

# Luminous Gaucho Bulbs

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Only fifty miles away from Santa Barbara, along the coast of the Pacific Ocean, gigantic gas clouds slowly exit from two distinct power-generating towers. A piece of paper is posted on one of the generators at the Ormond Beach Power Plant, which has been around for half a century providing electricity to the Ventura County. The document from the state Resources Control Board reads in bold letters, “April 2010” and “New State Rules for Coastal Power Plants.” For several years in the Santa Barbara and Ventura counties, electricity consumption has been under restrictions targeting power plants to neighborhood communities. In order to understand the controversies behind electricity consumption, sustainability communities must study the process of generating the energy and its effects on the environment. Here, at the University of California, Santa Barbara (UCSB), professors and organizations from different departments have conducted such research. With over 20,000 students and faculty members at the university, the issue behind electricity consumption is a familiar topic. The university spends thousands of dollars on electricity per year, and according to the UCSB Utility and Energy Services (2014), electricity consumption counted for 72% of the utility cost of 2013/2014. In addition, electricity expenditures actually increased from the prior year. While the university may be considered as “The Greenest Public School in the Nation” rated by the Princeton Review (2015), there is still room for improvement as a slight increase in the energy consumption will result in a significant cut from the school annual budget.

Undoubtedly, most students on campus take pride in studying at one of the most eco-friendly schools in the nation. However, statistics found online should not generalize each individual student’s electricity consumption behaviors. This research paper will focus on the primary source collected from an online survey of 32 people. The survey

included 17 questions asking students about their general background information, energy use behaviors, and environmental awareness. Unlike the school's respectable reputation of having an eco-friendly campus, responses from the survey were rather surprising. Even though school faculty members have put effort into keeping the campus green, a large population of the student community is still careless about energy use. For example, about 60% of the respondents answered that their roommates or themselves leave lights on when they leave the house. In general, students' careless approach to using electronic machines and facilities is not intentional but a result of lack of knowledge in the effects of energy waste. Although the school has taken actions to conserve electricity, a large gap between the school's goals and students' behaviors still exists. In order to stop electricity misuse successfully, the school must take a narrower approach such as holding mandatory presentations throughout the year to inform students about electricity consumption and its effects on the environment.

#### Electricity Generation: The Three E's

Even though people use electricity daily, not many know about the details of energy consumption. Often times, the media portrays electric cars, ovens, and other electronics as more eco-friendly than those products powered by natural gas. However, electric products can actually be more harmful on the environment than natural-gas-powered products if the generated electricity causes more pollution. For example, it would be more energy efficient to use a gas oven than an electric oven to cook a meal for an hour because the gas oven would be about seven cents cheaper and use 75% of the energy of the electric oven (Beach, 2011). Such case is not true for all machines powered

by electricity, but it is critical to notice the misconception in different energy powered products.

Nevertheless, electricity consumption is a complex idea that requires further research because there are myths and misinterpreted information behind energy usage. Before a researcher studies the importance of conserving electricity, he or she must understand the process of energy generation. Out of all the energy sources, burning coal is the most commonly used method. Many electric companies favor coal due to the low cost of materials and efficient burning process compared to other sources such as natural gas and nuclear power. A professor at the Griffith University also agrees with this idea, “Historically, the choice of energy has been economics” (Hossain, 2014). At the time when most power plants in the United States were built, coal was the most reliable, inexpensive source. Thus, most stations have kept the tradition and avoided the cost of converting the entire powerhouse to a different energy powered station.

While burning coal may be the cheapest option to generate electricity, it has everlasting effects on the environment. Some may think pollution from cars or industrialized factories is the largest factor in global pollution, but burning coal actually produces more carbon dioxide and greenhouse gas emissions (EIA, 2015). Two global energy and utilities experts also agree by stating, “The combustion of coal releases significant quantities of carbon dioxide” (Spiegel & McArthur, 2009). This is a crucial piece of information because burning coal alone adds up to almost two billion tons of carbon dioxide produced in the United States per year (EIA, 2015). In result, the pollution in the atmosphere causes ground level ozone and acidic rain. In addition to carbon dioxide, coal power plants release toxic gases such as sulfur dioxide, nitrogen

oxide, and mercury. Two engineering professors at the University of Toledo acknowledge the emission of other gases, “Coals contain mercury and can easily be discharged from power plants” (Franchetti & Apul, 2013). Unlike carbon dioxide, such emissions have more of a direct impact on the locals around the power plants because exposure to these gases can cause lung cancers, brain damage, and chronic bronchitis. The removal of these emissions takes years, and some of them can never be fully removed.

Certainly, before one can even use electricity for daily activities such as charging batteries or watching television, multiple steps of electricity production must happen in prior. As stated before, the process of generating electricity creates an immense amount of pollution. The effects of generating electricity are serious and affect everyone on the planet. If less electricity is used, then power stations have to burn a smaller amount of coal and other energy sources, which will eventually decrease the amount of pollution in the atmosphere. Thus, anyone who uses electricity should be eco-conscious and try to reduce electricity consumption as much as possible. Such case should not be an exception for students here at UCSB. Students on campus directly contribute to electricity consumption at the school. Moreover, for a school that uses billions of watts of electricity per year, even a percent decrease in electricity consumption will have a significant impact on both the campus and local communities. In addition to the environmental causes, the school will benefit financially from conserving electricity. According to the UCSB Utility and Energy Services (2014), the school spent about \$8 million on electricity last year. If the school spends less money on electricity, then there will be more room in the budget to benefit students by buying new equipment for laboratories or offering new classes.

For many years, the idea of conserving energy has been around and presented through campaigns, organizations, and media. Despite such effort, reducing electricity consumption has become one of those movements that only extremes participate in. For example, even though there is a critical drought over the state of California, some people do not pay much attention since it does not directly affect them. Living in a first world country, there are ways to resolve issues temporarily for people's convenience. However, electricity use is a subject everyone needs to be aware of as the human race continues to use up resources. This phenomenon is also apparent here on campus at UCSB. Many students misuse electricity because most students are not eco-conscious. On the contrary, there is still hope since energy use behaviors of students will drastically change once they are informed about the effects of electricity consumption on many levels such as the three E's: ethics, economics, and environmental causes. Thus, it is crucial for the university to hold programs to help students learn and become more eco-conscious.

#### Shadows behind the Gaucho Bulbs

As identified by the survey, there are numerous ways for students to reduce electricity usage. In order to analyze the results of the survey more effectively, the respondents were categorized into grade level and type of housing they reside in. It was essential to use such practice because a junior who lives off campus may be more eco-conscious than a freshman who lives in the dorms due to experience and utility bills the upperclassman has to pay for. Out of the thirty-two people that participated in the survey, there were eighteen freshmen, nine sophomores, four juniors, and one graduate student. Before performing any analysis of the survey, it is important to realize that most of the responses were from lower division students. Freshmen and sophomores contribute the

most to electricity consumption since the majority of them live on campus and use the energy in their dorms. Even though the survey will not include the entire population of the student body, it will still show a solid representation of electricity usage on campus.

Subsequently, the survey asked for electricity use habits of the respondents and their roommates/housemates. It was significant to note the behaviors of the respondent's roommates/housemates because the people the student lives with contribute to the overall utility usage of the household or dorm. When students were asked if they leave lights on when they sleep, seven people answered yes. Furthermore, eleven people answered that their roommates/housemates leave lights on when they sleep. In total, about 30% of the people leave lights on when they sleep according to the data. In the next two questions, the survey asked whether their roommates/housemates and themselves leave lights on when they leave their residence. The result was even more significant as about 60% people answered yes.

As most households still use traditional 60-watt incandescent light bulbs, leaving lights on overnight would be equivalent to about 1,100 watts per household (ENERGY.GOV, 2014). In addition, leaving lights on during the day when no one is home would be equivalent to about 2,400 watts per household (2014). On campus, various light sources are present such as compact fluorescent bulbs (CFL), light-emitting diodes (LEDs), and traditional incandescent light bulbs. The number of watts used overnight and during the day in dorms would be about 300 watts less than that of regular houses in each scenario. For each household, the total cost of energy waste for during the day and at night is only about two dollars (2014). While this may not carry much

meaning to individual households, it does to a school that boards about 7,500 students per year.

In addition to light sources, the research took account of students' behaviors on electronics they use on a daily basis. When asked how often the respondents charged their phones, 65% of the people answered twice or more. It is evident that even with the technology advancements in batteries and phones, an average college student still needs to charge their phones more than once a day. This phenomenon may never be solved due to the overwhelming of social media, which forces people to be on their electronics more often. However, certain habits when charging batteries could be changed such as charging when the battery is at most at 50% instead of charging at 60 or 70%. Students should also practice the same habit when charging laptops. According to a research conducted by the Lawrence Berkeley National Laboratory, charging laptops and phones is one of the top ten most energy costly home appliances (Crowe, 2010). Thus, it is crucial to practice correct habits when charging such appliances since they have a large impact on each individual's total energy consumption.

Moreover, the study showed a rather surprising result when it asked students how many hours they spend on computer per day. Only three people out of thirty-two people answered less than two, twenty-two people answered two to six hours, and seven people answered more than six hours. While pediatrics suggest limiting laptop usage to two hours per day (Ghose, 2013), only 10% of the students were practicing this suggestion. One of the most popular laptops on campus, MacBook Pro, uses about 49 watts to fully charge (McCarthy, 2011). As most people use more than two hours per day, many need to charge their laptop once or even twice for heavier users. Similar to household light



usage, the average number of watts it takes to charge laptops is not substantial. However, it will cost the university about a million watts per day considering that everyone has to charge their laptop at least once throughout the day.

Undoubtedly, many students on campus have heard of Professor Shuji Nakamura and take pride in his accomplishment of winning the Nobel Prize in Physics last year. His research in blue light LED lighting introduced white LED lights, which changed how the world uses cars, phones, and other electronics. One of the most important aspects about LED lights is not how colorful and bright they are, but their efficiency. They are about six times as efficient as incandescent, most regular household lights (ENERGY.GOV, 2014). When the question about the efficiency of LED lights was asked during the survey, a rather shocking result was collected. About 30% believed that the LED lights were not more efficient to run. It is ironic how students applaud Professor Nakamura's work, but does not understand the basics of his work. In result, the knowledge students have on electricity consumption and efficiency cannot be overlooked as it directly influences their energy use behaviors.

Towards the end of the study, the survey asked how many UCSB Sustainability events the respondents have attended. UCSB Sustainability is an organization on campus that coordinates program development to keep the campus as clean as possible. A number of people on board have been awarded nationally, and the organization is one of the main contributors to the school's recognition in environmental activism. A recent event that the group supported was "Gauchos Do it in the Dark Energy Competition" (PowerSave, 2015). For about three weeks, the UCSB residence halls competed against each other to save the most energy. Throughout the competition, there were individual events students

could participate online and on campus. In the survey, 72% of the respondents stated that they have not been to a single event for the whole school year. Only 28% of the students answered that they have attended either one or two events. Lastly, students were asked to reflect on the contribution of the student body towards winning the greenest public school title in the nation. The students' reflection on themselves along with the effectiveness of energy awareness events the school holds will serve as an important gateway to resolve the issue of electricity misuse.

To this day, there is still not an alternative energy source to produce a mass amount of electricity reliably at a low cost. This reality concerns scholars who study the Earth's climate system. Even if scientists found such discovery, people should not misuse any forms of energy, especially electricity. As energy prices and demand for electricity increase on campus, it has become a necessity to reduce electricity consumption. While changing one's belief on global warming may not be possible, there is clear evidence of global temperature rise for the past decade. As more electricity is used, more coal has to be burnt, which contributes to greenhouse gas emissions. In the primary source, when the survey asked if the students thought generating electricity has an effect on global warming, three people answered no. Whether or not global warming and generating electricity are related, generating electricity produces an incredible amount of pollution per year. In addition, a decrease in electricity consumption will increase the budget to give back to students and improve each individual's health as most college students are surrounded by electronics that may have a lifetime effect. Thus, it is necessary to educate the students on the topic and offer different perspectives on electricity use.

Bright, Glimmering Lights

Regardless of the issues that are still ongoing on campus, the greenest public school title does not come without any effort. The school as a whole has devoted many hours to keep the campus as environmental friendly as possible. Last fall, the school installed 1,800 solar panels on parking lot 22. Students funded and voted for installing the system back in 2011. The solar panels generate electricity not only cleanly but also economically. As a board member speaks, “We were approaching a cap in the budget and would have to start taking money from services” (Riley, 2014). This shows how the issue electricity consumption is urgent here at UCSB and not just something one reads about in a newspaper. The installation of solar panels is an example of the idea that students in the help themselves by participating in environmental activism in the long run.

Students have also taken on challenges outside of class to reduce energy consumption. The university has set a goal of zero green house emission by 2025. In order to help achieve this goal, four students from the Bren School of Environmental Science and Management presented their idea on April 24 to reduce energy consumption in three building on campus. There is “a disconnect” between electricity users and energy consumption because the users do not directly pay for their energy consumption (Harris, 2015). With the team’s behavioral-based energy-efficient program, there will be a definite decrease in energy consumption and a net present value of thousands of dollars. In addition to student led projects, there are researchers and professors on campus that have been leading renewable energy source and conserving electricity. For example, the Institute for Energy Efficiency (IEE) has been carrying on the work of Alan J. Heeger, a Nobel laureate and professor in the physics department, to develop solar cells and

improve thermoelectric performance of materials. The research is applicable not only to UCSB, but also to the industry throughout the world.

### Continue Illuminating

The university has taken the right approach by trying different ways to raise students' awareness in electricity consumption. Reducing energy consumption and reaching zero green house gas emissions cannot be accomplished overnight. The effort has to come from both students and staff members on campus. The reason to conserve electricity and be a leader in the most eco-friendly campus in the nation is not just because it is the ethical thing to do, but also because it is the Gaucho thing to do. At the end of the day, everyone at UCSB is responsible for sustainability. The school exists for the students, and the students have the power to impact the community both positively and negatively. While installing solar panels and conducting research are great accomplishments, perhaps the most tremendous accomplishment the school can do is get every student to be eco-conscious and put effort into reducing electricity consumption. After seeing several projects and events launched here at UCSB, I believe that the most effective way to approach the issue is by holding mandatory sessions for students to inform them about electricity consumption and its effects. Once the students are aware of electricity consumption, they will be able to come up with their own bright ideas since human thoughts and inspirations are the greatest light bulbs in the world.

## References

**Scholarly**

- Erjavec, J., & Arias, J. (2007). *Hybrid, Electric and Fuel-Cell Vehicles* (2nd ed.). Clifton Park, NJ: Thomson Delmar Learning.
- Franchetti, M., & Apul, D. (2013). *Carbon Footprint Analysis Concepts, Methods, Implementation, and Case Studies*. Boca Raton, FL: CRC Press.
- Hossain, J. (2014). *Renewable Energy Integration Challenges and Solutions* (p. 447). Springer Singapore
- Karki, R. (2014). *Reliability Modeling and Analysis of Smart Power Systems* (1st ed., p. 202). Springer India.
- Ohji, T. (2012). *Advances in Materials Science for Environmental and Energy Technologies* (III ed., Vol. 250). Westerville, Ohio: American Ceramic Society.
- Olson, S. (2011). *Global Technology Changes and Implications: Summary of a Forum* (p.46). Washington, D.C.: National Academies Press.
- Palchak, D., & Denholm, P. (2014). *Impact of Generator Flexibility on Electric System Costs and Integration of Renewable Energy* (p. 20). NREL.
- Shibli, A. (2014). *Coal Power Plant Materials and Life Assessment Developments and Applications*. Elsevier Science.
- Spiegel, E., & McArthur, N. (2009). *Energy Shift: Game-Changing Options for Fueling the Future*. New York: McGraw-Hill.

**Non-Scholarly**

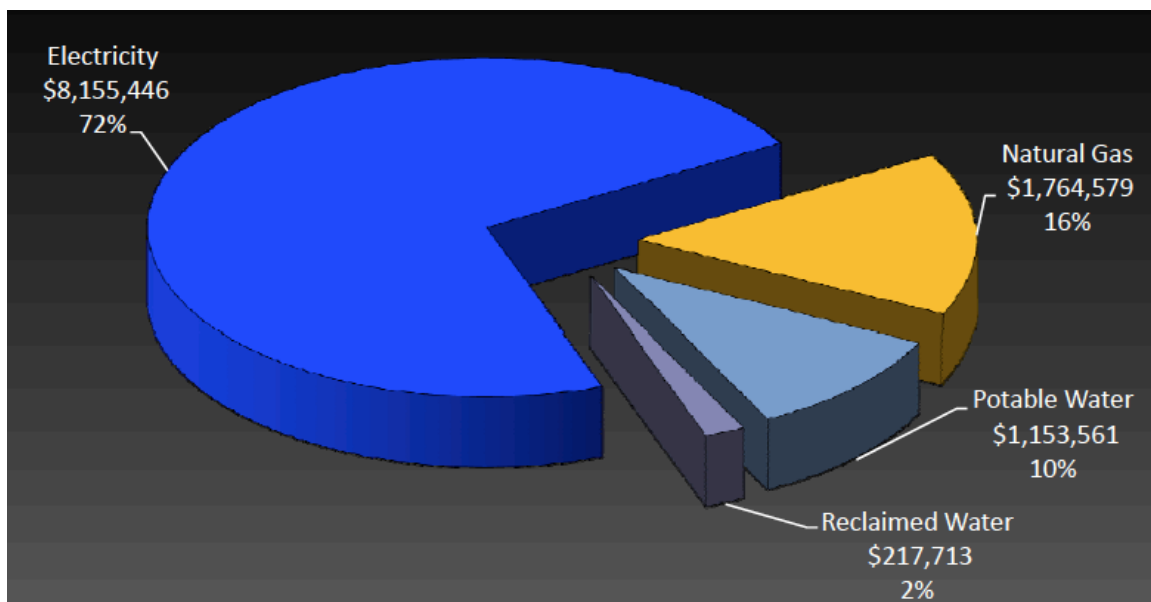
- Beach, E. (2011). Operating Costs for Gas Vs. Electric Convection Ovens. Retrieved May 5, 2015, from <http://homeguides.sfgate.com/operating-costs-gas-vs-electric-convection-ovens-70406.html>
- Crowe, A. (2010, June 10). 10 most costly appliances - DailyFinance. Retrieved May 7, 2015, from <http://www.dailyfinance.com/2010/06/10/10-most-costly-appliances/>
- How Energy-Efficient Light Bulbs Compare with Traditional Incandescents. (2014, November 5). Retrieved May 7, 2015, from <http://energy.gov/energysaver/articles/how-energy-efficient-light-bulbs-comparetraditional-incandescents>
- McCarthy, R. (2011, July 2). MacBook Pro Laptop Power Consumption Review. Retrieved May 14, 2015, from <http://nenergy.com.au/blogs/newsreviews/5842594-macbook-pro-laptop-power-consumption-review>
- Tia, G. (2013, October 28). Pediatricians: No More than 2 Hours Screen Time Daily. Retrieved May 7, 2015, from <http://www.scientificamerican.com/article/pediatricians-no-more-than-2-hour-screen-time-kids/>
- U.S. Carbon Dioxide Emissions from Electricity Generation. (2015, March 31). Retrieved May 5, 2015, from <http://www.eia.gov/tools/faqs/faq.cfm?id=77&t=11>
- UC Santa Barbara PowerSave Campus. (n.d.). Retrieved April 26, 2015, from <http://www.ucsbpowersavecampus.com/projects.html>

## Appendix A

## UCSB Annual Utility and Energy Report, Fiscal Year: 2013/2014

**Utility Usage & Cost – 2013/2014**

Electricity consumed:	87.2 gigawatt-hours
Peak electrical demand <sup>1</sup> :	14.6 megawatts
Natural gas consumed:	2.9 million therms
Potable water used:	159 million gallons
Reclaimed water used:	69 million gallons
Total spent on utilities <sup>2</sup> FY13:	\$11.3 million



## Appendix B

United States Net Electricity Generation Sources by Category

**Sources of U.S. Electrical Generation**