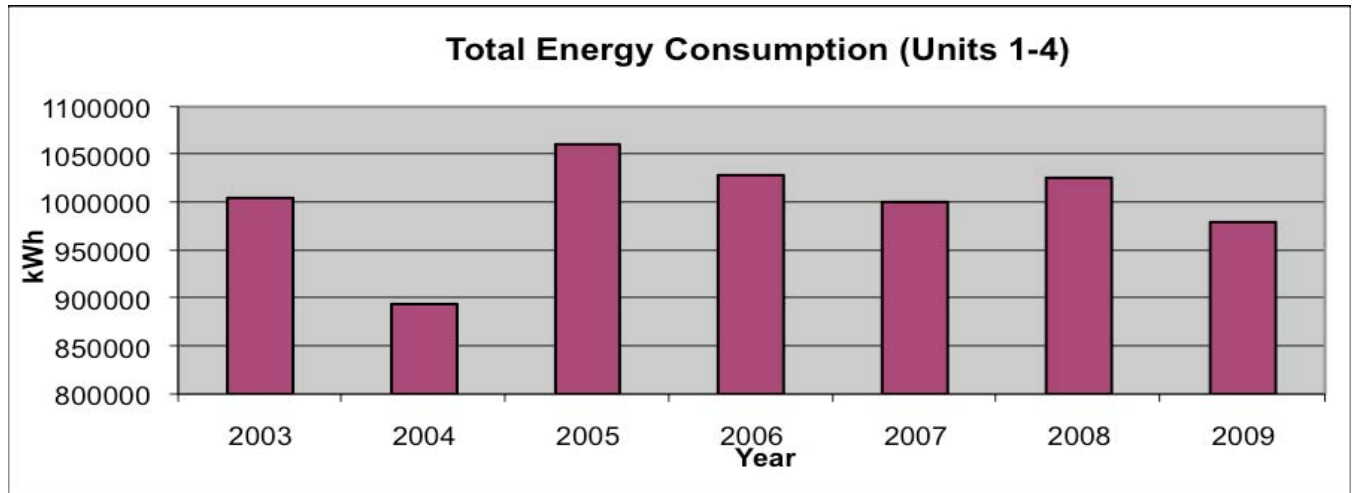


Figure 3. Energy consumption data measured in kilowatt-hours for all units from 2003-2009 during February 1<sup>st</sup> to April 1<sup>st</sup>

Table 2. Energy consumption measured in kilowatt-hours and change in energy consumption per year for all units from 2003-2009 for Feb 1<sup>st</sup> to April 1<sup>st</sup>.

Year:	2003	2004	2005	2006	2007	2008	2009
Energy Use (kWh):	1,004,623	894,034	1,061,122	1,027,900	1,000,554	1,026,169	979,025
Change in Consumption (%):		-11.01	18.69	-3.13	-2.66	2.56	-4.59

**Survey** 96% of the students who took the survey was considered to be “somewhat green” to “very green,” and 95% had heard of the competition. 37% of respondents believed that they were very energy conscious before the after the competition, 36% said they were practicing more energy efficient practices after the competition, while 20% said they didn’t change their energy behaviors at all (Fig.4).

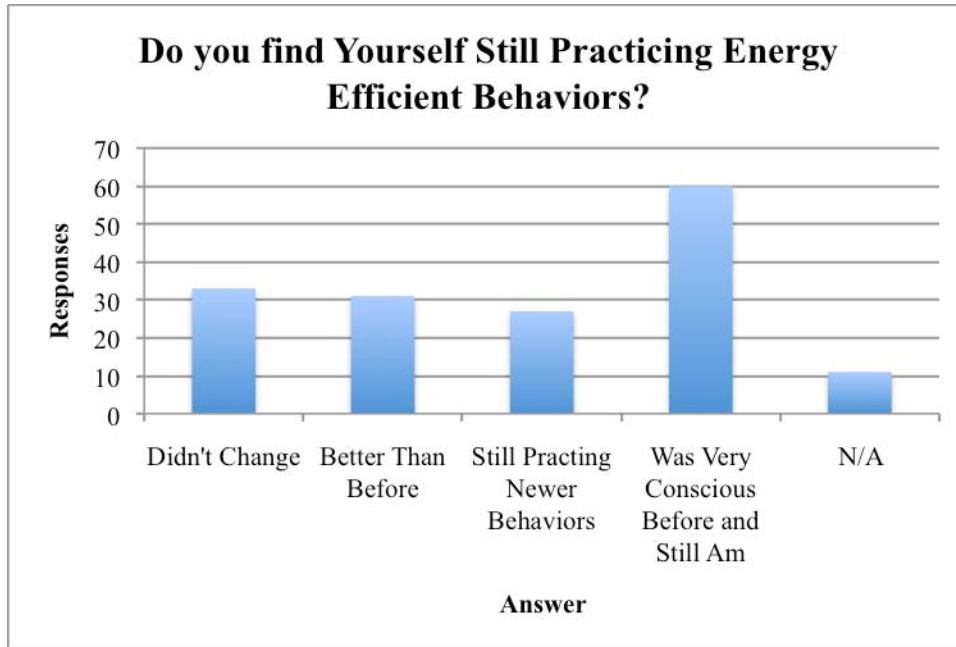


Figure 4. Responses from the 162 students asking “If you changed your behavior as a result of the competition, now that the competition is over, do you find yourself still practicing energy efficient behaviors?”

The nonparametric Wilcoxon/Kruskal-Wallis test revealed exposure to outreach materials had no significant correlation with energy efficient behavior after the competition except for exchanging more standard incandescent light bulbs with energy efficient CFLs (chi-squared value: 0.06). The first nonparametric Spearman’s Rho test discovered there was also no significance in frequency of energy efficient behaviors before and after the competition.

The second nonparametric Spearman’s Rho test showed no correlation between an individual’s “greenness” and energy efficient behaviors after the competition except for consideration of purchasing ENERGY STAR® appliances (Spearman’s Rho: 0.31).

**Interviews** A majority of the students who participated in the interview process were already aware of the competition. About 95% of the students also grew up in urban areas of California and 65% were interested in environmental issues prior coming to UC Berkeley. Turning off the lights was the most prominent answer students gave when asked, “When you think of energy efficiency and conservation what is the first thing you think of?” About a third admitted they sometimes forgot to turn off some appliances before leaving for class, mostly

because they were running late for class. Students who also lived on higher levels of residence halls (fourth floor and above) normally did not take the stairs on a daily basis because they did not enjoy the physical activity. Fifty-five students that participated in the interview process identified currently as environmentally conscious and said they practiced energy efficient behaviors on a daily basis. About 75% of these fifty-five respondents were aware of energy consumption and its contribution to GHG emissions. Five students considered themselves not environmentally conscious. Three of these five said they did not normally watch their energy or water consumption because they didn't have to pay a monthly utility bill, while two said they "just did not care about the environment." About half of the interviewees felt the competition was too long and people easily forgot about from time to time. One interviewee said, "I felt the posters were not very effective, especially when we are bombarded by various other events and student groups, it was very easy to just ignore."

### **Discussion:**

This study revealed that energy outreach materials resulted in a decrease in total energy consumption, but was not effective in drastically increasing energy efficient behaviors because a majority of students living in the residence halls identify as environmentally conscious and were already practicing energy efficient behaviors prior to the competition.

Compared to 2003, units 1, 3, and 4 reduced their energy consumption in 2009 while unit 2 increased its energy consumption. Total energy use in 2009 also decreased compared to the 2003 baseline. While these findings support my first hypothesis, trends in energy use have been constantly decreasing from 2006 to 2009 could be due to outside factors that were not investigated within my study. These factors could be energy retrofits that were not investigated within the study or the 2008 to 2009 group of students living in the residence halls were more environmentally conscious and practicing energy efficient behavior more frequently compared to students in past years.

According to my results, it appears that outreach materials are not effective in convincing students within UC Berkeley's residence halls to adopt more energy efficient practices, which does not support my second hypothesis and supports my second null hypothesis that there was no increase or decrease in energy efficient practices. The nonparametric Wilcoxon/Kruskal-Wallis test showed no correlation between exposure to outreach materials and energy efficient behaviors

after the competition. Although the last question on the survey reflected 36% of the respondents felt they were practicing more energy efficient behaviors after the competition, this could be due to students who were confused by the series of question in the survey asking about their before and after behaviors. Also the last question could be leading students to believe they have been practicing more energy efficient behavior.

Finally, a large majority of the students were considered to be “somewhat” to “very green.” Comparing these findings with the first nonparametric Spearman’s Rho test compared frequency of energy efficient practices before and after the competition revealed no drastic changes within students’ energy behaviors regardless of the competition. Looking specifically at the raw data, a majority of students claimed they were already practicing energy efficient behaviors just as equally before and after the competition. The interviews also provided more evidence that a majority of the students identified to be environmentally conscious practiced energy efficient behavior just as frequently before and after the competition. This means that the outreach materials were least affective towards environmentally conscious students, because they were already practicing energy efficient behaviors prior to the competition, supporting my third hypothesis. Also, the second Spearman’s Rho test revealed that “greenness” did not correlate with energy efficient behavior after the competition. There was no change in a majority of energy behaviors after the competition and most of the students identified as environmentally conscious so the test produced no results in determining if non-environmentally conscious students are affected to outreach materials differently than environmentally conscious students.

Unfortunately, there has not been much research in investigating effective ways to educate American college students about their energy consumption. My study and Peterson *et al.*’s study (2007) both focused on energy competition within American college residence halls. We both used publicity and incentives to educate students to reduce their energy consumption and both resulted in a decrease in energy consumption, but Peterson *et al.*’s study saw greater energy savings. Peterson *et al.*’s study had access to real time data metering during their competition to show residents their current energy consumption. This could have been a large factor in Peterson *et al.*’s achievement in larger energy reduction in energy use. Due to an outdated metering system, updates could not be provided to the residents in my study. Having an updated metering system could have resulted in higher energy saving by keeping the students informed about their current energy use and kept them excited about the competition.

The Tufts University study only investigated two halls to analyze the effectiveness of various forms of education, and revealed that socially based outreach materials were more effective in changing student energy behaviors (Marcell *et al.* 2004). My study only approached the students in a basic marketing approach and did not link energy consumption to larger problems, such as climate change and GHG emissions. Having a more socially marketed approach could have lead to more informed students in UC Berkeley's residence halls about why they should save energy. I could have used the prior energy competitions that used a basic marketing approach as a control group. This was my original intention but I accidentally left out the message linking energy use to climate change in the publicity and had to restructure the study midway during the competition. Also compared to Marcell *et al.*'s study, I feel that my sample size of 5000 was too large and the 162 respondents I received from the survey was not representative of the general student population living in the residence halls at UC Berkeley. This could have resulted in a bias of students whom appear to be very environmentally conscious, which in reality represent a small portion of students.

My research would not be able fit into bigger picture of seeing effective ways to reduce energy use in residence halls in American universities. The study revealed that UC Berkeley's residents are more environmentally conscious and cannot be compared to other American universities that are more conservative. I think if other campuses around the country hold energy competitions within their residence halls to educate students about energy consumption, especially on campuses that are not as environmentally aware as UC Berkeley, they would have a larger effect in increasing energy efficient behaviors in their residents. I feel I was not able to fill the gap of knowledge by identifying the real effectiveness of educational outreach in college residence hall energy consumption in a larger sample size, but helped gain a better understanding of UC Berkeley's students' behaviors. The use of outreach materials to educate students in a college residence hall was not effective in changing their behaviors to more efficient energy consumption on UC Berkeley's campus, but the feedback could be used in future marketing materials by UC Berkeley and universities similar to UC Berkeley's environmental awareness for educational campaigns concerning environmental issues such as energy and water consumption.

There were also multiple shortcomings within my study. Due to logistical errors, I was not able to take the initial surveys and interviews before the competition started on February 1<sup>st</sup> so I

could not compare people's energy behaviors before and after the competition. Instead I had to ask the subjects to try to remember how frequently they practiced energy efficient behavior before the competition, although this is a weak measure. Having a pre and post-test would have given my results stronger significance to see exact effectiveness of the educational campaign. Another problem was the inaccuracy of the energy data due to an outdated metering system in UC Berkeley's residence halls. I had to exclude multiple meters from the study due to broken meters or new meters coming online that did not have prior use data and ended up losing valuable data. These meters are read in person by engineers and it take over a month to attain the data. A modern, real time data metering system needs to be implemented into UC Berkeley's residence halls for more accurate energy consumption data, as well as a its useful tool in educating residents about their current consumption. Another discrepancy within the study is the potential bias within my survey results. The survey publicity asked residents to take a survey about energy and sustainability. Students that are interested in energy and sustainability issues might have been the majority of residents that decided to take the survey, leading to skewed results. Also, the Apple iPod music player incentives might have been too generous. This could have created respondents only motivation to take the survey was to win the prize and might have not answered the questions truthfully. Instead of publicizing the survey through flyers, mailbox flyers, and e-mails, I could have surveyed residents randomly such as one out of every four students within the residence halls to attain a more random, less bias group of respondents.

From the results of the study, it appears that energy has decreased over the years, which could be due to the outreach materials but could also be due to other outlining factors. The outreach materials did not drastically increase energy efficient behaviors but could have served as reminders for students to save energy during the competition. The survey revealed that a large majority of the students living in UC Berkeley's residence halls were very environmentally conscious and were already practicing energy efficient behaviors before and after the study and were not greatly affected by the outreach materials. Since my study had such a large sample size, it was harder to determine general trends to see if the energy outreach materials are effectively changing individual energy behavior on a large scale due to the potential biases in the survey respondents. More research is needed to investigate student's behaviors on a smaller scale with randomized sampling at UC Berkeley in order to discover more accurate energy behavioral

trends within the student population to establish more effective educational campaigns regarding sustainability.

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Appendix A: "Blackout Battles" Poster/Flyer Design:


Berkeley Green Campus Presents:

# Blackout Battles:

**Res Hall Energy-Saving Competition**

## February 1 - April 1


**Prize: An ice cream & sorbet party for your entire unit!**




For more information, contact  
BerkeleyGreenCampus@gmail.com

### How to Help Your Unit **WIN!**

- Turn **OFF** the lights when you leave a room.
- **UNPLUG** devices that you are not using.
- Turn **OFF** power strips at night and when you leave for classes.
- **SHUT DOWN** your computer when you are not using it.
- Use **HIBERNATE** and **SLEEP** modes on your computer during the day.
- Use the **STAIRS** to save energy and improve health



**Save the Environment!**



Appendix B: "Blackout Battles" Mailbox Flyer Design (Front):

<p><b>Berkeley Green Campus Presents:</b>  <b>Blackout Battles</b>  <b>Res Hall Energy-Saving Competition</b>  <b>February 1 - April 1</b></p>	<p><b>Berkeley Green Campus Presents:</b>  <b>Blackout Battles</b>  <b>Res Hall Energy-Saving Competition</b>  <b>February 1 - April 1</b></p>		
<p><b>What is it?</b>          Blackout Battles is a competition between Unit 1, Unit 2, Unit 3, and Unit 4 to see which unit can save the most energy.  <u>Look on the back for Energy-Saving Tips!</u></p>	<p><b>Prize:</b>          An ice cream &amp; sorbet party            For the unit!</p>	<p><b>What is it?</b>          Blackout Battles is a competition between Unit 1, Unit 2, Unit 3, and Unit 4 to see which unit can save the most energy.  <u>Look on the back for Energy-Saving Tips!</u></p>	<p><b>Prize:</b>          An ice cream &amp; sorbet party            For the unit!</p>
<p><small>Questions/Comments? Contact us at BerkeleyGreenCampus@gmail.com</small></p>		<p><small>Questions/Comments? Contact us at BerkeleyGreenCampus@gmail.com</small></p>	
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Appendix C: "Blackout Battles" Mailbox Flyer Design (Back):

**Energy Saving Tips**

- **Turn OFF the lights** when you leave a room
- **Exchange your LIGHT BULB** for a free energy efficient one at your front desk
- **SHUT DOWN your computer** when you are not using it
- **Use HIBERNATE and STAND BY modes** on your computer during the day
- **UNPLUG devices** that you are not using
- **Turn OFF power strips** at night and when you leave for classes
- **Use the STAIRS** to save energy and improve health
- **Use ENERGY STAR** rated products
- **Use COLD water** for laundry and hang dry

Save the Environment!  
Spread the word!

**Energy Saving Tips**

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Save the Environment!  
Spread the word!

**Appendix D: "Blackout Battles" E-mail to Resident Assistants:**

Dear Hall Staff,

I am writing on behalf of the Green Campus Program which is putting on two programs in the halls this semester: "Blackout Battles" and the CFL Exchange!

Please let your residents know that CFLs are available at each unit's mailroom and they're FREE! The main requirement is that they need to bring an incandescent (standard) bulb to exchange.

Berkeley Green Campus is also putting on its internal residence hall energy competition, "Blackout Battles," between Units 1-4. It runs February 1st to April 1st. The prize for winning the internal challenge is an ice cream party for the whole unit! You might be wondering, "What happened last semester?" We're wondering too and are currently waiting for the updated energy data.

We encourage you and your residents to participate and conserve energy at Cal!

Thank you,  
Kameron Kitajima

P.S. - I have attached an email you can forward to your resident email lists.

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Dear Residents,

Blackout Battles, the Residence Hall energy saving competition, has begun! This semester our unit is competing against all the other units (except CKC) to try and save the most energy per student. If we win, everyone in our unit gets an ice cream party! The competition goes from February 1st to April 1st.

Let's all try to do our part to save energy; here are some ways you can help save energy in our unit:

- Exchange your LIGHT BULB for a free energy efficient one at the mail room/front desk
- SHUT DOWN or "SLEEP" your computer when you are not using it
- USE A POWER STRIP and turn it off at night and when you leave for classes
- UNPLUG devices that you are not using
- Use the STAIRS to save energy and improve health
- Use ENERGY STAR rated products
- Use COLD water for laundry and hang dry (if possible)

**Appendix E: Online Survey Questions:**

1. I have heard of the "Blackout Battles" Energy Competition in the residence halls before.

Yes    No    I'm not sure

Please tell us your opinion by answering the following questions.

2. I try to recycle everything rather than throwing things away in the trash.

Never            Rarely            Most of the time            Always            I'm not sure

3. Please rank your level of concern about global warming and climate change.

Not that concerned    I am somewhat concerned    I am concerned            Two of my  
greatest concerns    I'm not sure

4. I \_\_\_\_\_ watch my consumption of energy and water...

Never            Rarely            Most of the time            Always            I'm not sure

Please describe your energy behaviors BEFORE to the "Blackout Battles" energy competition during February 1st to April 1st.

5. I have switched out my standard incandescent light bulbs for energy-efficient Compact Fluorescent Light bulbs (CFLs).

Have not changed any            I've changed at least one            I have changed all of the light  
bulbs to which I have access

6. I remember to turn off the lights before I leave a room.

Never            Sometimes            Most of the time            Always            I'm not sure

7. I turn my computer monitor off when I will not return to my room for more than an hour.

Never            Sometimes            Most of the time            Always            I'm not sure

8. I put my computer into sleep/hibernate mode when going to class/meeting/sleep.

Never            Sometimes            Most of the time            Always            I'm not sure

9. I take the stairs over taking the elevator.

Never            Sometimes            Most of the time            Always            I'm not sure

10. When I purchase new electronic equipment, I consider energy efficient ENERGY STAR certified appliances as a factor in my purchase.

Never            Sometimes            Most of the time            Always            I'm not sure

Please describe your energy behaviors AFTER to the "Blackout Battles" energy competition that took place during Feb 1<sup>st</sup> – April 1<sup>st</sup>.

11. I have switched out my standard incandescent light bulbs for energy-efficient Compact Fluorescent Light bulbs (CFLs).

Have not changed any            I've changed at least one            I have changed all of the light bulbs to which I have access

12. I remember to turn off the lights before I leave a room.

Never            Sometimes            Most of the time            Always            I'm not sure

13. I turn my computer monitor off when I will not return to my room for more than an hour.

Never            Sometimes            Most of the time            Always            I'm not sure

14. I put my computer into sleep/hibernate mode when going to class/meeting/sleep.

Never            Sometimes            Most of the time            Always            I'm not sure

15. I take the stairs over taking the elevator.

Never            Sometimes            Most of the time            Always            I'm not sure

16. When I purchase new electronic equipment, I consider energy efficient ENERGY STAR certified appliances as a factor in my purchase.

Never            Sometimes            Most of the time            Always            I'm not sure

Please respond to these questions, which are on a scale of 1 to 5. Where 5 means “Very Effective” and 1 “Not Effective at all”

17. Did you receive a flyer in your mailbox advertising the “Blackout Battles” residence hall energy competition?

Yes No I’m not sure

18. If Yes, do you feel the mailbox flyer was informative of the competition?

1 2 3 4 5 N/A

19. If Yes, do you feel the mailbox flyer was effective in changing your energy behaviors?

1 2 3 4 5 N/A

20. Do you recall seeing a poster in your hall advertising the “Blackout Battles” residence hall energy competition?

Yes No I’m not sure

21. If Yes, do you feel the poster was informative of the competition?

1 2 3 4 5 N/A

22. If Yes, do you feel the poster was effective in changing your energy behaviors?

1 2 3 4 5 N/A

23. Did you ever receive an email from your Resident Assistant (RA) or Resident Director (RD) about the “Blackout Battles” residence halls energy competition?

Yes No I’m not sure

24. If Yes, do you feel the email was informative of the competition?

1 2 3 4 5 N/A

25. If Yes, do you feel the email was effective in changing your energy behaviors?

1 2 3 4 5 N/A



26. Do you remember that an ice cream party for your unit was offered as an incentive to reduce energy use?

Yes    No    I'm not sure

27. If yes, do you feel that the ice cream party is an effective incentive?

1      2      3      4      5      N/A


28. If you changed your behavior as a result of the competition, now that the competition is over, do you find yourself still practicing energy efficient behaviors?

I didn't change      My behavior is better than it was      I am still practicing new  
behaviors      I was very energy conscious before and still am      N/A

Do you have any suggestions for further improvements to the competition?

## Appendix F: Survey Flyer Design:

## Take A Short Survey and Win an 4 GB iPod Shuffle!




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Environmental Science Senior Research Project


Do you remember the "Blackout Battles" energy competition?

Please take a short 5-10 minutes survey on energy behaviors to enter a raffle to win one of three newly released **4 GB iPod Shuffles!**

**Double** your chances to enter a 2nd raffle and win a **8GB iPod Touch** by taking an additional in-person (7-10 min) interview after you complete the survey.



Take the survey at:



[Http://www.surveymonkey.com/](http://www.surveymonkey.com/BlackoutBattles)  
**BlackoutBattles**

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This survey is part of an Environmental Science senior research project to assess the effectiveness of various educational outreach materials on changing students energy consumption behaviors.

*Any Questions/Comments, Contact [Kkitajima@Berkeley.edu](mailto:Kkitajima@Berkeley.edu)*

## Appendix G: Survey Mailbox Flyer Design:

**Take A Short Survey and Win an 4 GB iPod Shuffle!**

Environmental Science Senior Research Project

Please take a short 5-10 minutes survey on energy behaviors to enter a raffle to win one of three newly released **4 GB iPod Shuffles!**

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This survey is part of an Environmental Science senior research project to assess the effectiveness of various educational outreach materials on changing students energy consumption behaviors.

*Any Questions / Comments, Contact Kitajima@Berkeley.edu*  
Please Recycle. Printed on 100% Post Consumer Recycled Paper

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*Any Questions / Comments, Contact Kitajima@Berkeley.edu*  
Please Recycle. Printed on 100% Post Consumer Recycled Paper

**Appendix H: Survey E-mail to Resident Assistants:**

Do you remember the "Blackout Battles" residence hall energy competition that took place from February 1st to April 1st 2009?

Do you recall getting a mailbox flyer advertising the competition?

These are examples of some simple questions that will ask you about your personal energy behaviors.

Please take a short 5-10 minute survey to enter to win one of three newly released 4GB iPod shuffles! Double your chances to win a 8GB iPod Touch by taking an additional in-person interview (7-10 minutes) after you complete the survey!

Take the survey at [surveymonkey.com/BlackoutBattles](http://surveymonkey.com/BlackoutBattles)

The survey is part of an Environmental Science senior research project to assess the effectiveness of various educational outreach materials on changing student's energy consumption behaviors. We are looking for additional feedback to our "Blackout Battles" energy competitions that have taken place every semester in UC Berkeley's residence halls since 2004.

Upon completion of the survey, you will be entered in a drawing for the iPod shuffles. In addition, double your chances of winning by signing up a short 7-10 minute in person interview to get a better understanding of your personal energy behaviors. Those who finish the interview will be entered in a raffle for a 8GB Apple iPod Touch!

If you have any other questions or concerns, email Kameron at [Kkitajima@berkeley.edu](mailto:Kkitajima@berkeley.edu). Thank you!

**Appendix I: Interview Questions:**

1. Could you describe a little about your background (where you grew up, family values, etc.) and any perceptions they had on the environment/sustainability?
2. Where were you born?
3. Where were you raised?
4. Is your family more conservative or liberal?
5. What were your family views on the environment/conservation?
6. What are your views on the environment/conservation?
7. How many people were in your family?
8. Did you grow up in a rural or urban area?
9. Have you ever heard of the “Blackout Battles” energy competition held in the residence halls before? Do you recall the competition in the fall semester?
10. Have you ever heard of the Green Campus program before?
11. Were you aware about that the housing department offers free energy efficient Compact Fluorescent Light bulbs (CFLs) at your mailroom? Did you recall receiving a mailbox flyer advertising or seeing a poster about it in the fall semester?
12. Describe a typical school day for you and any specific energy behaviors before you leave. Do you remember to turn off your appliances before you leave?
13. How often the amount of electricity you use is considered in your daily activities? Why or why not?
14. How often do you turn your computer off or put it into sleep/hibernate mode? Were you aware if your computer has energy saving mode?
15. When you think of conserving energy what comes off the top of your head?

16. Do you think UC Berkeley is environmentally friendly?
17. Do you think UC Berkeley's dorms are environmentally friendly?
18. What would you suggest students could do to save energy?
19. What would you suggest to the university to do to save energy/money?
20. What do you think would convince you to save energy?
21. Do you associate energy use with climate change/global warming? Why or why not?