Solving the Problem of Student Energy Consumption:
An Energy Competition for Allegheny College

By
Abby Conroy
Department of Environmental Science
Allegheny College
Meadville, Pennsylvania

December 2009

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Submitted in fulfillment of the senior thesis requirements of the
Department of Environmental Science at Allegheny College
and approved by the senior thesis committee.

Dr. Eric Pallant	**Date**	***Dr. Rich Bowden***	**Date**

Pledge

Name: Abby Conroy Date: Fall, 2009
Major: Environmental Studies
Thesis Committee: *Dr. Eric Pallant, Dr. Rich Bowden*

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As a charter signatory of the ACUPCC, Allegheny College has been contractually committed to reaching carbon neutrality since April 2007. Part of that commitment required the college to complete a Greenhouse Gas (GHG) Inventory. Based on that inventory, it was realized that student energy consumption was a major contributor to GHG emissions. In order to counteract the effects of student energy consumption this senior comprehensive project designed and ran Allegheny College's first dorm energy competition. The competition was divided into two main parts, the first occurring while classes were in session, encouraging students to actively reduce consumption. The second part occurred over Thanksgiving break and focused on reducing phantom draws. Results of the competition were mixed with the biggest reducer of the first half saving just under 30% of their baseline and the biggest user consuming more than 50% over their baseline. Average reductions in the second part of the competition were around 40%. This competition provided insight into effective and ineffective strategies for encouraging student energy conservation. The competition was considered a success but in order to improve the results, methods have been suggested for future competitions.

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1 Introduction

1.1 Committing to Climate Neutrality

In 2007, the Intergovernmental Panel on Climate Change released its most recent report deeming warming of the climate system unequivocal by over 600 experts in the field (IPCC 2007). However, average citizens, including those who had studied in higher education, were not convinced that our environment was really in danger. In late 2006, the American College and University Presidents' Climate Commitment (ACUPCC or Presidents' Climate Commitment) was formed, demonstrating that many, but not all higher education institutions were in support of the IPCC report and of reducing university impact on the environment. This commitment requires signatories to be leaders in minimizing their institutions impact on the climate and to provide education to its current community and graduates to help achieve climate neutrality (ACCUPCC). Like many people, University presidents were hesitant to sign onto a binding commitment due to concerns over the cost and practicality of achieving carbon neutrality.

Today, over 650 Colleges and Universities have committed to the challenge of reaching Carbon Neutrality and are using the unique research and funding opportunities, provided through the commitment to minimize human impact on the environment (ACUPCC, 2009). Historically, College and University graduates are active and constructive participants in society (Rappaport and Creighton, 2007). The Presidents' Climate Commitment provides hope for future generations of environmentally literate, active and constructive citizens advocating for sustainable living (ACUPCC, 2009). The Presidents Climate Commitment was the first of its kind in scope and breadth in the United States. The response to the commitment, including international support, was a driving force towards addressing environmental issues, including climate change through higher education.

The Presidents' Climate Commitment helps connect colleges and universities to one another and provide them with guidance to reach carbon neutrality. Because the commitment is relatively new and many colleges lack the background knowledge and infrastructure to achieve carbon neutrality, the agreements within the commitment are flexible and do not demand a detailed timeline. The timeline and goals are entirely up to each of the colleges to establish, based on their own needs and desires.

The three major guidelines listed in the President's Climate Commitment are to:

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.

2.Initiate two or more tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed

3.Make the action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination.

Developing a comprehensive plan to achieve climate neutrality is a detailed and evolving process. However, there are several main areas that consistently need to be addressed. These areas include education, buildings and grounds, transportation, dining services, energy, purchasing and waste. In order to aid universities in developing their comprehensive plan and achieving carbon neutrality, the second guideline of the commitment provides examples of policies and requires that two of these policies become immediately adopted. Some examples include LEED standards for new construction and Energy Star appliances to replace old, outdated equipment in order to help the college reduce its annual energy usage. Although running these appliances will still require electricity, the efficiency standards reduce consumption drastically. For example, purchasing an energy star refrigerator to replace a model more than 9 years old could not only save hundreds of dollars a year but the new refrigerator

would consume 40% less energy than the old one. That means that the energy star refrigerator would reduce emissions by 40% (Energy Star 2009). Purchasing Energy Star appliances won't make a school carbon neutral but it can help save money that can be used for more updates that gradually help the college reduce emissions and work towards the ultimate goal of carbon neutrality. The third guideline acts as a system to help other universities by providing details on programs and policies adopted by participating schools, and it helps institutions stay on track and maintain their involvement with the community of colleges that have signed on. For a full set of guidelines, see appendix A.

1.2 Techniques for Reducing the Footprint of Higher Education

Allegheny College was a charter signatory of the ACUPCC. As a charter signatory, Allegheny has been contractually committed to reaching carbon neutrality since April 2007. In the summer of 2008 the college hired a sustainability coordinator to lead the college in making the changes necessary to reduce our environmental impact and reach carbon neutrality. Her duties include developing the college's Climate Action Plan, monitoring and collecting data for the greenhouse gas inventory as well as developing solutions to help the college reduce its green house gas emissions and save the college money. On October 20th 2009 the Climate Action Plan was updated, outlining a plan for achieving climate neutrality by 2020 (Kelly Boulton, 2009).

Some universities, like Yale have large budgets that have been used towards buying carbon offsets (Bass, 2007) however, at Allegheny we believe that it is more important to improve our efficiency and awareness rather than just paying for offsets. Because of this we are continuously improving the way we function and increasing efficiency on campus (personal contact, Kelly Boulton, January 2009).

As stated in the Environmental Guiding Principles, Allegheny College has a dedicated relationship with the surrounding region (Allegheny College, 2009). While carbon offsets are an effective method for reducing greenhouse gas emissions globally, in practice, the investment made in carbon offsets doesn't go directly to the surrounding community; rather it goes to "avoiding the release of a ton of CO2 elsewhere or absorbing / sequestering a ton of CO2 that would have otherwise remained in the atmosphere." (Taiyab, 2006). Therefore, Allegheny College will continue contributing locally by making personal changes instead of succumbing to the temptation of carbon offsets.

1.2.1 Setting a Baseline

On September 15, 2008 Allegheny College completed its first Greenhouse Gas (GHG) Inventory. There are many reasons to gather this data. These include determining the school's impact on climate change, establishing baseline data to help the school achieve a goal, deciding on priorities for improvement, and measuring the results of specific actions (Rappaport and Creighton, 2007). In 2007 Allegheny was emitting nearly 16,000 metric tons of CO2 equivalent annually (Boulton, 2009). As seen in *Figure 1.*, just under half of those GHG emissions came from electricity use on campus.

After analyzing the results of the GHG inventory, it was obvious that college needed to greatly reduce its electricity consumption. One easy, but initially costly way to reduce electricity consumption is through purchasing newer more energy efficient appliances (Creighton, 1998). Allegheny's campus is already committed to making energy saving improvements and has adopted an energy star purchasing policy. Those new appliances alone save anywhere from 10-50% more electricity and water than the older models being replaced (DOE, 2009). While purchasing more efficient technologies is an effective strategy, it is still important to weigh the

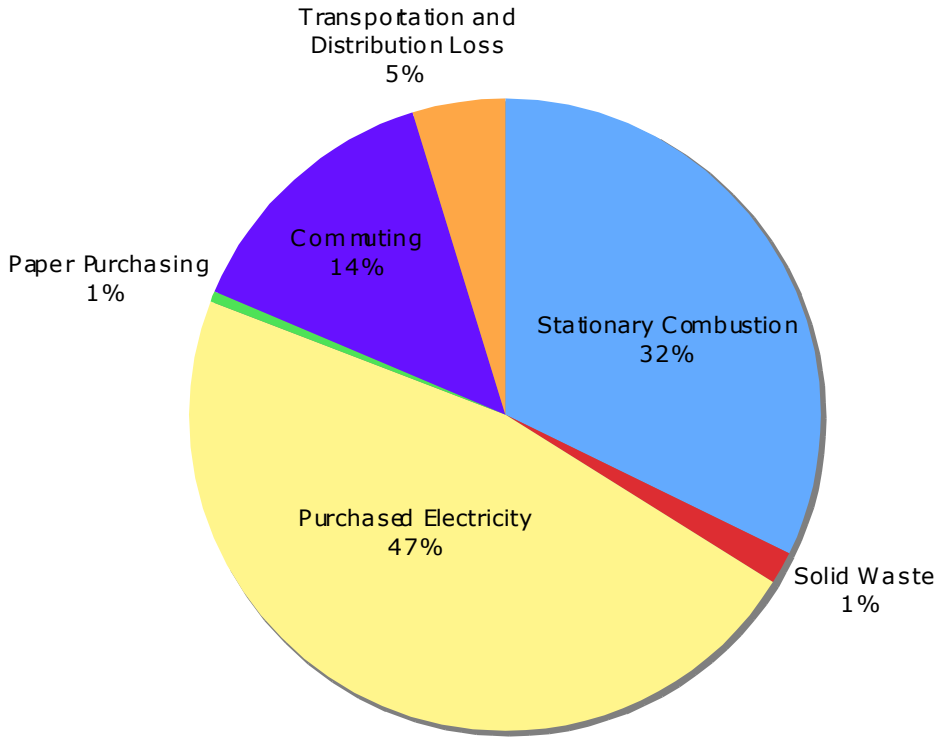


Figure 2. Percent CO2 equivalent emissions by source at Allegheny College in 2007.

environmental benefits of a new appliance over the environmental cost of discarding an old one. Regardless, improving efficiency should be priority over purchasing renewable energy, or carbon offsets to counteract excessive consumption.

Student habits also contribute to a major slice of the energy use on campus. Until spring 2009 the slice used directly by students was unknown since the buildings were not individually metered. Once the majority of those buildings were individual metered and the sustainability coordinator had access to the daily data, many opportunities to reduce energy consumption arose.

1.3 An Energy Competition for Allegheny

One of the cheapest but most difficult ways to reduce Allegheny's GHG emissions is through changing student behavior. In many ways, changing habits or in this case breaking an addiction to energy is easier said than done. Sometimes educating the student body about how their actions may help reduce their consumption (Creighton, 1998) is a successful method. However, it depends on the dynamics of the student body. Some schools have a population

dedicated to reducing their impact on the environment by making a conscious effort; others rely on more passive approaches by installing systems that do not require the students to think about their actions. An example of such a system is motion sensors. When installed in academic buildings students do not need to remember to shut off the lights because after a designated time without motion, the sensors automatically shut off ensuring that lights are not left on for extended periods of time without students in the facility. Passive approaches don't typically help students after they graduate however, unless they recognize the benefit of having such a system installed in their own residence. If students just rely on motion sensors to turn off the lights, they still won't make an effort to turn lights off someplace else, where motion sensors are not installed.

Passive approaches take away much of the teaching process that Allegheny wants students to go through. As required by the Presidents Climate Commitment, students leaving Allegheny should be environmentally literate and without teaching them any lessons, they will not be such. Therefore, while motion sensors will help the school save money and reduce carbon emissions, the students will not have the awareness about the consequences of wasting energy without some other influential source for information. Even though teaching students to be aware is more costly and requires attentiveness and support from the faculty and staff at the college, it is nearly impossible to fulfill Allegheny's pledge to environmental wellness through the Presidents climate commitment without a communitywide effort.

A popular method for getting students and staff actively involved in reducing energy consumption is an energy competition. Typically, energy competitions are a specific time of the school year ranging from a week to a full semester in which on campus dorms compete against each other to reduce their environmental impact by reducing consumption. Duke University has

what they call an “Eco- Olympics” entailing energy, waste and water consumption (Duke University, 2006). Ohio University on the other hand just focuses on reducing dorm electricity consumption (Marcus, 2009). Colleges have many variables and need to tailor these competitions to their own needs by using different methods for monitoring and motivating students to get involved.

One of the overarching goals of energy competitions is to make students aware of their consumption habits and break them. Lundgren et al. (2002) found that people were more likely to change their energy use habits under three main conditions. The first condition is when “People view energy efficiency in terms of benefits to themselves.” Once people can relate to energy conservation and find its benefits personally, they are more likely to adopt the new practices. Pending the monetary savings of energy competitions, contributions could potentially be made to campus facility efficiency updates. Such updates would include new, more efficient lighting, Energy Star appliances and LEED renovations. Making the reward something the entire campus can benefit from will helps keep everyone involved in reducing electricity consumption even after the competition has finished. Also, even if students weren’t living in the winning dorm, they were given other opportunities to win prizes, further encouraging their dedication for the duration of the competition.

Lundgren’s second condition is when savings and use are visible in daily life. If people can track their use easily and see the financial benefits, it helps them set and achieve goals for consumption. By either installing real-time energy monitors in main buildings around campus or providing access to real-time data on the web, this information should be visible in daily life.

The third condition is when information, with regards to energy consumption, is conveyed to the participants in a clear, personalized format. Making the content of a competition

relate directly to a participants life makes it easier for them to get involved and helps motivate them to become active on the subject (Lundgren et al, 2002). By updating daily data online, students are able to see how the changes they make in their own dorms changes the electricity readings.

In 2009, the sustainability coordinator at Allegheny, Kelly Boulton decided to focus efforts on conducting an energy competition at Allegheny. In coordination with Kelly this project worked to design and run an energy competition at Allegheny. The purpose of this project was to determine and test the variables necessary to establish an effective energy competition at Allegheny College in order to help reduce the GHG emissions produced by electricity consumption on campus and to help save the college money.

1.4 Tools for Breaking the Habit

1.4.1 Carrots

There are many strategies to help achieve the three conditions defined by Lundgren et al. Techniques are vast but have common themes including prompting, educating, modeling, reinforcement, punishment, persuasion, and feedback (De Young, 1993). A typical prompt or tool of persuasion, also called a carrot, might be a prize or reward for winning a competition. Luzenhiser (1993) cites this as an effective strategy for uniting groups with common interests and encouraging them to compete as best they can against their similarly united opponent. This method has been proven affective at Duke University. The monetary savings from their Eco-Olympics add up and could be spent on prizes for the winners, but many of the prizes like iPods, mountain bikes, and iTunes music cards are donated to help motivate students to really conserve and save the college money (Duke University, 2006). The University of Connecticut also features prizes however, the annual prize is free ice cream made by the agricultural school for the residents of the winning dorm (C. Pomposi, personal communication, April 17, 2009).

Prizes are a common motivator in energy competitions but the type of prize can really affect the way students use electricity after the competition is over. Prizes provided by Duke are longer lasting than a free ice cream cone and could potentially encourage students to continue to save electricity longer than ice cream. Once the ice cream is gone, what motivations do students have left? At least if they won a specially painted mountain bike, every time fellow students saw or rode that bike, they would be reminded of what was done to earn it perhaps, encouraging them to continue to practice energy conservation.

1.4.2 *Sticks*

Other tools for reinforcement are punishments referred to as sticks. One example may be an incurred charge to residents using more than an allotted amount of electricity. However, this negative method is not necessarily effective (Miller and Rollnick, 2002). Take smoking or eating for example, even though people are informed about the consequences of abusing either of these substances, they still do and pay for it in the end. At the college level, parents may just pay the charge for the offense of using electricity frivolously. $200 is insignificant when compared to the overall cost of college. This can be seen in housing. For example, at Allegheny, North Village costs nearly $1500 more than other housing options yet every year North Village is one of the first residence halls to fill up. It is evident that despite costs parents are willing to pay upwards of $1000 annually. If students pay for college on their own, this method might be more effective.

1.4.3 *Real-time Data*

Oberlin College has annual energy competitions that use two main tools to help students relate their actions to energy consumption. They have a real time energy consumption tracking system on the web and posted on touch-screen monitors around campus where students can see

at any moment of the day, which dorm is using the most energy. One study specific to Oberlin, and conducted through Psychology and Environmental Science departments monitored student interaction and participation in their energy competition. The study states that, based on the number of website hits and activity on the touch screen displays that there is a high level of interest and use of the tool. This suggests that both the online tracking system and touch-screen monitors are helpful tools for realizing and reducing student energy consumption (Peterson et al 2007).

Oberlin also has colored lights in the common rooms of all of the dorms. The lights glow deep red when there is a lot of energy being used and pale yellow when not much is being used. This tool helps educate the students on how their consumption patterns relate within the building. Students could literally walk into their room and unplug everything and see that they have affected the color and intensity of the light.

As quoted from conversations with the sustainability coordinator at the University of Connecticut, "Oberlin has one of the most successful programs anywhere"(J.L. Sayers, personal communication, March 30, 2009). The successes of past energy competitions demonstrate the effectiveness of many of the tools they use.

1.4.4 *Social Networks*

The growing popularity of social networking sites has united many people for a number of reasons. Facebook has over 200 million users worldwide and continues to grow as celebrities like Oprah publicize the site for their own causes. The environment has also become a popular cause on Facebook, uniting millions of users through simple applications. Mankoff et al recently published a paper on social networking sites such as Facebook. Mankoff et al (2007), supports social networking sites such as Facebook as being effective tools for motivating people to reduce

their environmental impact by uniting strangers with similar interests. However, depending on the target audience, social networking sites may not be very helpful.

In the case of Allegheny, it is likely that Facebook will be an effective tool for promoting the event based on the sheer number of users here. Students regularly promote school events, through Facebook, suggesting that it will be a useful tool for the purpose of a campus wide energy competition. It can provide a quick and easy space to post informative links and electricity use data throughout the competition. Also, Facebook can be used as a communication tool where students and faculty can exchange ideas for conserving electricity and vent their frustrations. It is likely that Facebook will be most useful for event promotion. While we are hopeful that students may participate and take part in discussion on the site, it is less likely.

Auburn University used Facebook, Twitter and youtube during their competition, the Sustain-A-Bowl. On Facebook, two groups were created; one for those students and faculty with general interest in the competition and the other group was for uniting potential volunteers. Ultimately Auburn found that Twitter was not as effective as the other two sites. They used Facebook events to let students know when the competition was occurring and when events were taking place as well as to post pictures and update students on campus happenings (personal contact, Alexander Pfeiffenberger, Auburn University, October 2009).

1.4.5 *Scoring*

Both Oberlin College and Williams College reward the dorm that reduces its consumption the most, based on averages. In order to do this, baseline data is collected prior to the competitions in order to find a weekly average consumption in each building. During the competition, the dorm that is able to reduce its weekly average the most wins. Oberlin's sample calculation is as follows:

Percent reduction = 100%*(average rate of electricity consumption so far during the competition)/(average consumption during the baseline period).[1]

The only difference between the calculations done at Oberlin and those done at Williams is that Williams only posts data on a weekly basis whereas Oberlin has an online reading system on which they can post real-time or daily data. Therefore, the sample calculation for Williams looks like:

Percent reduction = 100%*(average rate of electricity consumption for week x)/(average consumption during baseline period)[2]

At Allegheny using percent reduction will be a good strategy. The dorms all vary in size and age, and Brooks Dining Hall affects the amount of energy used in that dorm. Because of this it is important that the residents of on campus dormitories compete against their own baseline average to see which dorm can reduce their consumption average during the competition. By utilizing the percent reduction, students are still able to reduce their consumption per person and if they can encourage the dining hall to reduce consumption, they will benefit even more.

It is not necessary to go into extensive detail for establishing the baseline the first year because it will continue to change and be refined each year thus making the competition more and more difficult. It should certainly be based on fact and as much data as possible should go into establishing the baseline.

Ohio University, has an undergraduate population of 16,738 and houses just under 8,000 of them on campus. In order to house that many students, the college has 42 dorms that compete in an energy competition each year (Ohio University, 2009). Because the dorms have different

[1] Sample calculation for Oberlin College taken from http://www.oberlin.edu/dormenergy/
[2] Sample calculation for Williams College take from http://www.williams.edu/resources/sustainability/energy_competition/energy_competition_data.php

heating and electrical components, they run their competition in January and February. At that time of year, weather is relatively stable and air conditioning does not need to be considered as a factor for energy consumption, thus simplifying the baseline.

Allegheny has only had access to metering for each dorm since March of 2009 so unfortunately there was not very much data to work with in order to develop a baseline.

1.4.6 *Money Thermometer*

A common tool for fundraising is a money thermometer. It helps donors visualize the distance from fundraising goals and connects them to the cause. For the energy competition at Allegheny, a similar tool will be considered for the future. Since the theme is energy efficiency, our money thermometer will be in the form of a CFL light bulb and will have a number of financial goals on it. The savings accumulated throughout the competition will be added to the light bulb, demonstrating to students, the distance to accruing enough money to implement different updates on campus. For example, one goal may be enough savings to purchase motion sensors for the lights in all the academic buildings; another could be purchasing 5% more wind power. These goals will be based on cost and options will stem from the school's greenhouse gas inventory, further aiding Allegheny in reaching climate neutrality. If funding is available for multiple changes, the student body will be able to vote on what changes they would like to see. This helps relate them to the activity, even after the competition is over.

Because the cost savings of this year's competition were unknown and simply projections, it was not feasible to use such a tool. In the future, when savings are more predictable this effort could prove helpful. Furthermore, Pennsylvania currently has a price cap on electricity, to be lifted in January 2011. It is unclear how that will effect energy prices, some say it will sky rocket, others argue that there will be competition keeping prices low.

Nevertheless the residents of Pennsylvania will experience an increase in electricity costs in 2010(PUC, 2009). Currently, Allegheny College maintains a contract with the electric company keeping costs at only $0.06 a KWH. This means that projected savings are minimal compared to those at a college in Connecticut where residents pay $0.20 a KWH.

The aforementioned tools are just a few of the many options for designing an effective energy competition. The combinations vary from campus to campus and depend on the needs and resources of the school.

2 METHODS: THE PILOT ENERGY COMPETITION

To begin, information was gathered on other schools and their energy competitions through research on forums such as the American Association of Higher Education (AASHE) and personal contact with Williams College, and the University of Connecticut in order to get a feel for the many approaches used for tackling student behavior with regards to energy consumption. Furthermore, scientific papers about behavior change and effective tools for improving the long-term usage habits of students, faculty and staff within the college community also proved to be helpful resources. Attendance to the 2009 Ball State University/AASHE Greening of the Campus Conference provided further details on energy reduction issues at colleges and universities nation wide.

Using that information, a pilot energy competition was planned and conducted during the week of Wednesday April 15th through 22nd. The goal of the pilot energy competition was to determine if an energy competition at Allegheny would be successful (in terms of energy saved) with an expiring prize; that is a prize such as food that does not last forever as compared to a t-shirt. By conducting a study between two campus-owned houses based solely on the role of competition and incentive, the effectiveness of food prizes was determined.

2.1 Week One

Two campus-owned houses, 382 and 388 East College Street were monitored during the week of April 8th until April 15th. 382 East College Street, a special interest house known as Queers and Allies (Q and A) housed 4 students. 388 East College Street consists of two apartments, the first known as the Meditation house had four residents and the second, housed the area coordinator and his roommate meaning that there was a total of six residents in the building. The electric meters on the two buildings were individually read on a daily basis, beginning at 4:40 p.m. and ending at 4:45 p.m. in order to establish baseline usage data. This period lasted seven days. For each week a daily average was calculated and each house worked to lower that average for the duration of week one.

On the evening of Tuesday the 14th of April, two separate meetings were held, one per household. The purpose of the initial meeting was to learn about energy use habits and background knowledge. To begin, I introduced myself and discussed my work-study position (with the sustainability coordinator) and the plan for my senior project (designing the energy competition for the fall). During the first meeting the Initial Survey (Appendix B) was conducted. This survey inquired about current energy-use habits and then asked the students to come up with ways that they could help reduce consumption.

After the surveys, the competition that would be taking place during the next week, April 15th until April 22nd was described. Additionally, residents were informed of the electric meter readings that would be taken at the same time (4:40 p.m. - 4:45 p.m.) as during week one. To close, there was a discussion on ways in which the house could cut consumption. In the Q and A house, the students led a discussion on what they could do to “win the competition”! At 388 East

College I led a discussion on conserving energy and listed a number of suggestions on what the students could to do conserve energy. In part the student led discussion as compared to the discussion I lead was to help provide insight into whether or not the competition could be successful without structured input from the sustainability office. The students were thanked for participating in the study and provided with contact information in case any questions arose.

2.2 Week Two

During the week of April 15th through 22nd, both of the campus-owned houses competed against each other to see which one could reduce its energy consumption the most. Electricity meters were manually read for both houses at 4:40 p.m. - 4:45 p.m. each day in order to keep track of consumption patterns. The residents of both houses were given access to free CFL's provided by physical plant to help reduce consumption but had to retrieve the bulbs on their own. Also, the houses were giving updates every two days on the competition standings.

In order to determine the winner, the consumption average for week one was compared to that of week two. The house that had the greatest percent decrease in consumption during week two was declared winner. To calculate the winning house, the following equation was used:

Percent reduction = 100%*(average rate of electricity consumption for week x)/(average consumption during baseline period)[3]

On Wednesday April 22nd a final meeting was held but this time both houses were together in order to discuss the competition and techniques used. The students were given surveys (see Appendix C) to fill out about the experience.

[3] Sample calculation for Williams College take from http://www.williams.edu/resources/sustainability/energy_competition/energy_competition_data.php

2.3 Week Three

During week three, April 22nd through 29th electric meters were still read at their respective times to determine if the changes students made during Week Two had actually become habits or if the students had solely been motivated by competition for pizza. If the readings went back to consumption numbers observed during Week One I met with the students again to discuss.

3 RESULTS: THE PILOT ENERGY COMPETITION

3.1 Survey One

Through the surveys, majors and background knowledge on electricity consumption were collected. It was found that 382 East College Street had two seniors and two juniors one of whom is an environmental science major. The house already had mostly compact fluorescent light bulbs and practiced basic conservation techniques such as shutting off lights and computer monitors when not in use and turning off the tap while brushing teeth. Other ideas that they had for conserving electricity during the competition were turning off desktop computers (two students had desktops in addition to laptops that ran almost constantly), unplugging cell phone chargers and printers, and taking shorter showers if hot water heaters are electric.

It was found that 388 East College Street housed 5 juniors two of whom were environmental studies majors. Their electricity consumption habits were using natural lighting, turning off lights around the house at bedtime, and using CFL light bulbs. This house mainly focused on unplugging vampires or appliances not in use, throughout the competition. There were two major areas that were discussed during the first meeting that could be fixed to help reduce electricity. The first was the TV/stereo set. They had a number of electronics that, if unplugged could save a lot of electricity and they could easily be plugged into a power strip. This house also had an extra refrigerator that was unplugged for the duration of the competition.

3.2 Survey Two

Survey two covered techniques used throughout the competition and general attitudes towards the competition. In 382 E. College Street, major strategies for reducing electricity use included making better use of natural lighting, maintaining a rule of one light on at a time in the house, shutting off computers at night, and unplugging items while not in use. Students in this house noted that getting feedback on their consumption levels during the week was very helpful. In 388 E. College Street, the house made use of candles on occasion and unplugged their extensive tv/stereo/video game systems, extra refrigerator and most appliances. They noted however that they did not make good use of natural light, mentioning that they should have studied during the day. This house also enjoyed getting feedback but requested that next time, submitting consumption updates more often would be helpful. One aspect of the competition that 388 did not like was that it was paired with the upstairs apartment. The residents of the meditation house did not feel that the students living upstairs really participated. The students in that apartment never filled out surveys despite requests and did not attempt to return contacts to set up meeting times.

3.3 General

Neither of the houses took advantage of the free CFLs from physical plant. As demonstrated in Figure 2, after week two 382 East College Street was the winner of the competition they managed to reduce their weekly average by 48% over their week one average. 388 East College Street reduced their consumption by 37%. Since both houses were able to make significant percent reductions they both received pizza dinners, partly in thanks of participation but mostly because of the enthusiasm and helpful feedback given.

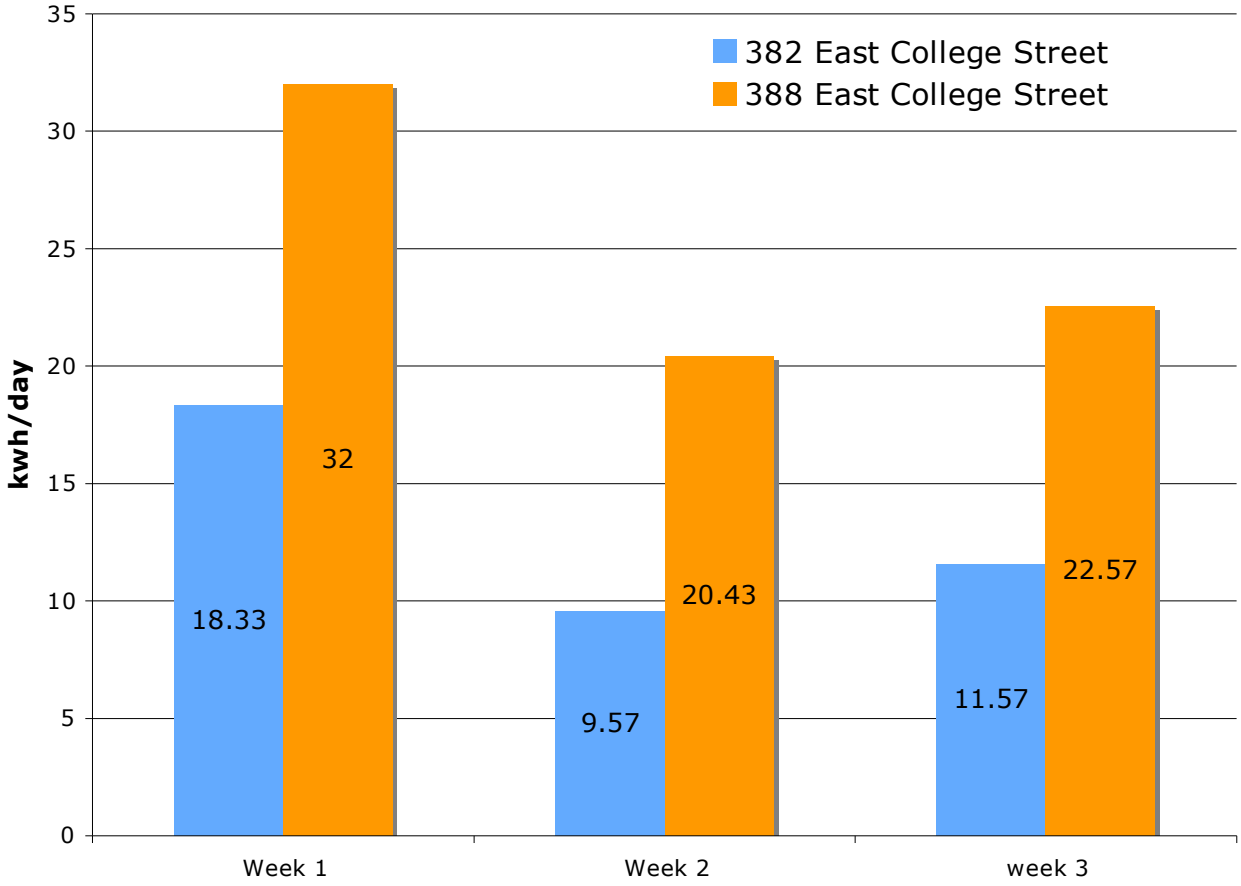


Figure 2. Average daily consumption patterns for both participating houses of the pilot energy competition, over the course of three weeks.

4 Discussion: The Pilot Energy Competition

Based on the lack of participation on behalf of the upstairs apartment of 388 East College Street, it is likely that the percent reduction of that household suffered. The residents simply did not respond to contacts and never filled out surveys. Also, in the case of 388, the six residents had two large refrigerators, factoring a three person per refrigerator average. At 382 East College Street, the house only had one refrigerator making the electricity load for the house, four people per refrigerator. It is likely that the difference in refrigerators affected the results of the competition. In reality, the houses could only reduce so much energy and it is possible that 388 nearly reached that point however seemed to be using more energy than 382 simply because

there were two separate apartments with one refrigerator in each at 388 East College.

It is for the previously mentioned reasons that the percent reduction method may not have been the most accurate means of conducting an energy competition on such a small scale. Because there were only two houses involved with the pilot competition, they were able to reduce electricity consumption to the extreme. In dorms, during the main competition, it is likely that the percent reductions will be much lower than during the pilot competition and therefore exact appliances in buildings will be unknown but controlled for. It will be assumed that on average during the competition students will be using no more appliances than during any other typical week. Thus, those consumption patterns will be already included in the baseline. If students happen to use fewer appliances during the course of the competition (which is what we want) than they will easily reduce consumption.

Both of the houses felt that seeing energy use data throughout the week was helpful and were interested in seeing more. This supports the need for a real-time energy monitoring system available to the student body for future competitions.

The electricity meter readings for week three, as shown in Figure 2 showed that despite lacking a prize for motivation, the students continued to use less electricity than during week one. This suggests that perhaps food prizes can be effective motivators despite not being permanent or long lasting. It would be interesting to monitor the effects for a longer period of time following the actual competition to determine if the consumption trends are long-term habits or simply fads.

5 Methods: Allegheny College's First Dorm Energy Competition

The goal of the campus wide dorm energy competition was to help reduce the impact of Allegheny College on the environment by reducing greenhouse gas emissions. By using the data

collected from this competition, an assessment of the effectiveness of competitions on electricity consumption at Allegheny was made. Many techniques were researched and were good fits for the college but simply were not feasible this year. Some of those techniques will be implemented next year, pending the results of this competition.

5.1 Advertisement

Allegheny Student Government (GAP), EcoReps, and Kelly Boulton contributed much of the advertisement for the competition. One radical method used was customized Fortune Cookies. The hope was that by using a non-traditional method of advertisement we would be able to capture the attention of the student body. One example message on the front side of fortune slips included "The Green Gator says… student who turns of power strip wins competition." The backside of the fortune slips said "Green Gator Energy Competition 2009. Compete and see results at sites.allegheny.edu/greengator." Allegheny Student government (ASG), the EcoReps, and Students for Environmental Action (S.E.A.) distributed CFLs and fortune cookies through a dorm-storming event on the evening of Tuesday November 17, 2009 around eight o'clock. Dorm storming consisted of several groups of students dispersing to all participating dorm residencies where they handed out CFL's and fortune cookies as well as provided details about the event to residents in the form of "Tips" cards (See appendix D). Over 4,000 fortune cookies and about 400 CFLs were distributed.

The web was also utilized for advertisement on sites such as Inside Allegheny, Facebook, the Sustainability Initiatives website and the Green Gator blog. Other traditional modes of advertisement included The Campus, napkin dispensers in the dining halls, banners, and posters, see appendix E and F for examples.

5.2 Summary of the Dorm Energy Competition

This year's competition was based solely on dorms. All funding was made possible through the physical plant work-study position for the Energy Czar. The position was never filled this year and thus funds were made available for advertising and prizes. The dorm energy competition ran the week before Thanksgiving, Monday November 16th, 2009 through Tuesday the 24th and during Thanksgiving break. It was divided into two sections; the first occurring while classes were in session the other occurring during Thanksgiving break. In addition to encouraging energy reductions in daily life, we hoped to experience cuts while students weren't around. According to the U.S. Department of Energy (Smyth, 2007), vampires or phantom draws, account for nearly 40% of electric bills. If you consider that most people are either sleeping or not at home for more than 50% of the day, it is likely that a good portion of energy bills is linked to items not currently being used but that remain plugged in.

The winners of the first half of the competition, the dorm residents who used behavioral changes to reduce overall electricity consumption while classes were in session were awarded the title of "Watt Chompers". The title "Watt Chompers" was chosen because of its connection to the school mascot, Chompers. Also, the name implies that those students crushed their watt consumption. For their efforts the residents of the winning dorm received a slide-in-certificate (meaning the winner can easily and cost effectively be printed on campus for each years competition) plaque made of sunflower hulls to be hung in the dorm as well as a study break party, occurring during the study days before fall examinations. The party was catered by Parkhurst and consisted of coffee, cider, cookies, cheese and fruit, hummus and pita. The winning dorm of the second part of the competition was awarded the title "Phantom Chomper" keeping with the theme of unplugging unnecessary electrical appliances, phantom draws. The

dorm that reduced electricity consumption the most while away on Thanksgiving break by curtailing phantom draws (unplugged appliances, chargers, turned off all the lights) was rewarded with a plaque also made of sunflower hulls and Smart Strip raffle within the dorm to help our green gators save even more.

Additionally, students campus-wide were able to earn raffle tickets to be entered into drawings for several different prizes including 2 Sigg water bottles, 2 Green Gator metal travel mugs, 3 gift certificates (bookstore: $100, Market House: $50, Whole Darn Thing: $20), Planet Earth DVD set, and a book: Toolbox for Urban Sustainable Living. The purpose of the raffle tickets was to get more students involved with the competition. Dining staff and CATA bus drivers handed out tickets to those students making use of reusable mugs and riding the LOOP. Dining staff was so excited about the idea that they began handing tickets out early. Tickets could also be earned by correctly answering the daily trivia questions available on the web through Inside Allegheny, the Green Gator Blog, and the Green Gator Facebook group for the first week of the competition. Students were then responsible for entering their tickets into the raffle except for when answering daily trivia questions. Kelly Boulton and myself manually entered all correct trivia answers into the drawing.

Winning raffle tickets were posted online just like the trivia questions, on Inside Allegheny, the Green Gator Blog, and the Green Gator Facebook group. From that point on it was up to the students to redeem their prizes. Students were given one week to do so and if left unredeemed, a new number was drawn.

While students did not actually have to reduce on campus energy consumption to earn tickets, reusing drinking containers and riding public transportation helps minimize effects of daily activities. Also, the trivia questions acted as a means of spreading knowledge, interesting

facts and tips were included to help teach students about how their daily choices effect the environment. Furthermore, the raffle made it possible to keep students involved. Even if their dormitory was failing in the competition, students who cared to participate were given the opportunity to be rewarded despite a lack of effort on behalf of their dorm mates.

5.3 Developing a Baseline

All dorms, except for College Court and Edwards were able to fully participate in the energy competition. Unfortunately, those two dorms lacked baseline readings and therefore could not compete for the main prizes but the residents were still able to receive raffle tickets and be entered into drawings for the raffle prizes. The winner of the competition was determined based on tailored percent reduction, using the following equation.

Percent reduction = 100%*(average rate of electricity consumption for week x)/(average consumption during baseline period)[4]

Individualized, daily data was not available for all dorms because of the way that they are metered. About 2/3rds of the dorm dwelling student body did have daily data available, the other third only had monthly data available. For the first 2/3rds, the sub-metered dorms: Brooks/Hulings, Walker, Caflisch, Crawford, Shultz and Baldwin, the baseline was developed using data from March and April 2008 and September and October 2009. Data from March and April but not including the week of spring break were used because the dorms were not sub-metered until the spring and more data points were necessary to determine a finessed baseline value. The baselines for the dorms that were not sub-metered, Allegheny Commons, Allegheny Hall, Delta Tau Delta, North Village, Phi Kappa Psi, and Ravine were calculated with data from

[4] Sample calculation for Williams College take from http://www.williams.edu/resources/sustainability/energy_competition/energy_competition_data.php

monthly electric bills for September, October, and November of 2008 and September of 2009. Data for October 2009 was not yet available and was replaced by data from November of 2008. Examples of daily consumption averages for each of the dorms can be seen in Figure 3.

Housing capacity data for each year was factored in. That is, weekly use was divided by the number of residents in each dormitory during the data collection period, in order to determine fairly weighted average weekly per capita consumption rates. There were more students living in the dorms in 2009 than in 2008 therefore physical plant witnessed an increase in electricity consumption over that of last year. Some dorms experienced recording errors; consequentially those weeks were not included in the baseline data.

Walker experienced consecutive recording errors this semester. Computing services was not able to fix the problem until the week of the competition so none of the data for this year was included in the baseline. Only data from March and April 2008 were available therefore the baseline for Walker was low assuming that Walker like most of the other dorms experienced an increase in consumption this year due to higher residential capacity. However, over the summer, the dishwasher in Brooks dining hall was replaced resulting in a more water and energy efficient machine. Additionally, a school-wide policy of tray-less dining was adopted. One school reported a nearly 10% decrease in energy consumption correlated to adopting tray-less dining (Greening the Campus, 2009). Therefore, Walker was not at a major disadvantage for using only last year's consumption to calculate a baseline.

On average, weekend consumption rates are considerably lower than weekdays. This distorted results making it seem that dorms were not reducing very much earlier on in the week. Once the weekend data was averaged with the weekday data this problem was resolved. North Village had a very high consumption most likely due to the heating and cooling systems

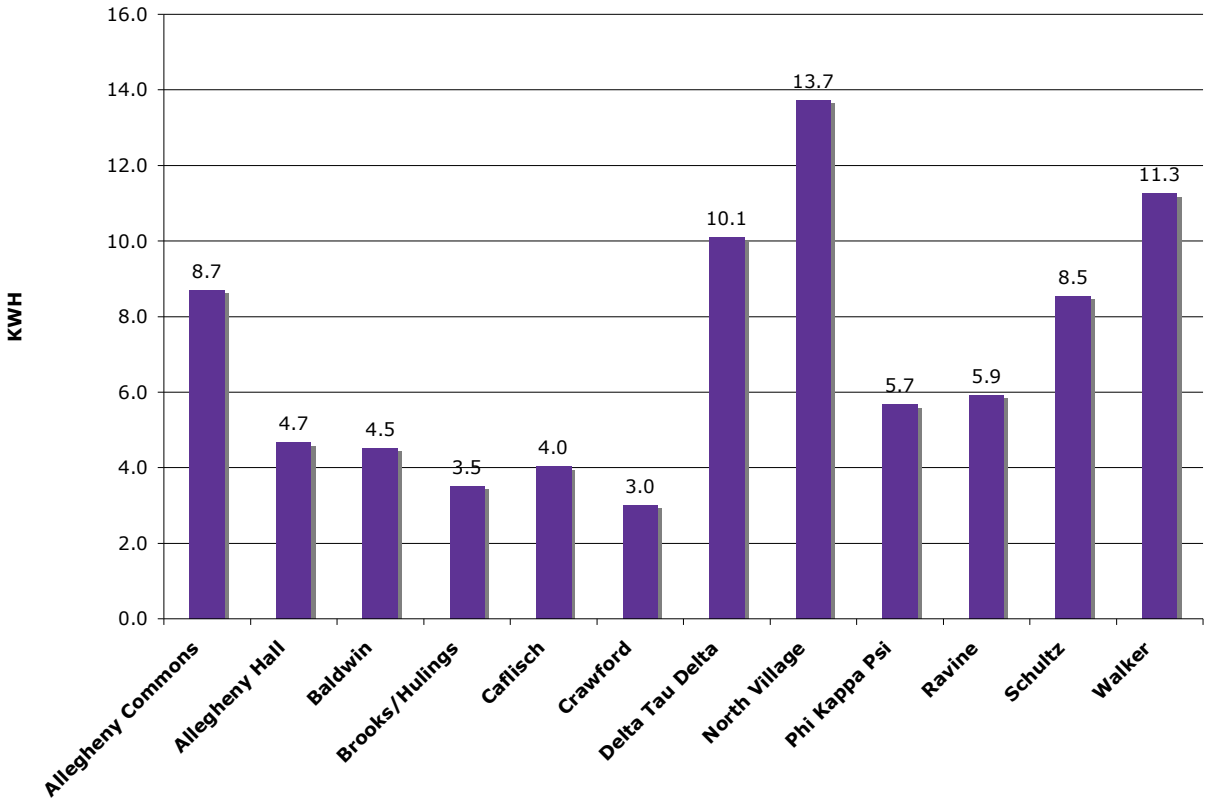


Figure 3. Shows the average daily per capita energy consumption baselines for each participating dorm in KWH.

constantly running. When the outside air temperature was above 75° Fahrenheit, the air conditioning in the building automatically turned on. Conversely when outside air temperatures reached below 55° the heating unit was stimulated. None of the residents of the building are able to shut off air, making it difficult to control energy consumption with regard to heating and cooling systems. Likewise, Allegheny Commons has air conditioners but students are better able to control heating and cooling because the building was originally built to be apartments for non-students. Walker and Delta Tau Delta both had high consumptions because both buildings have large kitchens. Brooks dining hall, the largest dining facility on campus is metered with Walker and Delta Tau Delta has its own kitchen with an outdated commercial dishwasher likely to be part of the reason that building had such high consumption. Shultz, like Walker, also has a dining hall attached to it but it is only used part time for smaller events. The building also has offices,

which require lighting all day, and has many computers running full time.

5.4 Meter Readings

Each day during the competition, electric meters were manually read on the un-sub-metered dorms in the afternoons between 2:30 and 4 P.M. The results for the sub-metered dorms were automatically updated daily.

5.5 Posting Daily Results

The daily results of the competition were posted on the Green Gator blog, Facebook and in Brooks to help inform the students of their progress and encourage energy reduction through competition. There were plans to post in the Campus Center. Initially, we wanted a large wall display to help catch attention from students but the Director of the Office of Student Involvement said that we must downsize. After downsizing the office of Student Involvement still did not permit us to make use of the advertising space in the Campus Center until Friday, halfway through the competition because we still wanted to use "too much" space. Despite the fact that the energy competition was a campus wide effort, many departments were not willing to participate. We were not informed until after the displays had been printed and results were to be posted that we could not make use of the Campus Center space despite communications well in advance of the initiation of the competition.

6 Results: Allegheny College's First Dorm Energy Competition

After the first portion of the competition, the "Watt Chompers" of Allegheny Hall, the dorm that used behavioral changes to reduce the most overall electricity consumption while classes were in session finished in first place with a 26.5% reduction and an over 10% greater reduction than the runner up, Delta Tau Delta, see Figure 4. Phi Kappa Psi was in last place consuming over twice as much energy over their baselines, as Allegheny Hall was able to reduce. Their consumption

jumped by over 50% for the duration of the competition. Results for the "Watt Chomper" portion of the competition can be seen in Figure 4.

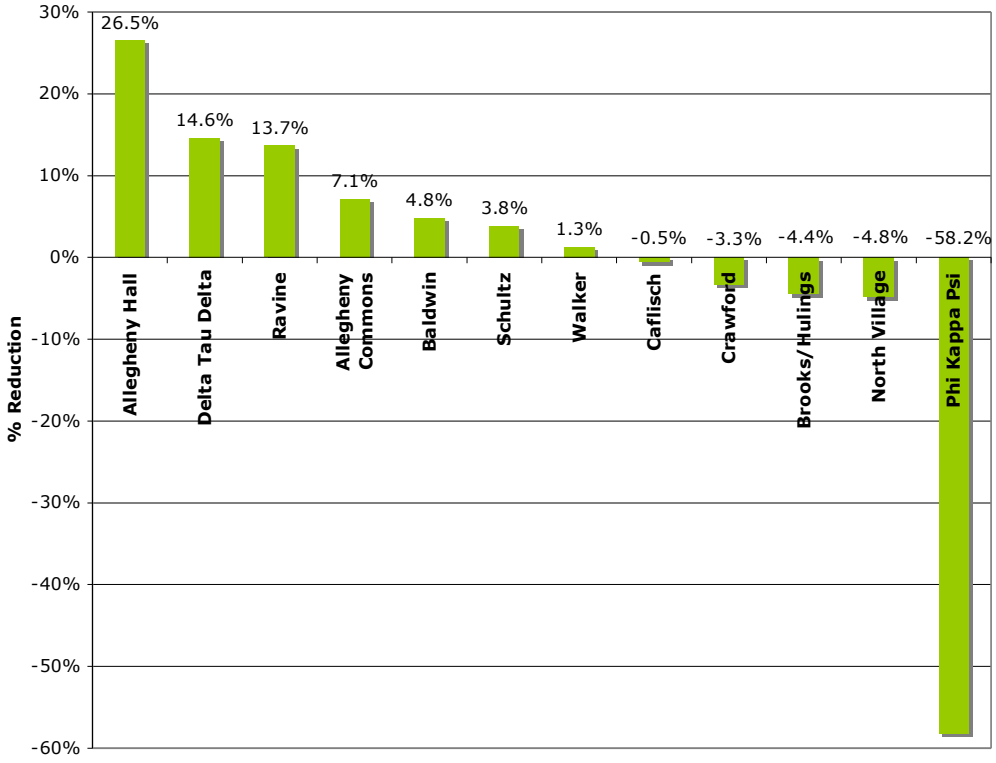


Figure 4. Shows the percent reduction or increase in each of the dorms for the "Watt Chomper" portion of the energy competition, November 16 – 24th.

Allegheny Hall also won the "Phantom Chompers" portion of the competition, being the dorm that reduced electricity consumption the most while away on Thanksgiving break by curtailing phantom draws, see Figure 5. North Village came in last this time with minimal reductions. Even Phi Kappa Psi was able to reduce by 5%. However, there is nearly a 30% difference between Phi Kappa Psi and Shultz, the dormitory placing third to last. On average, consumption dropped by about 38% during Thanksgiving break. Figure 5 demonstrates the results from this portion of the competition.

A total of about 18,722.6 KWHs were saved during the energy competition. While, that only amounts to about $1,120 in savings due to the low cost of electricity in Pennsylvania, it is nearly12 metric tons of carbon dioxide equivalent. That is roughly the amount of carbon

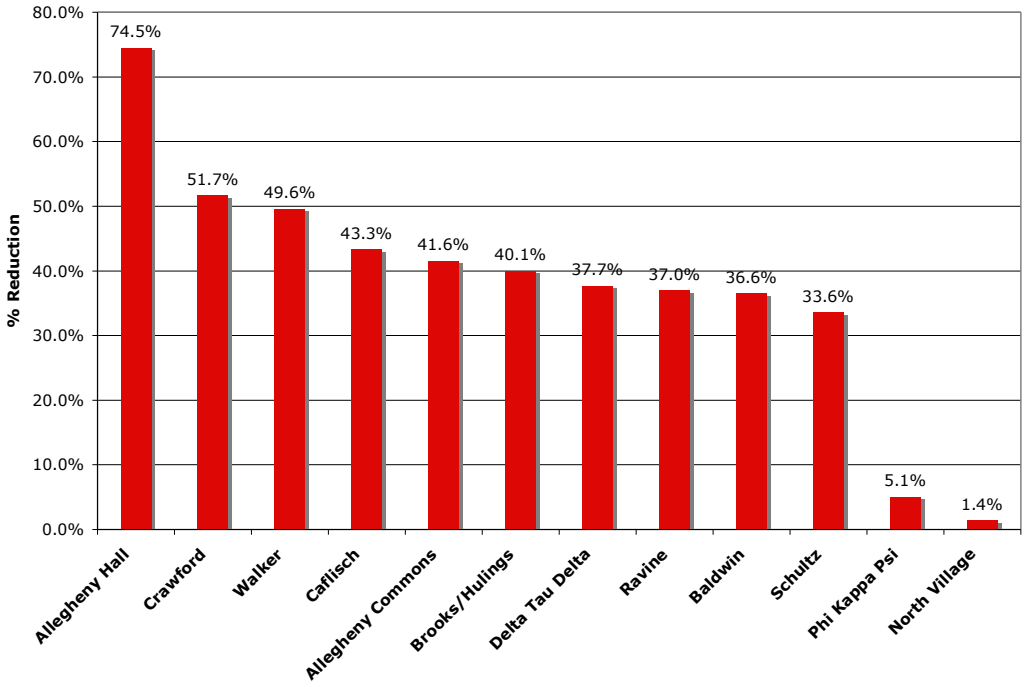


Figure 5. Shows the percent reduction occurring over the "Phantom Chompers" section of the competition, November 25- 30.

sequestered by 308 tree seedlings grown for 10 years (EPA, 2009).

Participation in the competition is very hard to quantify. Slightly fewer than 600 students joined the Green Gator Facebook group. While that does not necessarily mean they actively participated in the competition it suggests that they were at least interested in the idea. Very few students responded to daily trivia questions. The first day we received the most responses with 9 out of 26 students responding correctly. Responses trickled off from then on. However, over 800 raffle tickets were distributed. Almost 100 of those tickets were given out by CATA but only around 30 were given out for correctly answered trivia questions.

7 Discussion: Allegheny College's First Dorm Energy Competition

7.1 The Watt Chompers

As seen in Figure 4, Allegheny Hall decreased consumption by nearly 30%, this is likely due to the small size of the dorm. Because there are so few students living there, they are more

likely to make use of the community refrigerator and kitchen, rather than having their own major appliances running. Residents could potentially have unplugged items in their rooms such as microwaves and used the community one. Also, hallway and bathroom lights could be shut off for longer periods of time because there isn't much foot traffic. Very few people even know where Allegheny Hall is let alone visit there because it is on an extreme end of campus. Whereas many people visit Walker because it is central to much of the campus population and the biggest dining facility on campus. In Allegheny hall it is also easier to keep tabs on consumption patterns, and shut off lights with such a small residential population. The RA in Allegheny Hall mentioned that the residents made sure lights were turned off when not in use and that laptops were unplugged over night.

It is likely that Walker was only able to reduce by 1.3% because of the dining hall. In the future residents could encourage dining services to reduce consumption but they were not informed of their connection with Brooks Dining Hall. Estimates for the actual consumption by dorm and dining hall separately are difficult to come by but it is known that the facility is open for business for 3 meals a day 5 days a week and 2 meals a day 2 days a week. It is probable that the actual residential reduction was outweighed by the lack of electricity reduction in the dining hall. Without knowing their score was being affected by dining hall, the residents of Walker were actually placed at a disadvantage. However, given the seemingly low participation and support by the student body, it is unknown but likely that the residents of Walker would not have bothered to work with dining services to bring down their consumption regardless. It seems that awareness of their connection with the dining hall may instead instill a sense of hopelessness and likewise, discourage student participation.

Naturally, different groups of people have different consumption habits and that fraction

is difficult to discern without data reflecting the electrical cost of building function without inhabitants. Future studies may benefit from incorporating such data. In order to do so in the most efficient manner possible, sub-metering displaying at least hourly data would be most favorable.

Some studies, like one conducted by the Ontario Power Authority suggest that different sexes have different energy conservation tendencies. The study, published in 2008 showed that seven out of 10 of the most idealistic conservers, with idealistic conservers accounting for roughly 23 per cent of the population, are women (Ontario Power Authority, 2009). This study supports the outcome of the competition, as Allegheny Hall is an all female dormitory.

In general older, less efficient buildings were more likely to lead in reductions. If students shut off hall lights in Walker and in North Village, Walker would experience greater savings because their lighting is less efficient than that of North Village.

Unfortunately for North Village, their meter was not very accurate. Physical plant was not aware until this competition that the actual meter reading is multiplied by 300 in order to achieve rough consumption for the day. This however results in major error. For example, if the meter read 1000 KWH, the registered consumption would be 300000 KWH. Similarly if the meter read 1001 KWH, the registered consumption would be 300,300. Based on the multiplier of 300 it is easy to see how the reading is inaccurate. Residents of North Village would have to reduce by a factor of 300 KWH for that data to even register on the meter. According to the baseline, the dorm used a little over 10,165 KWH per week on average. That means that meter readings would only adjust down for every 3% reduction. This is one instance where a real-time monitoring system would be helpful because it would show actual consumption throughout the day and not just rough estimates for the day.

The extreme jump in consumption for the Phi Kappa Psi house is nearly inexplicable. Data for their baseline was retrieved from the electrical company. As a generalization, electricity consumption is up across campus but September's consumption at the Phi Psi house was down. Even if September had been an unusually conservative month for that dorm, averaging data from last year to create the baseline would counter a decline. This means that even if meter readings from September 2009 were added and caused a lower than normal baseline, there would still have to be a drastic increase in consumption in order for the meter readings to show the high consumption rates read during the week of the competition. Furthermore, a reading error could not be the cause as the meter was standard and read daily, therefore an error would be realized during the next reading session.

It seems that residents would have to work to increase use by that much. Not surprisingly, their name card was stolen from the display in Brooks when results placed them in last. Students would be much less likely to vandalize a real-time energy display simply because of the value or placement of such a system.

One resident of Walker, also a raffle winner, Steven Jones was particularly helpful. His personal habits during the competition (and after) were to "shut off his power strip when away because there were several appliances connected to it and lowering the temperature of his refrigerator so it would not need to run as much to keep itself cool. He also did homework in his work-study office to defer energy usage to a non-competing building. Steven narrated one student response to the competition:

> "There was one negative, sort of joke case of negative work done in our hall when unknown students took out the light bulbs of our overhead lights and put up a mock piece of paper saying to be truly green is to use natural sunlight and so our hall was pitch black for several hours."

In addition to his personal habits, Steven suggested that the competition become a bi-annual event. (Personal Contact, Steven Jones, December 2009). Another resident in Walker opted to line dry his clothing.

Bridget McCartin an RA in Ravine, commented on the excitement over the energy competition among her residents. “Everyone was really supportive and were always turning off hall lights and checking up one another throughout the week. It was a really fun experience!” It would have been helpful to receive responses from residents in the Phi Psi house but communications were only established based on raffle winners. None of the raffle winners were residents of that house. That could be a function of the small residential population in that dorm as well as lower participation rate.

I personally observed vandalism to the results display, in Brooks, by a men’s sports team and promptly reprimanded them. Their response was that they didn’t know the energy competition was a part of someone’s senior project, had I not been present it is likely that they would have defaced the display regardless of its role in my comprehensive project. Hopefully, the embarrassment of being caught red-handed was enough to deter them from further acts of destruction on campus.

Interestingly, three out of four of the top reducers in this category were within the four smallest dorms on campus with the exception of Ravine. The Phi Psi house is actually second smallest, behind Allegheny Hall but as previously discussed their efforts to minimize consumption appeared to be non-existent based on readings. Perhaps the smaller dorms were better able to reduce consumption as there was a higher sense of responsibility between the number of residents and because of minimal through traffic; the smaller the dorm, the easier to keep students accountable for their consumption patterns and to shut of lights in public rooms.

Ravine, a larger dorm was in third place. This is likely due to the design and location of the building. Living quarters are arranged into pods with easy to control lighting. At night, the pod hallway lights could be shut off without leaving the main hall in darkness. Also because the dorm is far away from the center of campus residents are more likely to spend time elsewhere in between classes and meetings, while that could be used as a strategy to reduce energy consumption, it is unknown whether or not the residents of Ravine actually implemented it.

Allegheny Commons was the 4th best reducer but because of the building design, apartment style, it was more difficult for students to reduce. Residents there are less likely to have individual minifridges like students in other dorms because they have one main refrigerator for the apartment. Unplugging mini fridges could have a large impact energy reduction, as refrigeration is one of the most energy intensive household processes. Also, many students living in Allegheny Commons have small meal plans because they have full kitchens, making it an even greater challenge for them to reduce energy consumption during meal times. Unlike students in the larger dormitories, who just go to the dining hall for their meals and shut off their appliances, those students living in apartment setups continued to use electricity during meal times.

7.2 The Phantom Chompers

As in the first half of the competition, Allegheny Hall dominated. Again North Village had a poor showing. The consumption patterns suggest that the heating and cooling system in North Village may have a greater impact on use then previously thought. However, this too could be attributed to the multiplier on the meter. While there is no way to know exactly how many students stayed in each dorm over the course of the break, we can estimate that well over half of the students would have left given campus facility cut backs such as limited dining facilities and

hours. With students removed from the equation, lighting in the common space and heating and cooling are probable culprits for the continued usage in North Village.

That being said, heating and cooling for future buildings may need to be reconsidered. While geothermal in itself may seem like a good option, there need to be alterations from the system in place in North Village. There is no way for students to shut off the unit making it difficult to conserve. In late September, mid October when the sun is hot but the air cooler, opening windows may be an equally effective method for maintaining comfortable room temperatures. In North Village it would be wasteful to open the windows since the building cooling system runs automatically. Over breaks, there is no reason to use mechanical heating either. Since the geothermal can maintain roughly 50 degrees, there is no worry of pipes freezing. Instead, over Thanksgiving break, the heating units continued to run unnecessarily in apartments where there were no students. There is potential to save energy in heating and cooling where it lacks in say walker. The heat has to stay on in Walker because it is a residential facility as well as a dining hall. There is much less individual control in rooms in Walker than in North Village.

The campus wide average reduction for the "Phantom Chomper" portion of the competition was just under 40%. As previously mentioned, the U.S. Department of Energy estimates that 40% of household electric consumption is by vampires, in order to achieve a reduction like that, students probably unplugged a number of electronics. It is likely that students took their ipods, cell phones, and laptops (as well as their chargers) with them thus reducing the number of phantom draws.

7.3 Challenges

Throughout the planning phase and the actual competition, many hurdles were encountered. First, metering and establishing baselines ended up being more complex than anticipated. In the beginning it was thought that all the necessary data was available. There was one list with hourly data and one with monthly electricity consumption, which was obtained through the billing. It was realized that College Court and Edwards were not on either of the lists for dormitories. The location of that data is still unknown. Because it took physical plant so long to search, baseline data was not manually collected for those dorms and they could not participate.

Residence Life was not very cooperative with providing data on residency numbers nor with partnering with Eco Reps to establish a Community Activity. Eco Reps however, also lacked initiative. They were entrusted with developing community-building activities in order to get the dorms and RAs involved but did not get the work done in time. They also expressed interest in creating advertisements for the competition but were not very thorough.

The lack of enterprise on behalf of the Eco Reps, supposed environmental student leaders suggests that perhaps the student body is eco literate but not eco active. Previous research done by Kelly Boulton showed that the majority of the student body had taken classes with environmental content. While the student body has been educated, the means of learning may not be effective in actually getting students to participate in the school's environmental efforts.

Multipliers on the electricity meters distorted many of the results, especially for North Village. Once the electric bills for November are received by physical plant, the option to calculate more accurate consumption will be made available however that will not change the actual results of the competition.

Daily trivia questions did not nearly have the level of participation we anticipated. Despite being posted in multiple locations and requiring minimal effort very few students responded. It is unknown whether or not the method will be used next year. Now that the word is out about a dorm energy competition and many kinks have been worked out perhaps participation will increase next year. Developing trivia questions is not very difficult or time consuming and posting them does not require much time either. The school would loose very little by trying the method again next year since raffle tickets will be distributed for a second time anyways.

The raffle itself could be improved slightly by making it easier for students to redeem their numbers. Google Docs has potential to be the tool for the job. An online form could be submitted and tracked essentially establishing an online database of all redeemed tickets so that the office of sustainability can draw numbers and contact that person via email. It is understandably difficult to keep track of raffle tickets over the course of two weeks so making it easier for students to redeem tickets and prizes may improve feelings towards all aspects of the competition.

Now a mailing list can be established for students who are interested in conserving energy. All those students who are part of the Green Gator Group on Facebook will continue to receive updates and those students who won the raffle can be used as leaders or volunteers for future events.

7.4 Successes

Having completed the first EVER dorm energy competition at Allegheny, the one major thing to be proud of is that we pulled it off. This competition was invaluable, though stressful, in that the framework for future competitions was established. The advertising scheme and public announcements created by Kelly were thorough, attractive, and meshed very well.

8 Conclusions for Future Competitions

In the future the college would like to include campus owned houses in the competitions. Due to lack of data for baseline as well as missing or inaccurate data from the office of residence life, it was not possible to include them this year. Also, some of the campus owned properties house faculty, making it difficult to determine whether or not they would need to participate in the competition. It could be a good move for faculty (leaders in the college community) to work side by side with students on an environmental initiative such as the energy competition.

Prizes for the winning dorms and for the raffle could be improved upon in addition to the ways in which students earn raffle tickets. Future prizes should be more plentiful and be used for advertisement as well. T-shirts have potential and the water bottles were a good affordable way to spread the word. Unfortunately this year, there was not enough time to customize bottles but could prove to be a good way to spread the popularity of the competition. It was deemed too biased to allow student groups to hand raffle tickets out. The least biased method determined was through RAs Each RA would be given an amount of tickets equal to the number of students on their hall; that way each student would be given equal opportunity to earn up to one raffle ticket through their RA. All the planning done could not account for the lack of participation and excitement on behalf of Residence Life. They were very difficult to get information out of.

This year's energy competition at Allegheny did not have access to monitors or a web based system to post real-time data. Next year the installation of such a system could make the competition infinitely better by automatically organizing data and eliminating the need for manual meter readings and the error caused by multipliers like in North Village. It would also free up time to focus on incorporating campus owned houses into the competition. It is evident that the efforts that went into this competition were not entirely effective. Fulfilling the criteria

set by Lundgren et al. (2002), that is making consumption and savings regularly updated and available may evoke more participation. Displaying consumption via a real-time energy monitor, as suggested by Peterson et al. (2007) would be the easiest and most accurate way to motivate students to participate. As discussed in section four, the students participating in the pilot competition would have preferred more than once daily updates on use, but given time and personnel restrains that was not possible for the main competition.

Next year the Green Gator blog, where advertisement, trivia questions and results were posted, could be written in advance and posted using the autopublish tool. Rather than waiting until the morning we wanted things published, the autopublish tool would also save time during the weeks of the competition. Also, if possible student wide emailing could be one way to maximize responses and thus drive participation at least in the trivia section of the competition.

Though a part of the greenhouse gas emissions reduced throughout the span of the competition at Allegheny, are likely to be due to updates made by the school and the use of CFL light bulbs funded by physical plant, many of the changes made by students in their personal lives, though simple also prove to have a beneficial impact on Allegheny's GHG inventory. Next year's competition will be an even greater challenger for the students because reduction data from the week of the competition will be factored into the baseline.

It would be interesting to include a sex dynamic to the competition. As seen in the study by the OPA (2009) and the results of this competition, it is possible that sex does affect consumption patterns. Therefore a study on sex distribution within the dorms might be telling.

As an assessment of the effectiveness of competitions on electricity consumption at Allegheny, the competition showed that future competitions will require great effort to get students more involved. The scope of this senior comprehensive project did not allow for a

thorough discussion of feedback from participating dorms however, acquiring that information would be infinitely beneficial for future energy competitions. Discussions were attempted via Facebook but the only students who participated in the discussion were personal friends. Given a more involved and personal approach, such as asking questions during dorm storming could result in productive responses, for example, " How did you hear about the energy competition?" Knowing common responses would help us provide more effective means of advertisement. Other feedback such as tricks used to reduce consumption could be helpful also.

Moving forward energy competitions have potential for reducing the impact of student energy consumption. The challenge is ensuring continued reductions take place and not just during the energy competition. As demonstrated in the pilot energy competition, some energy conserving habits were made throughout the competition. It seems that Allegheny Hall may continue to use less energy than their baseline after the competition although that is unknown without continued monitoring. Also, once the electricity price cap has been lifted in January 2011, money saving potential of competitions will increase.

9 APPENDIX

9.1 A. Text of the American College & University Presidents' Climate Commitment

We, the undersigned presidents and chancellors of colleges and universities, are deeply concerned about the unprecedented scale and speed of global warming and its potential for large-scale, adverse health, social, economic and ecological effects. We recognize the scientific consensus that global warming is real and is largely being caused by humans. We further recognize the need to reduce the global emission of greenhouse gases by 80% by mid-century at the latest, in order to avert the worst impacts of global warming and to reestablish the more stable climatic conditions that have made human progress over the last 10,000 years possible.

While we understand that there might be short-term challenges associated with this effort, we believe that there will be great short-, medium-, and long-term economic, health, social and environmental benefits, including achieving energy independence for the U.S. as quickly as possible.

We believe colleges and universities must exercise leadership in their communities and throughout society by modeling ways to minimize global warming emissions, and by providing the knowledge and the educated graduates to achieve climate neutrality. Campuses that address the climate challenge by reducing global warming emissions and by integrating sustainability into their curriculum will better serve their students and meet their social mandate to help create a thriving, ethical and civil society. These colleges and universities will be providing students with the knowledge and skills needed to address the critical, systemic challenges faced by the world in this new century and enable them to benefit from the economic opportunities that will arise as a result of solutions they develop.

We further believe that colleges and universities that exert leadership in addressing climate change will stabilize and reduce their long-term energy costs, attract excellent students and faculty, attract new sources of funding, and increase the support of alumni and local communities. Accordingly, we commit our institutions to taking the following steps in pursuit of climate neutrality.

1. Initiate the development of a comprehensive plan to achieve climate neutrality as soon as possible.
    a. Within two months of signing this document, create institutional structures to guide the development and implementation of the plan.
    b. Within one year of signing this document, complete a comprehensive inventory of all greenhouse gas emissions (including emissions from electricity, heating, commuting, and air travel) and update the inventory every other year thereafter.
    c. Within two years of signing this document, develop an institutional action plan for becoming climate neutral, which will include:
        i. A target date for achieving climate neutrality as soon as possible.
        ii. Interim targets for goals and actions that will lead to climate neutrality.

iii. Actions to make climate neutrality and sustainability a part of the curriculum and other educational experience for all students.
iv. Actions to expand research or other efforts necessary to achieve climate neutrality.
v. Mechanisms for tracking progress on goals and actions.

2. Initiate two or more of the following tangible actions to reduce greenhouse gases while the more comprehensive plan is being developed.
    a. Establish a policy that all new campus construction will be built to at least the U.S. Green Building Council's LEED Silver standard or equivalent.
    b. Adopt an energy-efficient appliance purchasing policy requiring purchase of ENERGY STAR certified products in all areas for which such ratings exist.
    c. Establish a policy of offsetting all greenhouse gas emissions generated by air travel paid for by our institution.
    d. Encourage use of and provide access to public transportation for all faculty, staff, students and visitors at our institution.
    e. Within one year of signing this document, begin purchasing or producing at least 15% of our institution's electricity consumption from renewable sources.
    f. Establish a policy or a committee that supports climate and sustainability shareholder proposals at companies where our institution's endowment is invested.
    g. Participate in the Waste Minimization component of the national RecycleMania competition, and adopt 3 or more associated measures to reduce waste.
3. Make the action plan, inventory, and periodic progress reports publicly available by providing them to the Association for the Advancement of Sustainability in Higher Education (AASHE) for posting and dissemination.

In recognition of the need to build support for this effort among college and university administrations across America, we will encourage other presidents to join this effort and become signatories to this commitment.

Signed,

The Signatories of the American College & University
Presidents Climate Commitment

9.2 B. Survey 1

House Number:
Major: Class Year:
1.What do you currently do to help conserve water, energy and other resources? Why?

2. What are other things that you could do to help reduce electricity consumption?

9.3 C. Survey 2

Major: Class Year:
What did you do to help conserve energy that was different from what you were doing before and why?

What were things that you didn't do and why?

What do you think you could have done better?

What did you enjoy about participating in this study?

What could I have done better?

9.4 D. "Tips" Top 10 Ways to Save Energy

THE green GATOR

A message from your Eco Reps:

Top 10 Ways to Save Energy:

1. Use CFLs - Replacing traditional incandescent lights can save up to 90% of energy that is normally lost to heat. Plus a 25 Watt CFL bulb generates the same amount of light that 100 Watt traditional incandescent lights produce.
2. Sleep - When you're leaving your room for a short period of time, put your computer on a standby or hibernate mode.
3. Turn off appliances when not in use - Even when TVs, stereos, computers, play stations, and X-boxes are on a stand-by mode, they still consume energy. Simple rule: if you are not using it, just unplug it.
4. Kill the vampires - Energy vampires are those little things in your room that continually steal power even though the appliance is off. This is also called a phantom draw. TV's, Microwaves, play stations, lamps, cell phone chargers and other devices that are always plugged in continue to suck energy even when not in use. You can use a power strip to stop the vampires- it's cheap, easy to use and all devices can be switched off at once!
5. Limit usage - Limit usage of coffee pots, ovens, microwaves, and hair dryers that all consume a great amount of electricity. Do not preheat or peek inside the oven more than necessary. When the oven is open, the electric consumption increases dramatically!
6. Chill - Set refrigerator temperature at 38 to 42 degrees Fahrenheit, and the freezer between 0 and 5 degrees Fahrenheit.
7. Fill up - Wash and dry only full loads when you do laundry. This saves water, the energy used to heat the water and air to wash and dry, and ultimately, your time!
8. Turn Off - Do not waste water. 3-6 gallons are saved when you turn off the tap while brushing and shaving! Taking a warm shower instead of a hot shower can also save up to 60% of energy in heating water alone. Even better, take a faster shower or turn off the water while you lather up!



9. Blow away - Make sure the wings of fans are balanced properly and there is no dust accumulated on them. Friction results in the fans working harder or slower, increasing energy consumption.
10. Lights Out! - Finally, SWITCH OFF THE LIGHTS when leaving the room! Remember, electricity was invented only a little over a hundred years ago. The world went on fine without electricity for more than eight thousand years before that!

Visit the Green Gator Blog @ sites.allegheny.edu/greengator and join "The Green Gator" Facebook group to learn more about the Green Gator Energy Competition. Get involved!

9.5 E. Napkin Holder Advertisement



9.6 F. Poster

greenGATOR energy competition

November 16—29



Turn it off.

Unplug it.

Win.

Competition Categories:

Watt Chompers—awarded to dorm that reduces overall electricity consumption* while classes are in session, November 16—24. Prize=Study Day Party and plaque.

Phantom Chompers—awarded to dorm that reduces electricity consumption* during Thanksgiving break, November 25—29, by reducing phantom draws. Turn off power strips or unplug stereos, TVs, printers, fridges, speakers, computers, phone and laptop chargers, all of which have a phantom energy draw when turned off but still plugged in. Prize=plaque and a raffled SmartStrip.

**How's it calculated? To make sure every dorm has an equal chance of winning the competition, we've calculated the average baseline electricity consumption for each dorm and will measure daily competition results as a percent reduction of electricity from each individual dorm's unique baseline. This will help level the playing field between dorms. Unfortunately, Edwards, College Courts, and campus-owned houses are not yet set up to allow accurate energy tracking. Students are encouraged to practice energy reduction strategies anyway and are still eligible to win prizes by participating in the raffle drawing!*

**What will the college do with the savings? All financial savings resulting from energy reductions will be carefully tracked and reinvested in further energy efficiency retrofits on campus. This ensures students will benefit from their efforts and may help buffer future tuition increases. This could mean motion sensors for bathroom lights, more efficient heating systems, LED lights, etc.*

Raffle—students earn tickets by riding the CATA LOOP, bringing reusable cups or bottles to McKinley's and correctly answering trivia questions posted daily at the Green Gator blog, Green Gator Facebook group or Inside Allegheny. Check out the raffle prizes below!

Win: **Gift Certificates**

$100: Allegheny Bookstore
$50: Market House
$20: Whole Darn Thing





Visit the Green Gator Blog @
sites.allegheny.edu/greengator
and join "The Green Gator" on Facebook
for daily updates.

Contact Sustainability Coordinator, kelly.boulton@allegheny.edu, with questions.

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