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# Student Electricity Consumption and Strategies for Conservation

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Williams College

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## 1. EXECUTIVE SUMMARY

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Throughout the course of the semester, I have engaged in an Independent Study project focused on student electricity consumption at Williams College. My efforts have been twofold: First, I have attempted to put together an accurate understanding of electricity consumption in student residences through the campus-wide administration of an electricity use survey. Secondly, I have organized a new student group (the Thursday Night Group) and have used the motivation of this group to increase student awareness about global warming. The Thursday Night Group has also sought to encourage energy-smart behaviors through a compact fluorescent light bulb exchange.

Results of the student electricity use survey show that refrigerators, incandescent lighting, and computers are the largest consumers of electricity in student residences. Within each of these categories, there are significant targets for reductions. Less than half of reported refrigerators were used to capacity and only 45% are shared between friends—most of these between first years and sophomores. Incandescent bulbs make up 63% of the light bulbs in personal task lighting and consume 87% of the electricity used by personal lighting. While most computers go into standby mode when not in use, few are turned off during these idle periods. In addition, a small percentage of desktop computers (8%) uses half of the electricity allotted to computer use. Standby power consumption of other, seldom-used electrical appliances adds an additional utility burden.

Taking this information and using knowledge from current research, I have put together the beginnings of a program to reduce energy use in student dormitories. Entitled “Stop it Here,” the program will be unveiled following the release of the Climate Action Committee’s recommendations. The program will focus on increasing student awareness of energy use, gathering commitments to reduce, and creating a climate of energy-smart behavior.

## 2. INTRODUCTION

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<http://www.williams.edu/admission/location.php>

### *2.1 Williams College*

Williams College is a private, co-educational liberal arts college located in Williamstown, Massachusetts. Founded in 1793, the school has grown significantly over its 213 year history—now covering 450 acres and including 112 academic and dormitory buildings. Each year, approximately 2100 students enroll in the College, and the vast majority of these students live in college-provided dormitory housing. These students choose from 33 academic majors and 12 additional special concentrations and programs.

Nestled in the Purple Valley just north of Massachusetts' highest peak, the College is intimately connected to its natural surroundings. Henry David Thoreau, reflecting upon Williams once wrote, "It would be no small advantage if every college were thus located at the base of a mountain." These advantages are reflected both in educational and recreational activities at the College. From Mountain Day (an annual fall tradition in which classes are cancelled and the College community gathers for festivities atop a local mountain) to Winter Study, students are encouraged to connect with their surroundings. The College-owned Hopkins Forest also provides opportunities for recreation and research.

## *2.2 Environmental Initiatives at Williams*

Due in part to this connection and intimacy with its surroundings, Williams College has taken steps to address its environmental impact. These environmental initiatives have been spearheaded largely by Dining Services, Facilities, OIT, and other key departments.

Dining Services continues to pursue a goal of environmental sustainability and responsibility. Local, organic, and fair trade products are a staple of dining hall menus, and several special dinners (particularly Harvest Dinner) are centered on these foods. Food waste is sent to local farms for composting. In addition, Dining Services has made a strong effort to reduce water consumption, energy use, and waste. Projects such as the installation of water-efficient dishwashers and VendingMisers have helped these efforts significantly.

Similarly, Facilities continues to cut costs and energy consumption through a variety of environmental projects. Lighting retrofits, energy efficiency projects (such as chiller replacements), and improved utility monitoring have been a central part of their strategy over the past several years. In addition to these projects, close to 25% of the College's electricity is co-generated at the College's heating plant during the winter months. A small portion is generated by solar panels on the roof of Morley Science Center.

These initiatives demonstrate Williams' commitment to its natural surroundings and to the environment in general. While they are impressive, they continue to be refined so as to have the greatest and most cost-effective impact.

### *2.3 The Williams Climate Initiative*

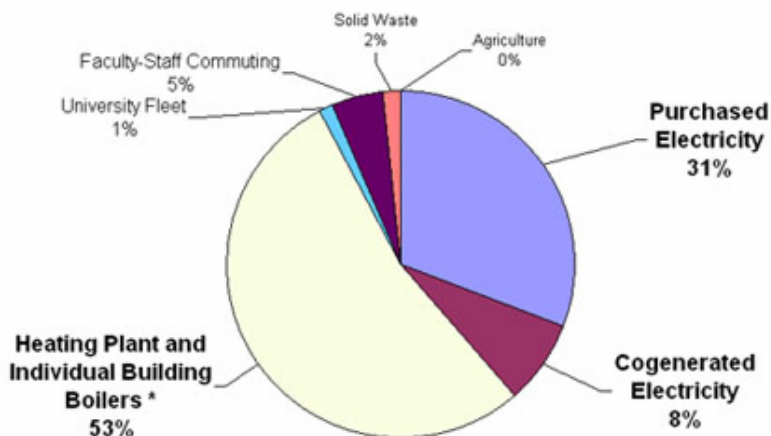
In November of 2005, a group of concerned students and faculty drafted a petition which urged President Schapiro and the Board of Trustees to address Williams' rising greenhouse gas emissions. While the College had taken action to cut costs and improve energy efficiency, no policy had yet been implemented to deal directly with the College's emissions. The petition proposed a two-fold target: 10% below 2005 emission levels by 2010, and 20% below 2005 levels by 2015. Over the course of two weeks, it received the signatures of 1,100 of students, faculty members, and staff.

In response, President Schapiro announced the formation of the Williams College Climate Action Committee on April 20, 2006. The Committee was "to recommend by the end of [the 2006] calendar year a goal for the reduction of College greenhouse gas emissions and ways to attain it."<sup>1</sup> Chaired by Stephanie Boyd, Interim Director of Facilities Operations, the CAC began its work by compiling an accurate inventory of the major sources of greenhouse gas emissions at the College. According to this inventory, the fuel oil burned to heat the College comprises over 50% of overall emissions. Purchased electricity makes up the next largest percentage, at 31%. Because they comprise over 80% of overall emissions, reductions in these areas became a key focus of the Climate Action Committee.

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<sup>1</sup> Schapiro, Morten Owen. Earth Day Letter. E-mail to the College community, 20 Apr. 2006.

## Emissions Sources Fiscal Year 2006



\* This number includes the natural gas and fuel oil burned at the central heating plant and individual buildings.

**Figure 1:** Greenhouse gas emissions, by source, FY 2006.  
Source: Sustainability at Williams [www.williams.edu/resources/sustainability](http://www.williams.edu/resources/sustainability)

While the actual emissions reductions targets are yet to be announced, the CAC has outlined a number of potential strategies for reaching final targets. Of these strategies, the burning of lower carbon fuels (17%) and the purchase of renewable energy credits (47%) weigh heavily in emissions reductions. However, conservation (22% of reductions) plays a valuable and important role. Improvements in building efficiency and building envelope will make up over half of these reductions.

According to statistics from the Climate Action Committee's initial report, behavioral changes will only make up 4% of the College's projected emissions reductions. This number, albeit small, is a critical facet of the CAC's recommendations.

### *2.4 Energy Conservation*

As an institution of higher education, Williams College must capitalize on the educational opportunities inherent in the Climate Action Committee's forthcoming

recommendations. Conservation and behavioral change are visible, highly symbolic activities. While they do not cut down significantly on emissions, they increase awareness about energy consumption and provide a valuable tie-in to global issues. Behaviors that reduce energy use are grassroots actions that simultaneously address overconsumption and impact overall carbon emissions. Campaigns to inspire conservation, addressed in the second half of this paper, can serve as a valuable medium for campus-wide discussion of energy consumption, electricity use, and issues such as global warming.

In addition, inspiring conservation-minded behaviors in Williams students will ultimately affect a broader impact. Electricity use from lighting and kitchen appliances alone comprises over 30% of US residential electricity consumption.<sup>2</sup> By encouraging reductions and educating students about their environmental impact, some students will ultimately carry this knowledge beyond their four years at Williams. In so doing, they will leave Williams with a better grasp about their daily impact, as well as, hopefully, more environmentally-responsible habits.

As an education of higher learning, Williams College ultimately has a responsibility to encourage and actively promote good stewardship of our environment. Because of this, conservation—which promotes a greater awareness and acknowledgement of one’s impact—must be a core part of any emissions reduction strategy.

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<sup>2</sup> [http://www.eia.doe.gov/emeu/reps/enduse/er01\\_us.html](http://www.eia.doe.gov/emeu/reps/enduse/er01_us.html)

### **3. INSPIRING STUDENT ENERGY CONSERVATION: A PROJECT**

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This independent study project seeks to analyze the energy consumption of Williams College's 2,134 current undergraduate students and to ascertain the most effective targets for energy conservation efforts. While the College has a general figure for electricity consumption in student housing, little research has been done into the specifics of this figure. According to Don Clark, Utilities Program Manager, student housing consumed 13% of Williams' energy consumption in 2005-2006, totaling 3,702,813 kWh. A report by Alison and Rebecca Davies in Spring 2005 provided an insight into the energy consumption of one dormitory building, but at that point, no studies had polled the campus at large. In surveying all of Williams' 2,134 students, this Independent Study Project draws much from Alison and Rebecca's previous research. However, with a larger sample size, I hope to put together a more accurate picture of how electricity is used by students, as well as how student electricity use can best be reduced.

#### *3.1 Part A: Student Electricity Use Survey*

The first part of this Independent Study project analyzes the 13% of Williams' energy use that is used in student dormitories. Based on surveys of electricity use filled out by 550 individuals, Part A determines the number of appliances owned by students and their usage (in hours) and uses this to calculate the daily average electricity use by student dormitories. It elucidates the most numerous electric appliances, as well those that cumulatively consume the most electricity. The survey also sought to gauge general willingness to participate in energy reduction projects, such as switching to CFL's, taking shorter showers, or giving up one's refrigerator.

### *3.2 Part B: Strategies for Inspiring Student Conservation*

With the knowledge from Part A, I intend to determine the most likely places for energy reductions. I will then attempt to create strategies to promote conservation-oriented behaviors regarding these appliances or actions, relying heavily on research in the current psychology, marketing, and business literature. While it is beyond the scale and scope of this project to ascertain the effectiveness of these campaigns, they will be implemented and assessed during the remainder of the 2006-2007 academic year.

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## PART A: STUDENT ELECTRICITY USE SURVEY

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This section of the report details the results of an electricity use survey distributed to 2,134 students at Williams College. By distributing this survey, I hoped to gain a better insight into what electric appliances Williams College students own, as well as how often they use those items. Several questions in the survey sought to ascertain students' willingness to change their consumptive behaviors.

### 4. METHODOLOGY

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#### 4.1 *Student Electricity Use Survey*

The survey (Appendix A), was electronically distributed to 2,134 Williams College undergraduates between November 15<sup>th</sup> and November 20<sup>th</sup>, 2006. The survey was divided into six sections: an initial question gauging respondents' concern over rising energy consumption, followed by sections on the use of lighting, computers, refrigerators, and other electric appliances. The survey concluded with several questions regarding respondents' shower habits and use of campus dryers. The final question was an open-ended question asking students to suggest strategies for reducing energy consumption focused on personal mini-fridges.

After an initial question determining respondents' concern over energy consumption and their motivation for this concern, seven questions ascertained their use of lighting. These questions determined the time of day that lighting was most used, the number of personal lamps each respondent owned, how often those lamps are used, and the type of light bulb in each lamp. The final question asked whether respondents would be willing to bring compact fluorescent light bulbs (CFL's) to school in place of incandescent bulbs.

The second section focused on the respondent's use of personal and campus computers. Questions sought to determine when respondents use computers most frequently, what type of computer they own, and how often they use computers each day. One question asked about respondents' use of campus computers in order to create a more accurate picture of computer energy consumption. Following this, three questions asked how often respondents' computers are turned to standby or off when not in use. The final part of this section sought to determine respondents' willingness to turn their computer to standby more often.

The third section of the survey was targeted to those respondents who own personal refrigerators. This portion asked respondents to account for the number of refrigerators they own, their size and energy efficiency (EnergyStar or not), and their use (how full they are). Given the large electricity use of these devices, it also gauged respondents' eagerness to give up their refrigerator or share with friends. This section was followed by a general section in which respondents were asked to list the number of electrical appliances they own and elucidate their use (in hours). For some of these appliances, respondents were also asked to note what time of day they typically use it. They were then asked whether they would be willing to unplug appliances when not in use or use a college-provided power strip.

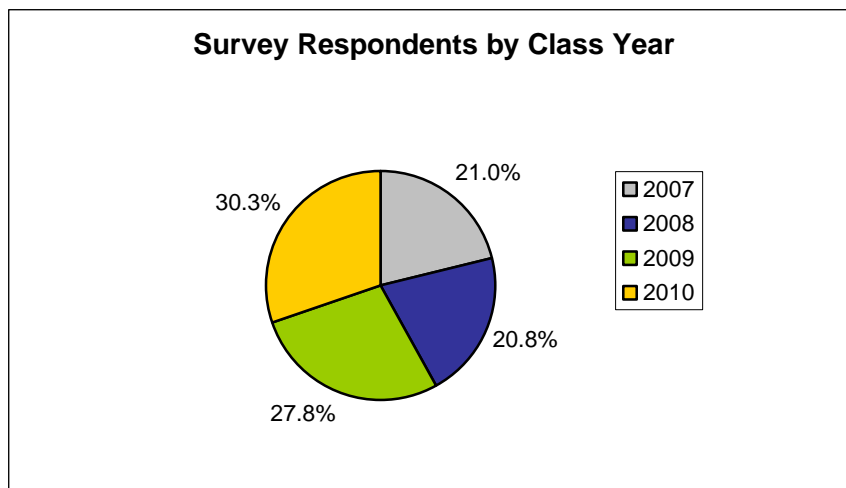
The final section of the survey assessed respondents' shower and laundry habits. Respondents were asked how many showers they took per week and how long those showers were. They were also asked whether they would be willing to take shorter showers. Two of the final questions ascertained potential use of drying racks and shorter dryer cycles. Finally, the last question was an open-ended question which called on respondents to provide strategies for reducing the electricity consumption attributed to personal refrigerators.

## SURVEY RESULTS

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### 5.1 Respondents

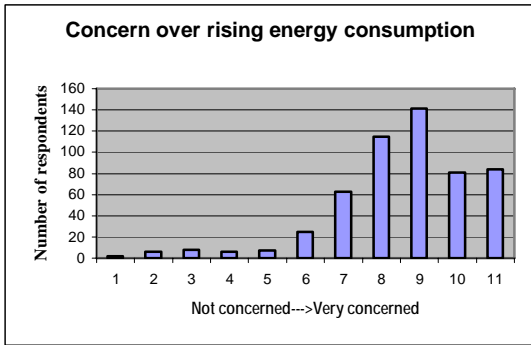
Of the 2,134 undergraduate students surveyed, 550 responded. Of these 550 respondents, roughly 515 completed the survey completely. First year students comprised 30.3% of respondents, followed by sophomores, seniors, and juniors (see Figure 2).



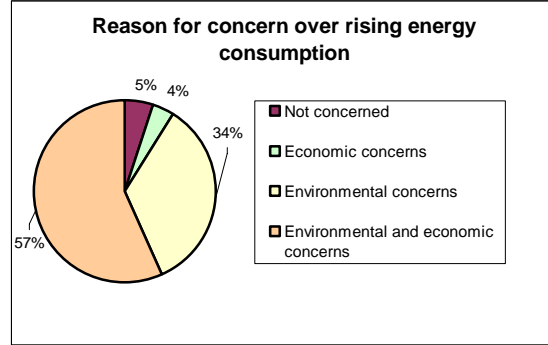
**Figure 2:** Number of Survey Respondents by Class Year. First year students were followed by sophomores, seniors, and juniors.

These students represented members of all of the dormitory buildings on campus, as well as members of all co-ops and 16 off-campus residents. Residents of Armstrong/Pratt were the most likely respondents, comprising 9.8% of the total. Of upper-class dorms, Prospect had the largest number of respondents (6.6% of total respondents). No calculations were done to determine the highest per-resident dorm response rate.

Ninety percent of respondents displayed some degree of concern over rising energy consumption (Figure 3). Respondents who rated their concern at a 6 or lower will be referred to as “Unconcerned respondents.” Those who rated concern above neutral will be referred to as “Concerned respondents.” The worry of these respondents was largely driven by either environmental factors or a combination of both economic and environmental concerns (Figure 4).

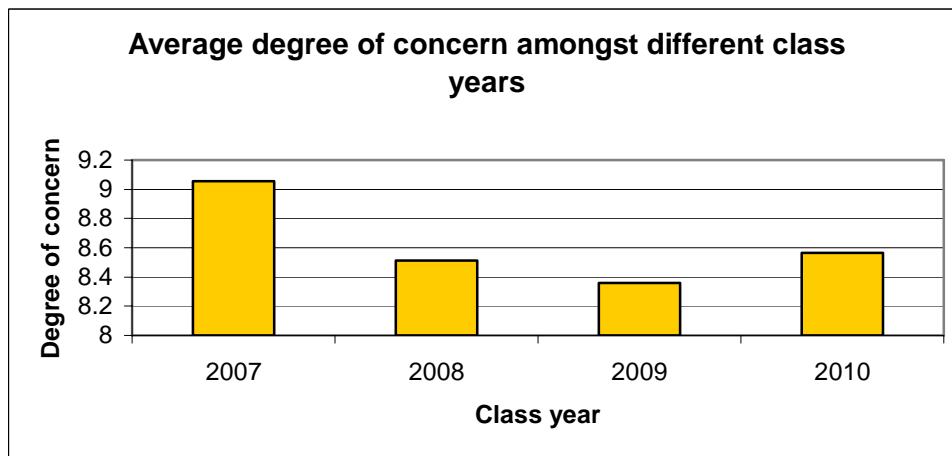


**Figure 3:** 90% of respondents are concerned about rising energy consumption (value >6)



**Figure 4:** A combination of environmental and economic concerns is behind this concern over energy consumption

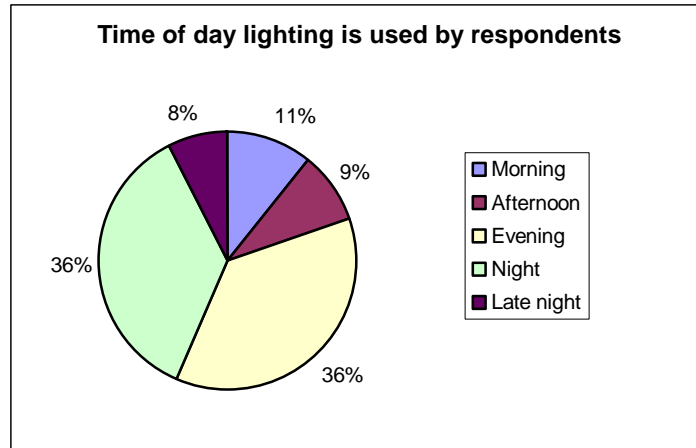
This concern, however, did not predict the different response rates of particular class years. In fact, the class of 2010, which exhibited the highest response rate, showed the second to lowest degree of concern over rising energy consumption. Conversely, the class of 2007 (which had the second to lowest number of responses) showed the greatest concern over rising energy consumption (See Figure 5).



**Figure 5:** The class of 2007 showed the greatest concern over rising energy consumption, on average.

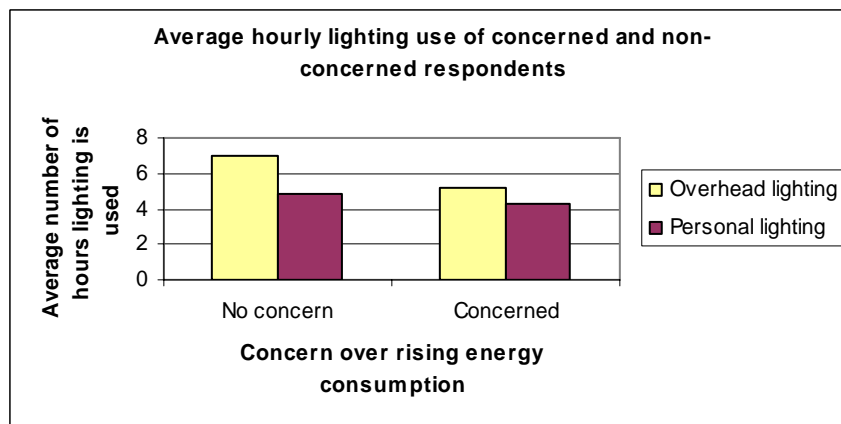
## 5.2 Lighting

The survey's respondents used a daily total of 7,479 hours of lighting. This included both personal lighting (personal lamps) and college-provided overhead lighting. The majority of these lighting hours occur at suspected times—72% fall between the hours of 5pm and 2am. However, as shown in Figure 6, 20% of lighting hours occur during daylight hours.



**Figure 6:** Lighting is used mostly at night (72%), but a sizeable portion (20%) of lighting hours occur during daylight hours.

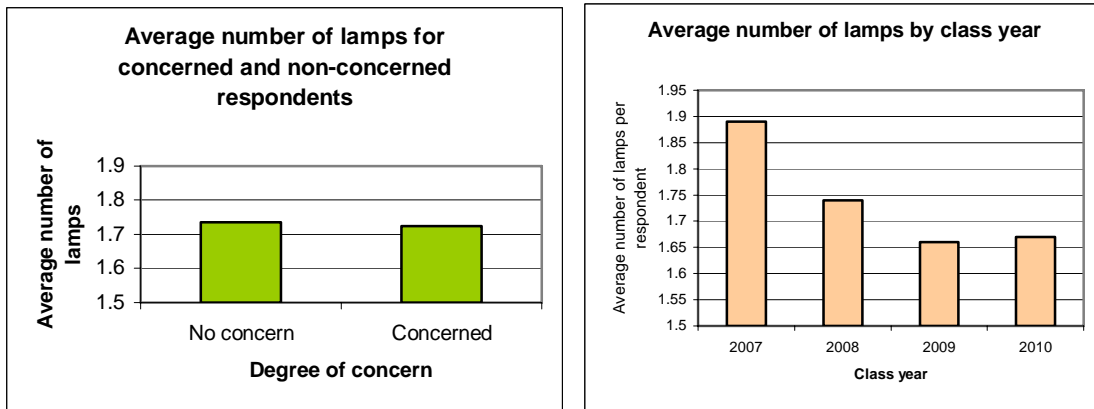
Overhead lighting accounts for 40% (2,970 hours) of the reported total lighting hours. This lighting is used an average of 5.4 hours per day by survey respondents, with this figure not differing significantly between class years. However, as is shown in Figure 7, the average overhead lighting use of non-concerned respondents (those who rated concern over rising energy consumption at a 6, neutral, or lower), is approximately two hours greater than those respondents who are concerned about rising energy consumption.



**Figure 7:** Differences in average daily use of lighting by concerned and non-concerned residents. While the use of personal lighting does not differ significantly, overhead lighting use is much greater by non-concerned respondents.

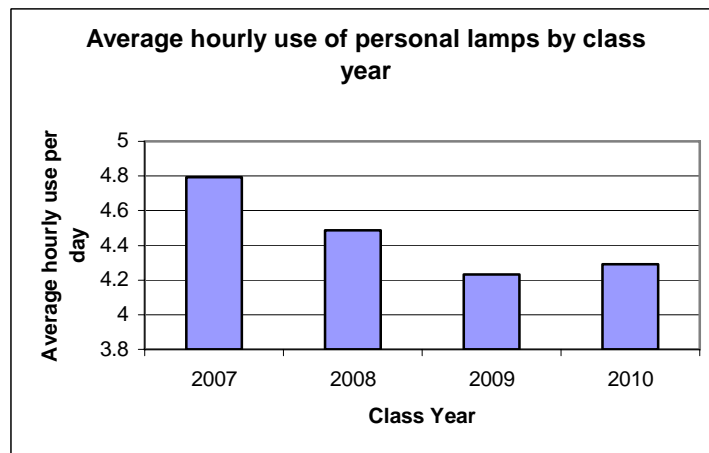
Respondents reported a total of 943 personal lamps, an overall average of 1.7 lamps per respondent. Concerned and non-concerned respondents did not show a significant difference in the average number of personal lamps reported (Figure 8). However, members

of different class years differed in their average number of personal lamps. Seniors owned an average of approximately 1.9 personal lamps per respondent. Sophomores displayed the lowest average lamp number, at 1.66 per respondent.



**Figure 8 and 9:** Average number of lamps reported for concerned and non-concerned respondents, as well as average number of personal lamps reported by class year.

In addition to owning on average more lamps, seniors used these lamps approximately 20 minutes longer than their peers. Sophomores consume the fewest average lighting hours, according to Figure 10.



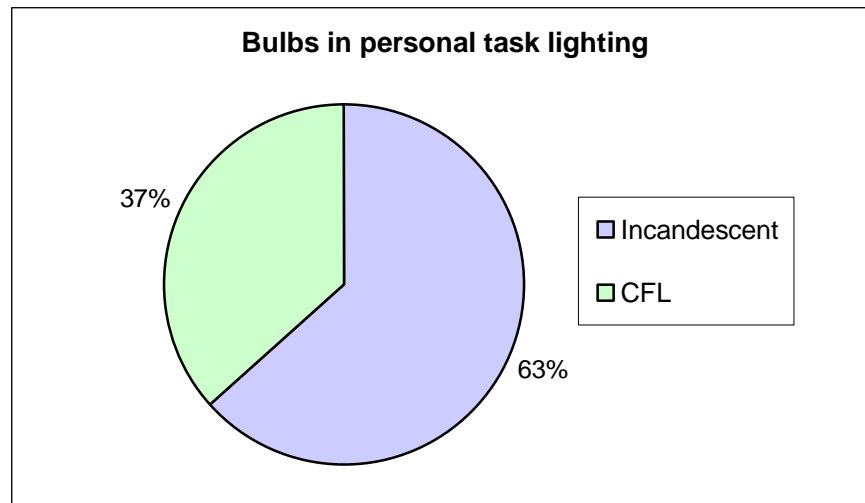
**Figure 10:** Seniors use their personal lamps approximately 20 minutes longer than their peers, while sophomores use the fewest lighting hours with personal lighting.

Currently, 63% of the light bulbs reported by respondents are incandescent bulbs.

This number includes a portion of the light bulbs reported by respondents who had both CFL's and incandescent bulbs. As a conservative estimate, 1/3 to 1/2 of the bulbs reported in

the “both incandescent and compact fluorescent” category were included in the CFL category.

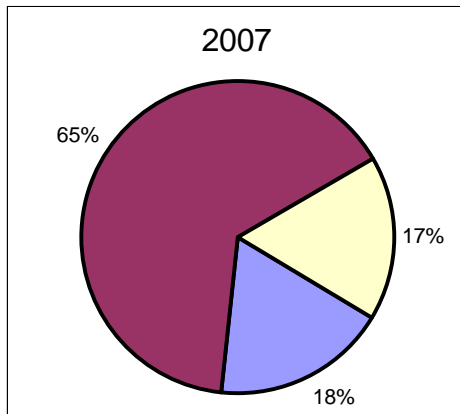
Figure 11 shows the breakdown of respondents’ personal light bulbs.



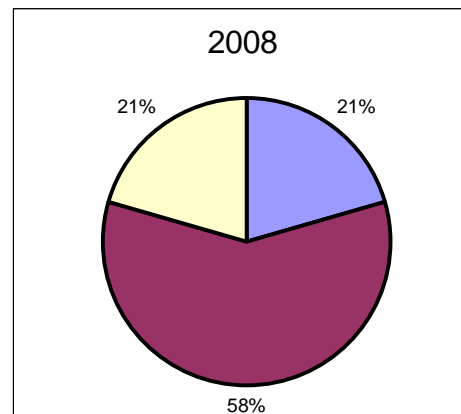
**Figure 11:** Almost 2/3 of respondents’ personal light bulbs are compact fluorescent bulbs. However, 37% of respondents’ personal lighting is provided by incandescent bulbs.

While it does not appear that concerned respondents have a higher average number of compact fluorescent light bulbs, there are differences between light bulb type and class year. According to Figures 12a through 12d, upperclassmen (particularly seniors and juniors) have a much greater percentage of incandescent light bulbs in their personal lighting fixtures. First year students have the highest number of respondents with CFL’s, totaling 46%. It is important to note that several first year dorms were targeted by a campus-wide compact fluorescent light bulb exchange before this survey began. This fact, coupled with literature that went home to first year students at the beginning of the year, helps to explain the high percentage of first year respondents using CFL’s.

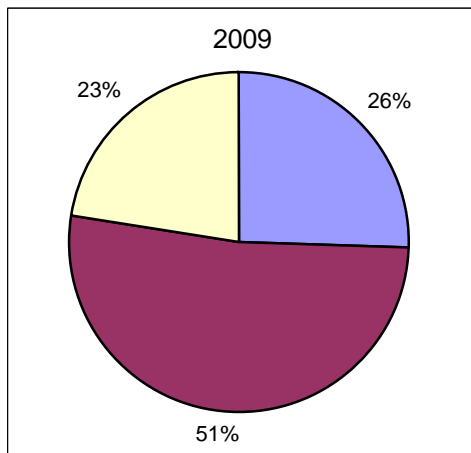
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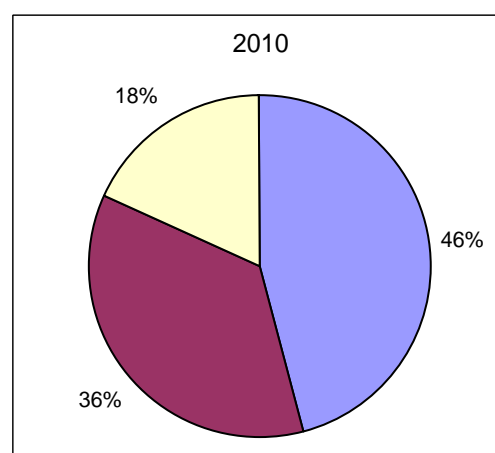
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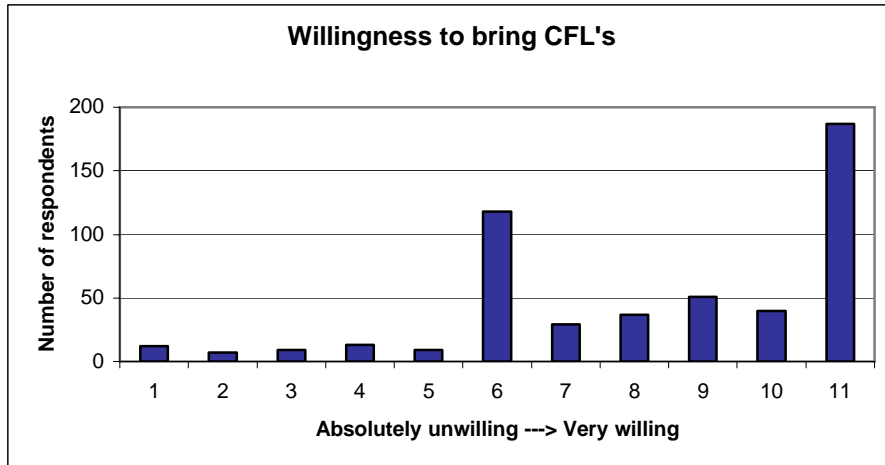


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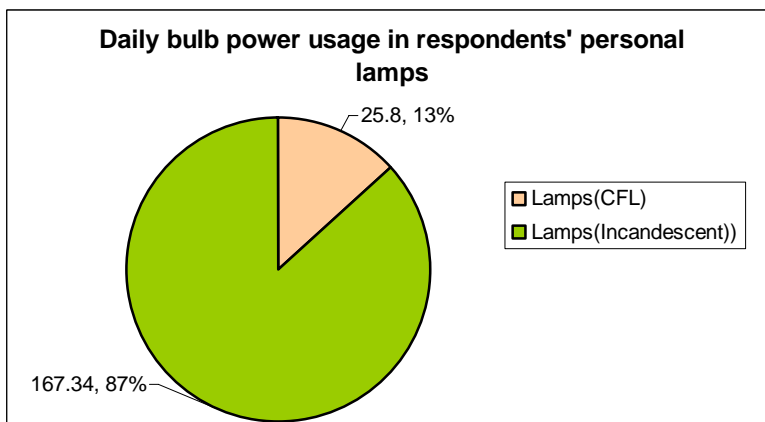
**Figure 12a-d:** These graphs represent the proportion of different light bulb types recorded by respondents. Blue sections represent those individuals who own CFL's, burgundy sections show individuals who own incandescent bulbs, and yellow sections represent those with both.

The final section of the lighting section of the survey sought to determine respondents' willingness to come to school with CFL's in place of regular incandescent bulbs. This proposal was strongly supported by the survey's 550 respondents. 258 (50.6%) indicated that they would be 'Very willing' to bring CFL's to school in their personal lamps. Interestingly, a sizeable portion of respondents indicated that they were neutral on this issue. It is likely that these individuals can be convinced to participate in the program given that they receive more information on the benefits. Figure 13 displays these findings.



**Figure 13:** Over half of respondents would bring CFL's to school instead of incandescent light bulbs. A high percentage (23%) are neutral about this issue.

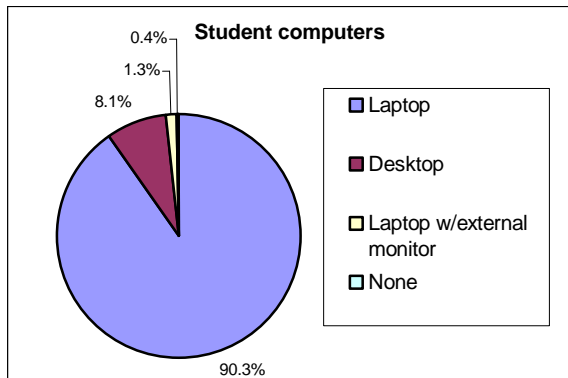
According to this survey, respondents' energy needs for lighting currently total roughly 193 kWh per day. As shown in Figure 14, 87% of this energy consumption is consumed by incandescent bulbs. Scaled up to the entire student body, this would account for an electricity demand of approximately 700 to 750 kWh per day. Electricity demand if all respondents switched to CFL's would be approximately 35% of current demand (67.6 kWh per day for respondents), scaling to 246 to 262 kWh for all students per day.



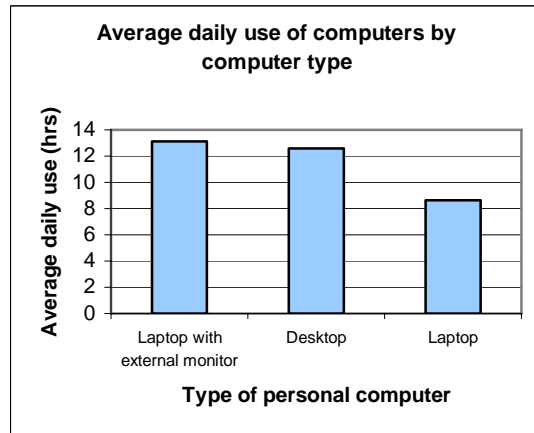
**Figure 14:** Incandescent light bulbs comprise the largest portion (87%) of personal lighting power demand.

### 5.3 Computers

Only 2 respondents did not own a personal computer. Of the 99.6% of respondents who did own a computer, laptops were the most numerous (90.3%), followed by desktops (8.1%). Seven respondents owned a laptop with an additional external monitor. These results are shown in Figure 15.



**Figure 15:** Laptops comprise the majority (90%) of respondents' personal computers.

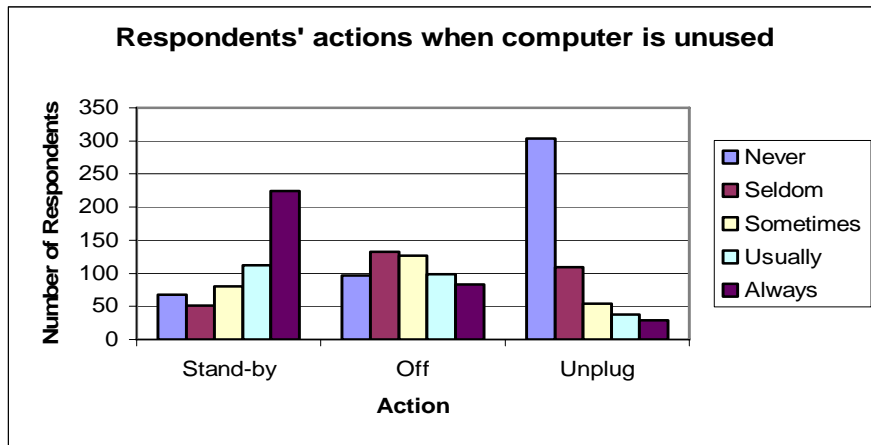


**Figure 16:** Respondents with laptops use them significantly less than respondents with other types of computers

Respondents reported to use computers a total of 4,886 hours. Laptops, representing 90% of respondents' personal computers, comprised 87% of this total usage. Individual respondents used computers, on average, 9 hours per day, but this number varied between different types of computers. Respondents' who owned laptops with external monitors used computers for over half an hour longer than desktop users and over 4 hours longer than laptop owners (Figure 16).

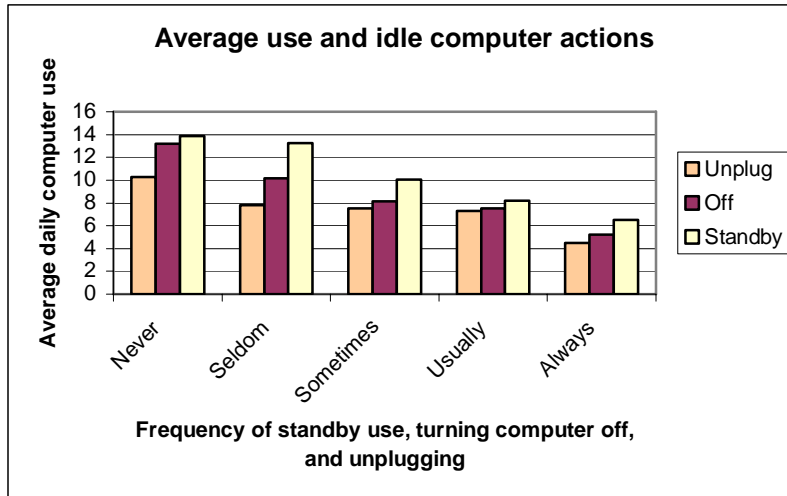
Computers were used during most hours of the day. The largest proportion of respondents reported using personal computers during the evening hours (5pm-10pm, 91.2% of respondents). This was followed by night hours (10pm to 2am) and the afternoon (71.9%). Only 22.6% of respondents used their computer during late night hours (2am-7am).

When computers were not in use, 72.2% of respondents used a screen saver. However, of respondents, the vast majority (82.2%) have their computer set to go into standby after less than an hour of idle time. Respondents were also likely to manually put their computer into standby when they left their room for several hours. As is seen in Figure 17, few respondents turn their computer off or unplug it when it is not in use for several hours.



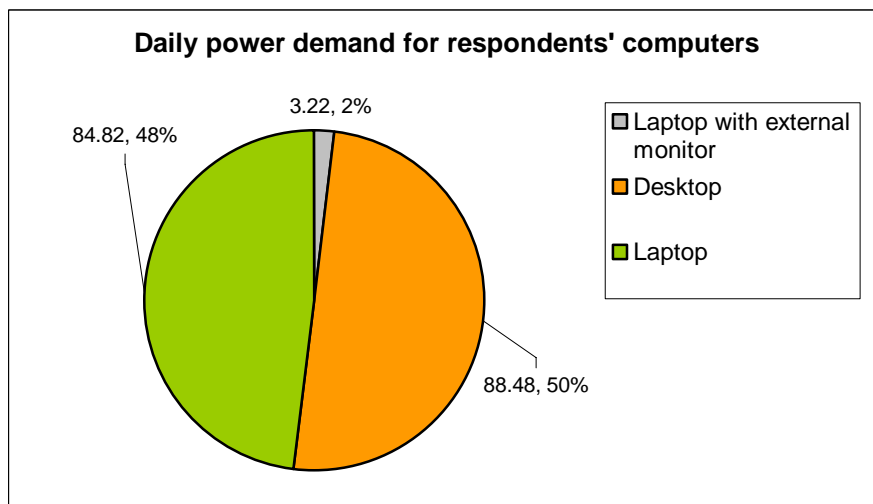
**Figure 17:** Many respondents (42%) put their computer in standby when not using it for several hours. However, few turn their computer off (43%) or unplug it (77%) when it's not in use.

Respondents who use their computer less, on average, are more likely to engage in energy-saving behaviors while their computer is idle. Individuals who reported always putting their computer in standby mode when idle have a daily personal computer use of 6.5 hours, as opposed to the 13.9 hours used by individuals who never put their computer in standby mode. Similar trends are seen for individuals who turn their computer off or unplug it when it is not in use, as is shown in Figure 18. While it seems obvious that individuals who use their computer more will turn it off or put it in standby more, it is important to note that these behaviors apply to time when the computer is idle. Respondents who use their computer more may not engage in energy-saving behaviors because they feel that they will soon be using their computer again.



**Figure 18:** Respondents who engage in energy saving behaviors use their computer far less than other respondents.

However, over three-quarters of respondents (78%) are willing to put their computer in standby mode more frequently. Given that 17.8% of reported computers do not go into standby automatically and only 42% of respondents manually put their computer into standby when they leave their room, this is a promising area for energy reductions.



**Figure 19:** Desktops use the most of computers' 195 daily kilowatt-hours of consumption, even though they represent only 8% of reported computers. Their consumption is followed by laptops, which comprise 90% of personal computers on campus.

Respondents' computers consume roughly 178 kWh per day while on. 50% of this (88.48 kWh) was consumed by desktops (Figure 19), even though these computers only

comprise 8% of reported personal computers. Desktops also used 3688 hours less each day than laptops. Desktop consumption was followed by laptops (90% of reported computers), which consumed 84.82 kWh per day while operating. If this sample is representative of the campus as a whole, active energy consumption by personal computers could be equivalent to 647 to 690 kWh of electricity per day. This figure does not include standby energy consumption or power demand while the computer is off. Including these numbers could raise personal energy consumption on campus by upwards of 199 kWh per day. If all personal computers on campus were switched to laptops, total daily electricity consumption for these computers (active use plus upper estimate standby use) could be reduced by 285 to 303 kilowatt-hours.

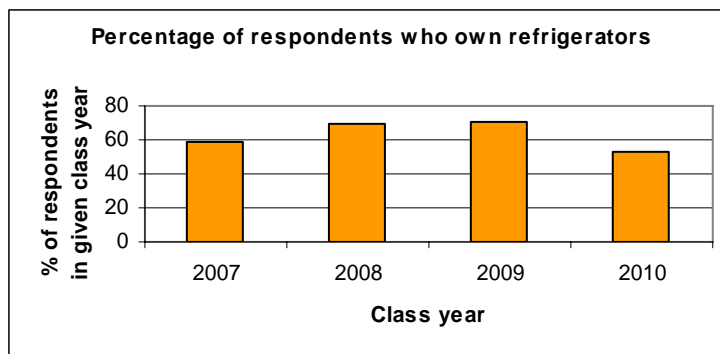
In addition, respondents do not solely use their own personal computers. The campus has roughly 300 computers in computer labs across campus. 60.4% of respondents use these computers “frequently” or “sometimes.” While the survey did not specify to what extent these computers are used (e-mail, paper-writing, etc), they clearly make a contribution to campus computer energy consumption. It is important to note that the majority of these computers are desktops

#### *5.4 Refrigerators*

Of the 550 survey respondents, 62.9% owned at least one refrigerator. Of these, 7 respondents (1.3%) owned more than one (most likely 2). This makes for a total of 346 reported refrigerators. 57.3% of these refrigerators are small (less than 2 feet tall), and 42.7% are medium-sized or larger. Although larger refrigerators typically consume more electricity than smaller ones, this survey uses one standard power demand value for both.

Sophomores were the most likely to own a refrigerator (based on per-respondent ratios), followed by juniors. As seen in Figure 20, first year respondents were the least likely

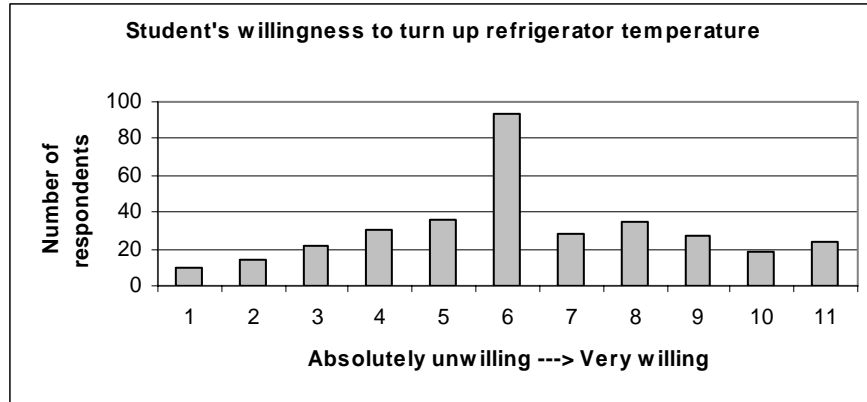
respondents to own a refrigerator, most likely due to the availability of refrigerators in entry common rooms. It is surprising that seniors did not exhibit a higher percentage of refrigerator ownership, given that these respondents are often on a smaller meal plan and have access to cooking facilities.



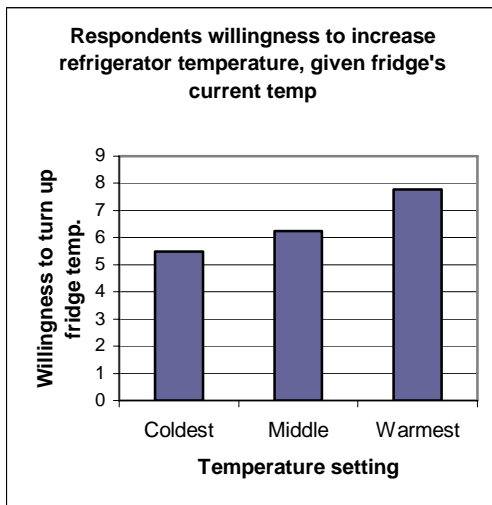
**Figure 20:** Sophomore respondents were the most frequent owners of refrigerators, followed by juniors, seniors, and first years.

Most respondents (71.6%) did not know whether their refrigerator was an EnergyStar appliance or not. However, of those that did know, 18.4% owned these energy-saving fridges, totaling 63 in all. The remaining 10% owned a less-efficient refrigerator.

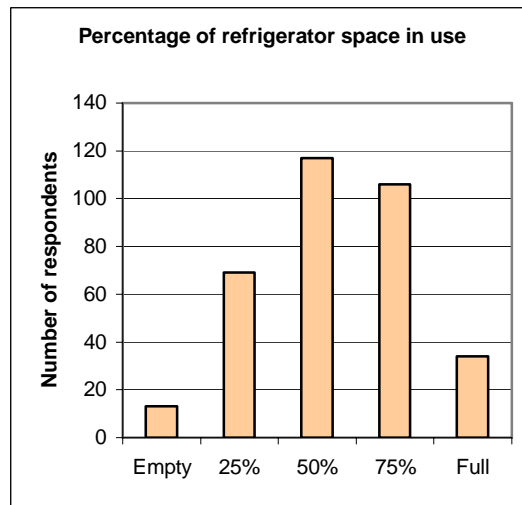
The majority of respondents had their refrigerator temperature set to a middle temperature setting, and only 8.5% had temperature set to the maximum (coldest setting). As is shown in Figure 21, a large portion of these respondents were neutral about increasing refrigerator temperature. Their neutrality is significant because it suggests that respondents could be convinced to reduce energy consumption by increasing average refrigerator temperatures by several degrees. Interestingly, those respondents who reported having a refrigerator set at a relatively warm temperature setting were the most willing to increase its temperature by several degrees (Figure 22). Individuals with refrigerators at the coldest setting were, in general, slightly opposed to turning up their refrigerator's temperature.



**Figure 21:** Respondents' willingness to increase refrigerator temperature. A large number of respondents were neutral in regard to this action.



**Figure 22:** Respondents with the warmest refrigerator setting were most willing to increase refrigerator temperature.

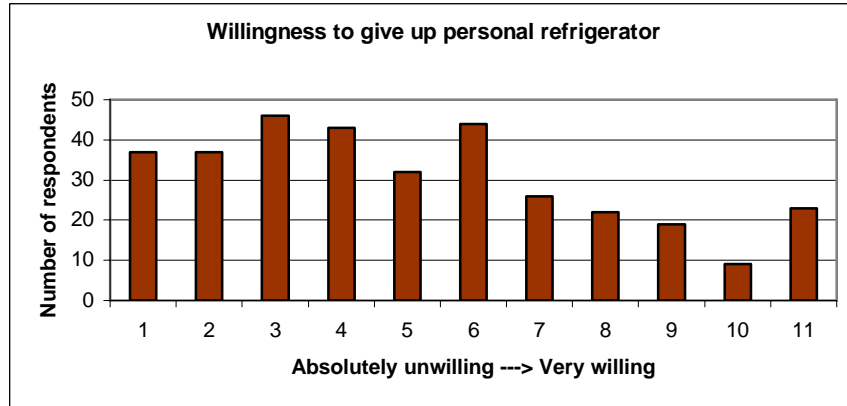


**Figure 23:** The majority of refrigerators (58.7%) were either half full or less. Only 10% were full.

Over half of the reported refrigerators were half full or less. As is shown in Figure 23, half full,  $\frac{1}{4}$  full, and empty refrigerators comprise 58.7% of reported refrigerators. Only 10% of individuals' refrigerators are considered full. Of respondents in different class years, juniors had the fullest refrigerators on average, followed by seniors.

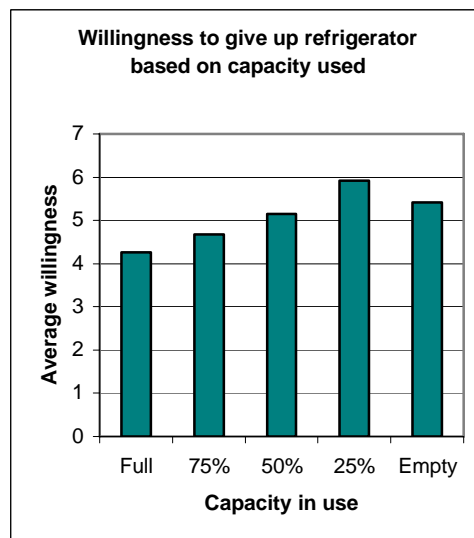
Juniors and seniors were less likely to be sharing their refrigerators with others. While only 28% and 28.6% of these respondents (respectively) reported sharing their fridge with their friends, first years and sophomore respondents shared their fridge 52.9% and 58.6% of the time, respectively. Overall, 44.7% of refrigerator owners reported to share their

refrigerator. When asked if they would be willing to give up their refrigerator and share with friends, 58% of refrigerator owners expressed some degree of unwillingness (Figure 24, 5 or lower)



**Figure 24:** Most refrigerator owners show some degree of unwillingness to give up their personal refrigerator, replacing it with common refrigerator use or sharing with friends.

Unsurprisingly, respondents who already share their refrigerator with friends were slightly more willing to give up their personal refrigerator. Along these lines, individuals with refrigerators that were ¼ full were the most willing, on average, to give up their refrigerators. However, their average willingness was close to neutral.

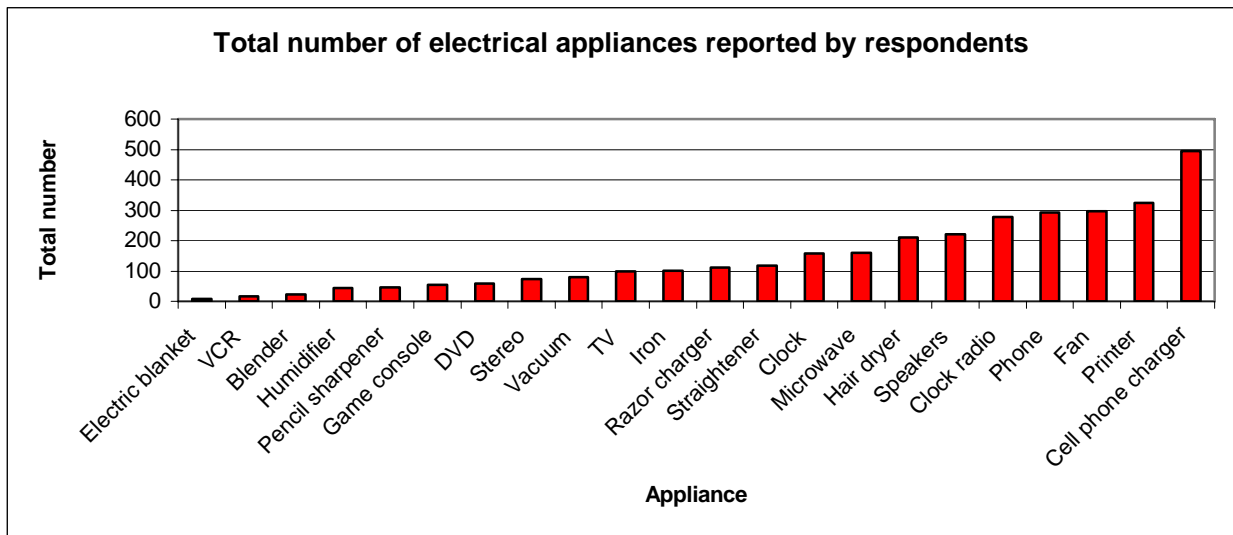


**Figure 25:** Respondents with empty or ¼ full refrigerators are the most willing to give those refrigerators up.

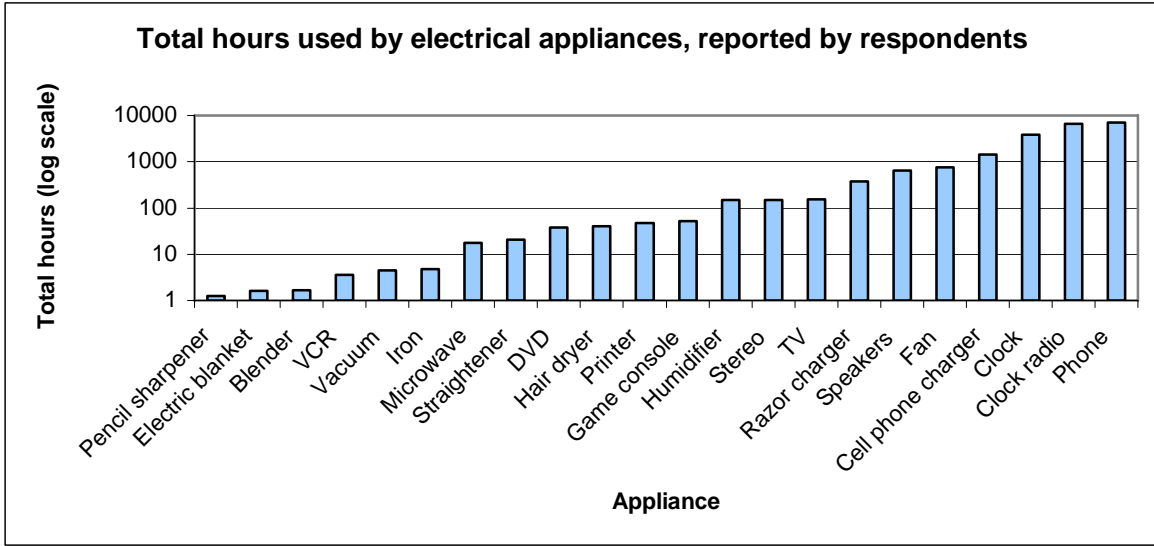
The 346 reported refrigerators consume electricity for 8,304 hours each day cumulatively. At an average power demand of 450W each, refrigerators account for 3,737 kWh of electricity consumption each day. Scaled to all campus residents, this equals approximately 13,600 kWh to 14,500 kWh daily, but does not account for size differentials or differing degrees of energy efficiency between reported refrigerators.

### 5.5 Other electrical appliances

For each of 22 additional electrical appliances, survey respondents were asked to indicate how many they owned and how often they used them. They were also asked what time of day they used ten of the more common items. Overall, respondents reported owning 3,277 additional electronic devices (excluding lights, computers, and refrigerators) and using these items for a cumulative daily total of 21,341 hours. Figures 26 and 27 break appliances down by number and daily operating hours.



**Figure 26:** Cell phone chargers, printers, and fans are the most numerous items reported by survey respondents.

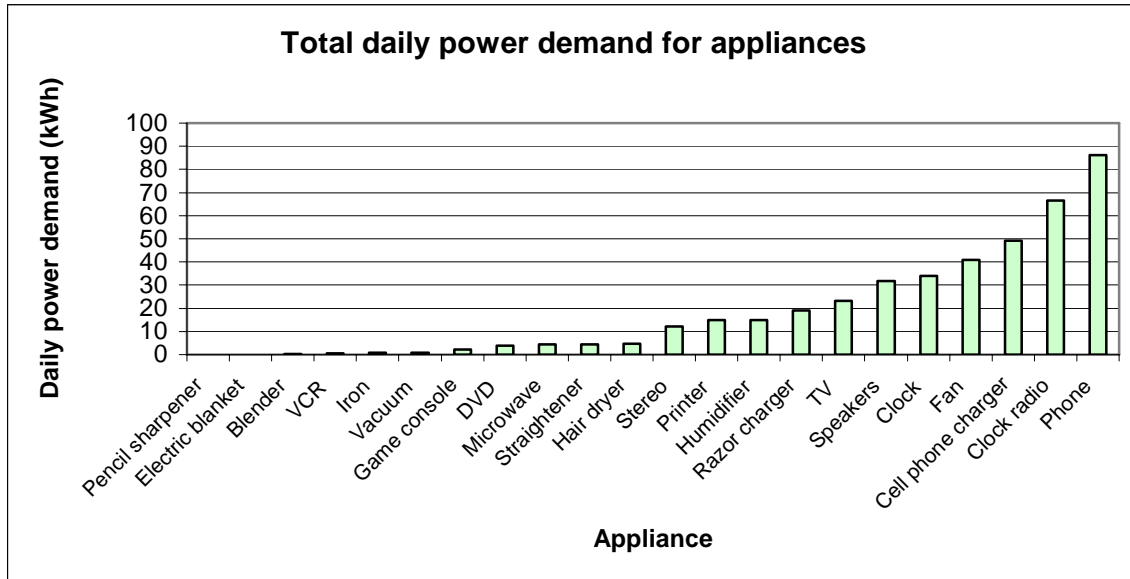


**Figure 27:** Phones, clock radios, clocks are used the largest number of hours. These are followed by fans, speakers, and razor chargers.

Cell phone chargers are the most numerous items reported by survey respondents, followed by printers, fans, and telephones. Other staples of respondents' dorm rooms are clock radios, speakers, and hairdryers. All told, individuals averaged roughly 6 plug-in items in their rooms (in addition to lamps, computers, and refrigerators). First years, on average, owned roughly one less electronic appliance than upperclassmen (average of 5.66 items versus 6.54 items).

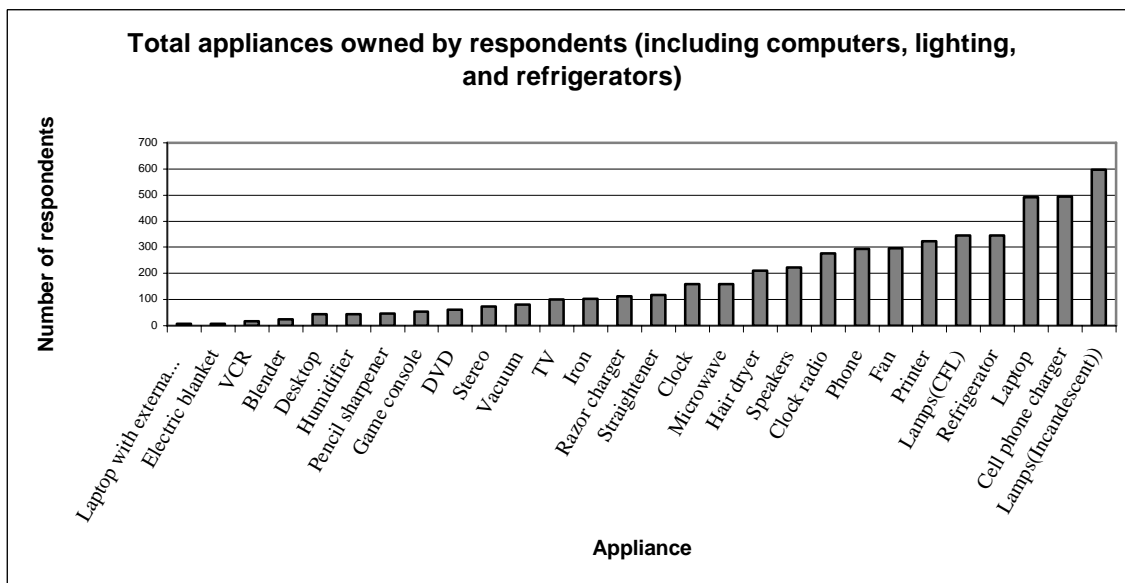
Items which are plugged in 24 hours per day, such as clocks, clock radios, and telephones, had the greatest total use (in hours). They were followed by cell phone chargers, fans, and speakers. Most of the items with the largest total use correspond with the most numerous items. However, some of the most numerous items, such as printers, are not used for any significant length of time and therefore are not significant in Figure 27.

Total daily power demand for these devices equaled 415kWh each day. Figure 28 outlines the energy consumption of each, as reported by 550 respondents. If this use were scaled to the campus as a whole, energy consumption would equal 1,510 kWh to 1,610 kWh. This figure does not include the standby energy consumption of these appliances.

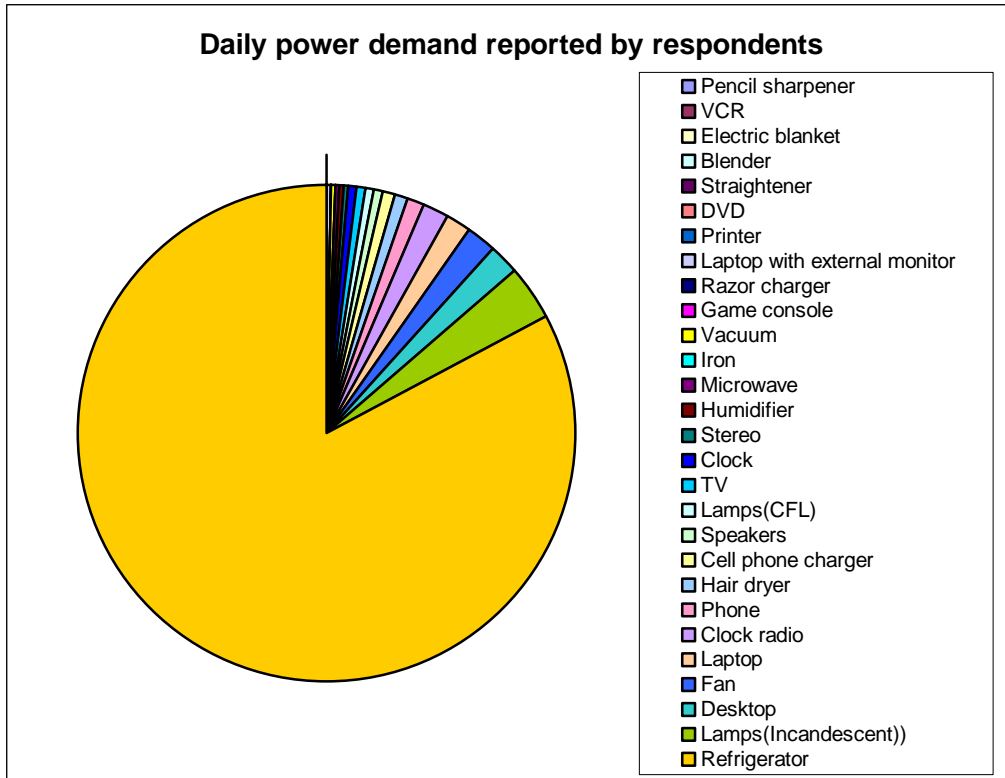


**Figure 28:** Total daily power demand of additional electric appliances. Scaled to the entire campus, these appliances would account for over 1500 kWh of electricity consumption each day.

When lighting, computers, and refrigerators are included, they dominate graphs of total number and power usage. In Figure 29, lamps with incandescent bulbs are the most numerous item reported by respondents, followed by cell phone chargers and laptops. Refrigerators are the fourth most-numerous appliance reported by respondents.



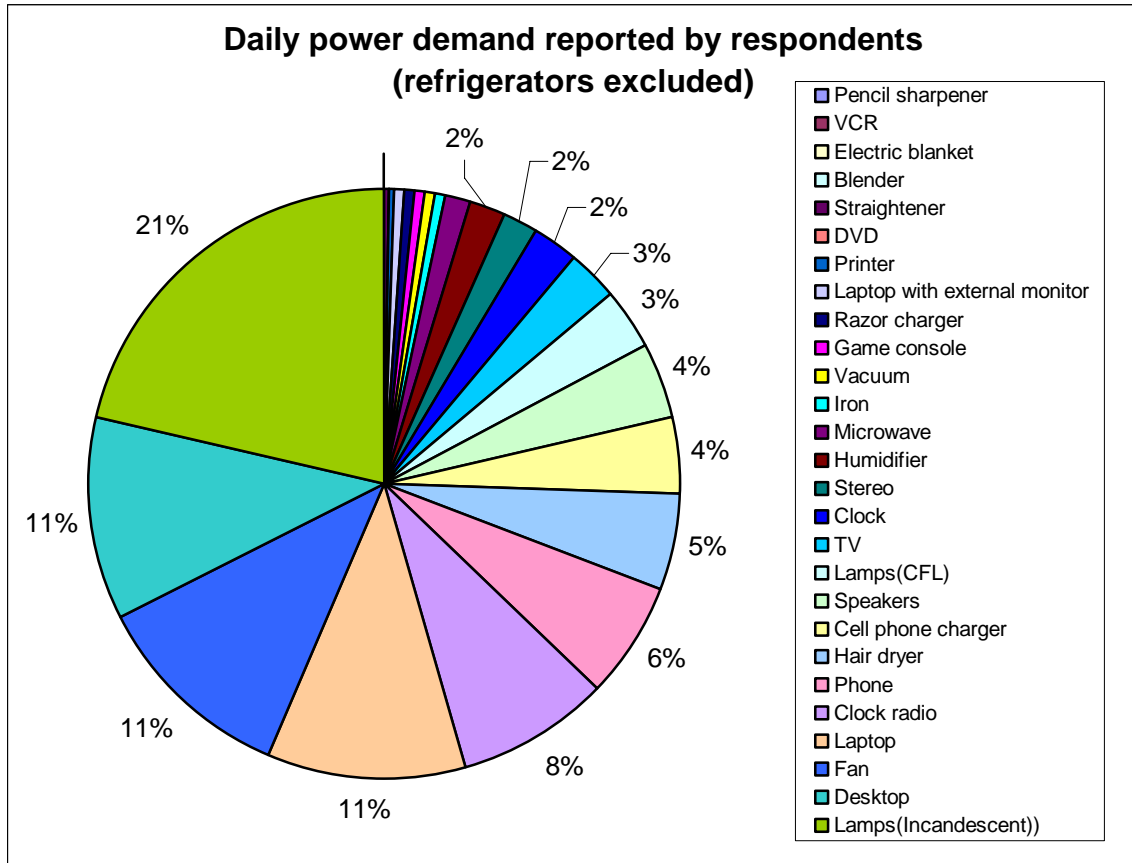
**Figure 29:** When lighting, computers, and refrigerators are included, they become some of the most numerous items reported by survey respondents.



**Figure 30:** Daily power demand of all appliances, as reported by survey respondents. Refrigerator energy use comprises 83% of reported electricity consumption.

Refrigerators, although the fourth most-numerous appliance, consume the majority of reported energy use. Totalling 3736 kWh per day, refrigerators account for 83% of daily energy use. Lamps with incandescent bulbs are the next most consumptive appliance, accounting for 4% (167 kWh) of total daily power demand. Lamps are followed by desktops, fans, and laptops, all consuming roughly 2% each of the total.

It is interesting to compare these appliances with their position in Figure 29. Refrigerators are the fourth most numerous appliances, yet they consume over 80% of daily reported consumption. Cell-phone chargers, which are more numerous than laptop computers, only consume 1% of the total. Printers similarly consume only 0.05% of respondents' reported daily use. In contrast to this, desktop computers use 2% of respondents' reported energy use even though they are one of the least numerous appliances. Figure 30 outlines daily power demand for each appliance, excluding refrigerators.

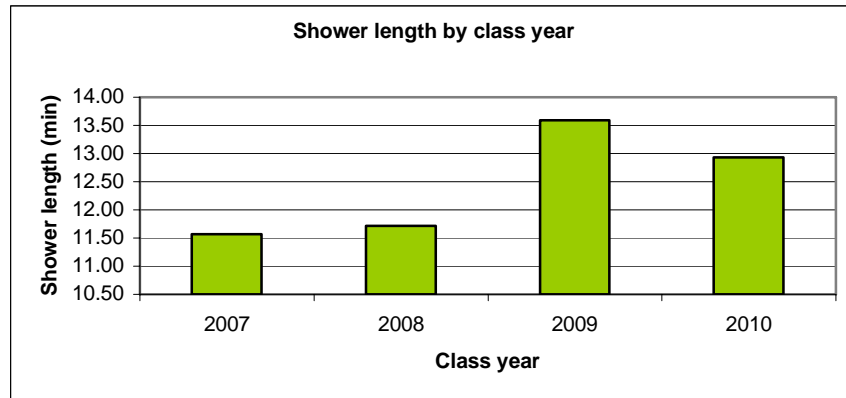


**Figure 31:** Daily power demand of respondents' appliances, excluding refrigerators. In their absence, lamps with incandescent bulbs create the greatest power demand.

The 550 individuals who responded to this energy survey collectively use 4522 kWh of electricity per day. This number, albeit large, is likely an underestimate. This survey only looked at active power demand, and did not ascertain the power demand due to standby usage and phantom usage. Scaled to the entire campus, the student body should use between 16,459 kWh and 17,544 kWh per day. The low end figure assumes that 2000 people are on campus at any given time. Given the proportion of individuals who are off campus during a typical semester, these may serve as slight overestimates of total campus consumption. However, any overestimation may serve to account for the lack of standby power usage in total demand calculations.

### 5.6 Showers and laundry

The average respondent takes a 12.5 minute shower, seven times a week. However, this number varies by class year. While all years take approximately seven showers a week, sophomores take up to a minute longer while washing up (Figure 32).



**Figure 32:** First years and sophomores take up to a minute more in the shower each day.

Most individuals (59%) are neutral about shortening the length of their showers. However, although respondents who were concerned about rising energy consumption were neutral in regard to this action, individuals that were unconcerned typically showed some unwillingness to shorten the length of their showers (average willingness of 4.22 with neutral equaling six).

The survey also gauged willingness to line dry their clothes and use shorter dryer increments. Overall, respondents were conflicted over line drying. 51% said that they would not take advantage of this feature. Contrary to this, roughly 71% of respondents said that they would be supportive of a dryer option which allowed one to dry clothes for shorter than 60 minutes.

### 5.7 Open-ended responses

The final survey question asked respondents:

“Preliminary evidence suggests that mini-fridges are the largest drain on energy consumption in student residences. Given this information, do you have any

ideas on how we could limit the use of these devices or decrease student energy consumption in other ways?

231 respondents wrote an answer to this question. The responses discussed a wide variety of energy-reduction strategies regarding consumption by refrigerators. Some suggestions include increasing the number of communal refrigerators, providing ways to secure these refrigerators, or encouraging students to share with friends. Other responses indicated that encouraging or forcing students to buy energy-efficient refrigerators would be an effective response.

Many of the responses highlighted the barriers to decreasing personal refrigerator use. The two most oft-cited concerns were stealing and cleanliness. Over one-third of respondents were concerned about theft from common refrigerators. Only a handful of these respondents, however, cited specific incidents when their food was stolen. Many individuals also noted that common refrigerators quickly become disgusting and unusable. They indicated that if common refrigerators were cleaner, they would be more willing to use them.

Given the overall power demand of refrigerators on campus, these barriers and suggestions must be taken into account in any attempt to decrease energy consumption.

## 6. DISCUSSION

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This discussion attempts to analyze the results seen in the previous section. While it is not completely comprehensive, it captures the most pertinent and interesting aspects of the survey results.

26% of survey recipients (550 individuals) filled out the survey to some extent. Of these, approximately 515 completed the survey in its entirety. In order to encourage recipients to fill out the survey, we advertised that five gift certificates would be given away to randomly selected survey respondents. This incentive clearly encouraged individuals to complete the survey, and may have eliminated some of the bias that would have been included if no reward had been offered (i.e.-only interested recipients would have filled out the survey). However, respondents were not necessarily random—they all chose freely to fill out the survey.

It is difficult to ascertain the effect that this had on findings regarding individuals' concern over rising energy consumption. The majority (90%) of individuals exhibited some degree of concern over rising energy consumption, and the largest number (57%) were concerned because of a combination of economic and environmental reasons. In this survey it is impossible to tell whether environmentally-minded individuals made up the majority of respondents, or if the campus, as a general whole, is concerned about rising energy consumption. I feel that much of the problem comes in the wording of the question. Given current news about global warming and rising utility costs, it seems likely that many respondents would have a concern about this issue, even if it does not affect their habits.

Degree of concern over rising energy consumption did not appear to predict survey response. Giving credence to the fact that a representative sample responded to the survey, the class of 2007 (which had the second lowest number of responses) exhibited the highest concern

over rising energy consumption. Because concern and response rate were not correlated for any of the class years, it appears that the results are mostly representative of a random sample.

### *6.1 Lighting*

70% of lighting hours occurred, unsurprisingly, at night, but 20% of lighting hours were used during daylight hours. While using lighting in the early morning seems reasonable, typically using lighting during the afternoon (when natural light is greatest) seems to be a target for energy reductions. This figure can likely be explained by those dorms that do not receive a significant amount of light during daytime hours. It can also be explained by individuals' use of desk lamps or other small lamps (not all of their lighting) when working during the day. Lastly, it is possible that some individuals turn lights on whenever they are in their room, regardless of the amount of natural light. This survey does not illuminate the reasons for this large daytime lighting use, but it is something that should be addressed in the future.

The 550 survey respondents reported owning 943 personal lamps. Divided amongst them, this averages approximately 1.7 lamps per person. However, the average number of lamps increased with rising class year. First year students owned 1.67 lamps on average, compared with seniors' 1.9 lamps. While this is not a large difference, it may reflect a change in average room size. Whereas first years' rooms are relatively small and may be adequately lit by installed overhead lighting, seniors' rooms (in many cases) are significantly larger and may require supplemental illumination. This may also tie in to the fact that seniors use approximately 20 more minutes of average lighting time than their peers. The rising number of lamps per class year may also be due to the accumulation of material over four years at Williams, the inferiority of overhead lighting in upper-class dorms, or by sampling error.

Seniors, in addition to having the highest average number of lamps, had the largest percentage of incandescent bulbs in those lamps. Roughly 25% of seniors bulbs were comprised of CFL's, whereas other classes exhibited percentages of 30% or higher. Over 50% of first year light bulbs are CFL bulbs. This is most likely due to two factors. First of all, literature sent home to first year students over the summer encouraged them to bring compact fluorescent bulbs to campus. Secondly, a compact fluorescent light bulb exchange program had begun to target first year dormitories during the course of this survey. Because half of the class of 2010 had been targeted during this initial exchange, it comes as no surprise that close to half of bulbs reported by first years are CFL's.

Ongoing efforts to switch all campus bulbs to CFL's should be continued. According to Figure 13, the majority of respondents are either neutral or willing to bring CFL's to campus. Once questions regarding the lighting quality of these bulbs are addressed, it seems that many individuals would be willing to have them installed in their personal lamps.

As the most numerous item reported by respondents and the second largest power consumer after refrigerators, lighting is a key target for reductions in student power demand. Respondents reported an energy demand for lighting of 193kWh per day, at a cost of roughly \$25. Scaled to campus, lighting in student dormitories consumes 700 to 750 kWh per day, or \$90 to \$98. 87% of this consumption is due to incandescent bulbs. If all student incandescent bulbs were removed from campus, it would reduce lighting power demand to ~246kWh per day and save the college a total of \$60 to \$64 each day. While these monetary savings do not seem significant, they add up. Over the school year, Williams would save over \$14,000 by having its student body switch to compact fluorescent light bulbs in personal fixtures. If it provided these bulbs, purchasing them at a cost of roughly \$2 each, it would still manage to save over \$7,000. Due to its clear effects on power demand and its visible monetary incentives, converting campus

incandescent bulbs should be a forerunning conservation strategy. Methods to effect this change will be discussed in Part B.

## *6.2 Computers*

Laptops were the most numerous type of computer reported by respondents and accounted for 87% of total computer usage. Laptops were also the third most numerous appliance overall. All told, computers were in operation for 4,886 hours cumulatively each day—an average of 9 hours per respondent. Individuals who owned desktops or laptops with external monitors tended to use their computers an average of 3 to 4 hours longer than owners of laptops. This is an interesting finding, but a sufficient explanation for it is difficult. It's possible that individuals who own desktops have a greater demand for high-powered computing (such as gaming or graphic design) that can only be provided by a desktop. It's also possible that computer use dictates the type of computer a respondent purchases. Because desktop and laptop with external monitor users are on their computer for longer each day, they may have made a conscious decision to purchase a computer with a large screen (i.e. a desktop or external monitor).

The more an individual uses their computer, the less likely they are to put it in standby, turn it off, or unplug it when it's idle. The average daily computer use of those who always put their computer in standby, turn it off, or unplug it, is less than half that of those who never engage in these behaviors. At first this seems obvious—if an individual is using his computer more, he will have less time in which it's idle to shut it down. However, computers were seldom in use greater than 14 hours per day. In these ten hours of idle time, low-time users were likely to engage in energy-saving behaviors.

By leaving their computers on when not using them, low-end users (in particular) could contribute significantly to overconsumption. However, by engaging in energy-saving computer

behaviors more frequently, these users vastly cut their consumption. Of those energy-saving behaviors, placing one's computer in standby was the most cited. 82.2% of respondents' computers go into standby mode automatically after less than an hour or less of idle time. Few respondents unplug their computer when not in use (77% do not), and only slightly more turn their computer off when not using it. Given the standby power demand of these computers, efforts should be taken to increase the number of respondents who turn their computer off when not in use for an extended period.

Respondents' computers collectively consume 178 kWh per day. If we multiply this across all students and add upper limits of standby power consumption, this number increases to 847 to 890 kWh of power each day at a cost of ~\$115. Over the course of the year, student computers will consume 188,000 to 197,000 kWh, thus costing the college upwards of \$25,000 in utility costs. 50% of this consumption is driven by desktop computers, even though they only comprise 8% of total reported computers and are used 3700 hours less than laptops.

As one of the most numerous and consumptive appliances, computers serve as a key target for reductions in daily power demand. If computers were turned off instead of placed into standby mode, daily electricity use could be reduced by almost 200 kWh (at a savings of \$26). Over the course of the year, this would save the college close to \$6,000. By limiting the number of desktop computers on campus, the College could cut daily electricity demand by 285 to 303 kWh. This would reduce daily load to 587 kWh and save an additional \$8,000 dollars over the course of the year. Unlike CFL replacements, which require a capital investment, programs to reduce computer power consumption are cost-minimal. Given respondents' willingness to turn their computer to standby more often (78% were willing to), this is a key area for promoting energy-smart behavior.

### 6.3 Refrigerators

Refrigerators are the fourth most numerous appliances listed by survey respondents and consume the greatest total amount of daily electricity. Over 60% of respondents owned at least one refrigerator. Sophomores were the most likely to own a refrigerator, followed by juniors, with first years being the least likely to own one. This differentiation is interesting—first year students most likely show a lower percentage of refrigerator ownership due to living arrangements (mainly the prevalence of entry refrigerators or shared suite refrigerators in Sage and Williams). However, after their first year, removed from an entry or suite living arrangement, many of these respondents bring a refrigerator to school with them. It is possible that the percentage of individuals that own fridges declines as individuals realize they don't need their refrigerator or that they can share with friends.

Of the 346 refrigerators reported, the majority are set on a middle temperature setting. This is one area in which significant reductions in electricity demand can be made. In general, respondents were neutral about turning up their refrigerator's temperature by several degrees. Interestingly, those respondents with the warmest temperatures were the most willing to do so. These respondents, however, are accustomed to slightly warmer fridge temperatures and would not be significantly impacted by increasing temperature. Individuals who keep their refrigerator on the coldest setting are accustomed to cold temperatures and might feel that increasing fridge temperature would sacrifice some degree of cooling quality. This is one potential target for reducing the consumption of refrigerators.

Underutilized refrigerators are another potential target. 58.7% of reported refrigerators were half full or less. Juniors and seniors had the fullest refrigerators, but only 10% of total reported refrigerators were actually considered "full." Probably because of this, juniors and seniors were the least likely to be sharing their refrigerators with others. This is also likely caused

by the arrangement of upper-class housing. Juniors and seniors are the most likely to have their own room, and only a handful of upper class houses employ a suite-like arrangement in which refrigerator-sharing between friends would be easy. This may drive juniors and seniors to own their own refrigerator and use it exclusively.

Respondents were generally unwilling to give up their refrigerator. Many respondents cited concern about common refrigerator use—particularly the risks of theft and their typically unclean condition. However, individuals who currently share their refrigerator or those with nearly empty fridges were less averse to giving up a personal refrigerator. These trends are an important indicator of effective targets for reducing personal refrigerator use on campus.

Overall, refrigerators use 3,737 kWh per day. If respondents with refrigerators that are less than half full (empty, 25%) left their refrigerators at home, this consumption would drop to 2,851 kWh, a 24% reduction. Halving the number of refrigerators on campus through mandatory reductions or incentive programs could reduce electricity consumption even further—by 1,869 kWh per day. Given the incredible impact that these appliances have on student dormitory electricity demand, they are a critical component of any effective conservation strategy.

#### *6.4 Other electrical appliances*

Compared to refrigerators, lighting, and computers, other electrical appliances have a small impact on electricity use in student residences. However, there are several places in which reductions can be affected among these appliances. Cell phone chargers, printers, and fans are the most numerous appliances in this category. Of these, fans consume the most electricity (86 kWh daily), followed by clock radios and phones (66 and 49 kWh, respectively). However, it is likely that fan consumption peaks in the fall and spring and decreases significantly during the winter

months. Because clock radios and phones must be plugged in 24 hours per day, there is little that can be done to reduce these appliances' energy consumption.

However, for appliances which do not require power 24 hours per day, there is hope for some small reductions. 47.4% of respondents said that they would plug electrical items into a power strip if one were provided by the college. While these devices do not reduce the energy consumption of appliances, they cut down on standby or "phantom load" power consumption. Most of the appliances outlined in this section consume 2-3 Watts of power when off but still plugged in. Given that most individuals own an average of 6 of these items, standby power consumption could be up to 500 kWh per day. A program to draw attention to this source of power and address its cause (unused items being plugged in) could save Williams over \$9,000 in yearly utility costs (reduction of 71,000 kWh over one year if implemented perfectly). While small and broad reaching, the program would draw attention to the wide range of electrical appliances used by students and potentially save a good deal of money. However, given the cost of power strips, providing one to each student would not necessarily be cost-effective.

### *6.5 Showers*

Shower length is another area where energy reductions can be achieved. With 59% of respondents neutral about shortening their showers, a campaign to encourage students to reduce overall shower length or turn water off while soaping up could potentially be very effective.

### *6.6 Sources of error*

550 individuals responded out of 2,134 total recipients for a 26% response rate with an associated +/- 3.6 margin of error. As established at the beginning of this section, it is likely that these respondents were a fairly representative sample of current students. The fact that

environmental concern did not correlate directly with response rate for different class years lends credence to this.

Much of the error inherent in this survey comes from respondents' reporting of device usage. Particularly with items such as printers, blenders, or irons (which aren't used frequently) it is difficult for respondents to determine how many total hours the appliance is used. Because of this, many devices are categorized as being used "a few hours per week" or "a few hours per month." For each device, I calculated a daily energy use based on the most likely value for this (typically 2-4 hours per week or month). This subjective distinction may have skewed power consumption values away from reality. However, the items which were seldom used did not comprise a significant portion of daily energy consumption. Error in the reporting of these values, therefore, most likely did not have a significant effect on the accuracy of the survey's findings.

Finally, the power values used to calculate total power demand are averages based on best-available sources. In most cases, these values do not reflect the differences between varying brands and sizes of a given appliance. However, they give a general assessment of the energy demand of the "average" appliance. Also, this survey did not explicitly evaluate standby power usage, as is outlined in Section 5.5. Adding this value could increase the calculated daily electricity consumption by upwards of 10%.

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## **PART B: STRATEGIES FOR INSPIRING STUDENT CONSERVATION**

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Electricity consumption in student residences comprises 13% of total electricity use, and reductions in this area will be a key portion of the Climate Action Committee's emissions reduction strategy. Inspiring conservation by students will serve as an educational experience as well as a significant source of cost-savings. While the hope is that these cost-savings will be re-invested in further energy reducing behaviors, it is possible for them to be used toward building improvements, green power development, or the purchase of renewable energy credits (REC's). Regardless, in order to most effectively reduce consumption by student residences, a focused effort must be made to increase awareness of energy consumption and promote environmentally-responsible actions.

### **7. TARGETS FOR REDUCTION**

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Based on survey findings in Part A, there are a number of highly visible targets for reductions in student power demand. In this section, I attempt to outline the most feasible and effective targets based on capital cost, projected cost-savings and energy reduction, and visibility. I also attempt to explicate the barriers that must be overcome in order to affect campus-wide reductions

As is clearly shown in Part A, refrigerators are the largest consumer of electricity in student dormitories. They are also, it seems, among the most underused appliances. Over half or reported refrigerators were not being used to their full capacity. In addition, 55% of refrigerator-owners were not sharing their refrigerator with friends, even though they could do so with no detriment to their own use (because refrigerators had unused space). Potential

campaign strategy should focus on getting rid of underused refrigerators, increasing fridge-sharing, and making common refrigerators more suitable for general use.

Lighting is another area in which significant reductions can be seen. According to the findings in Part A, incandescent personal lighting is the second largest source of power consumption after refrigerators. These incandescent bulbs comprise over 85% of the power consumed by electricity. Switching personal bulbs to incandescents, as is currently being done by members of the Thursday Night Group and Greensense, could reduce power demand by over 100,000 kWh. However, many residents have significant concerns about the lighting quality of compact fluorescent light bulbs. Efforts must be made to confront these concerns, as well as to reach all of the campus' residents through the exchange program.

Reducing computer energy demand will save the college upwards of \$6,000. Currently, a large majority of individuals put their computer in standby mode when it is not in use. However, laptops still consume 6.2 Watts and desktops consume 8 Watts while in this mode. If we could reduce this demand by getting individuals to shut their computers off when they're not in use, student power demand would be greatly reduced (by up to 200 kWh per day). However, students who use their computer frequently will see the extra time needed to restart their computer as a significant cost of this action. Efforts must be taken to address this, as well as to target the individuals least likely to engage in energy-saving behavior (see Sections 5.3 and 6.2).

Other electrical items consume 415 kWh each day. However, the real usage of these items is likely much greater, given that calculations did not include standby or "phantom" power usage. As is outlined in Section 5.5, most of these items are used for only a few hours a day but remain plugged in at other times. Some appliances, such as printers may see over 23 hours of idle time each day. Power demand from standby consumption could be vastly

reduced if individuals unplugged their items. Results indicate that 66% of respondents would be willing to do this. Conservation campaigns should therefore take advantage of this willingness to tackle reduction measures. Students also said that they would be willing to use a power strip if one were provided to them. Power strips vastly reduce idle power consumption, and should be an integral part of any conservation strategy.

## **8. RESOURCES**

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Campaigns to reduce electricity consumption in student dormitories will rely heavily on the cooperation and participation of many groups on campus. Some of these groups are outlined below.

### *8.1 Greensense*

Greensense, Williams' student environmental group, is comprised of roughly 30 members who meet once a week. Each semester, Greensense tackles several projects that ultimately reduce the College's impact and increase its commitment to environmental sustainability. In the past, Greensense members have promoted recycling and composting on campus, called for increases in local and organic food in dining halls, and worked with Dining Services to install energy-saving VendingMisers on campus vending machines. Recently, Greensense members gathered 1,100 signatures on a petition which ultimately began the Williams Climate Initiative.

As a large and active group on campus, Greensense will have a critical role in publicizing, encouraging, and modeling energy-smart behaviors. Individual members of Greensense who have energy-smart rooms could open their rooms as examples, similar to the

EnergyStar Showcase Dorm Room at Tulane University.<sup>3</sup> These rooms would help to show that energy-efficiency can be achieved without significant impacts on comfort.

### *8.2 The Thursday Night Group*

Much of this independent study focused on organizing a core group of students to tackle issues of carbon emissions, energy consumption, and sustainability on campus. Along these lines, this semester saw the creation of a brand new student group on campus. Centered on the issue of global warming, the Thursday Night Group was inspired by an active and incredibly effective group at Middlebury College in Middlebury, Vermont. The Thursday Night Group takes a much different approach than many groups on campus. Instead of having rigidly structured meetings, TNG instead relies on a casual atmosphere in which social interactions are encouraged. After an initial “hang-out” period and a period more focused discussion, the group determines which projects it would like to tackle and then divides into subgroups. These subgroups work out the details of each project and become its core group of promoters.

This structure has already had significant success this semester. Members of the TNG are currently undertaking a campus-wide compact fluorescent light exchange that has converted over 600 personal lamps to CFL's. This exchange has been a valuable way not only to reduce energy consumption, but also to disseminate information about the Thursday Night Group, the Williams Climate Initiative, and global warming in general. Members of TNG have also sought to raise awareness through several public art projects. Many forthcoming projects are currently in progress.

### *8.3 The Campus Environmental Advisory Committee*

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<sup>3</sup> <http://green.tulane.edu/energysmart/EnergySmart.html>

The Campus Environmental Advisory Committee (CEAC) is an *ad hoc* committee comprised of students, faculty, and staff that advises the Vice President for Operations on matters related to the College's environmental impact. In such a position, the committee can potentially impact policymaking and overall operations at a high level. CEAC also tackles projects similar to those undertaken by Greensense and the Thursday Night Group. In the future, I hope that CEAC renews its focus on policy formation and urges the administration to create a stringent set of green building guidelines and a more environmentally-mindful electricity-purchasing policy. However, in the meantime, CEAC can push for changes in the way "environmental" initiatives are seen at the college.

Currently, Alison Davies, Chair of CEAC, is working on a proposal to create four Neighborhood Eco-Rep positions. These Eco-Reps would potentially be paid by Facilities (as a work-study position) and would help to advertise and promote environmentally sustainable behavior. Many other schools with effective sustainability programs have created similar positions. Eco-reps will be a key player in ongoing conservation promotion if they come to fruition.

**9. “STOP IT HERE”:  
A CAMPAIGN TO REDUCE ELECTRICITY CONSUMPTION AND EMISSIONS AT WILLIAMS**

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In January 2006, the Climate Action Committee will make its recommendations for a greenhouse gas emissions reduction target. Their recommendation will ultimately include a list of potential strategies for reaching these targets within the suggested time frame. Currently, the CAC, Greensense, and the Thursday Night Group are preparing for the announcement. Given the scale and scope of this initiative, the day of the announcement will be a momentous one in Williams’ long history. The College must take advantage of this opportunity by raising significant awareness of their efforts and encouraging individual members of the college community to follow suit. Greensense and the Thursday Night Group, in particular envision a day of events, discussions, public art, and celebration on the day of, or shortly after, the announcement.

As part of this, I intend to begin a “Stop it Here” campaign, beginning at the start of the Spring semester of 2007. “Stop it Here” will be a publicity and awareness campaign calling on Williams’ students to stop our local contribution to global warming. It will hopefully come to be used as a slogan and advertisement for a formal Williams Climate Initiative. The focus of “Stop it Here”, however, will be on promoting energy-smart behaviors within the college community. By creating a “brand” for these behaviors, it will allow people to recognize smart actions and receive recognition for their participation. The campaign will first seek to raise awareness about student energy consumption, and then will seek simple, energy-saving commitments from individuals. These commitments will be used both as a foot-in-the-door for increasing committed individuals’ reductions and to garner further commitments. “Stop it Here,” in these efforts, will focus on the targets for reduction outlined in Section 7.

### 9.1 Raising Awareness

Doug McKenzie-Mohr, psychologist and author of *Fostering Sustainable Behavior*, writes that “all persuasion begins with capturing attention” (84). One of the first steps of the “Stop it Here” campaign will be to publicize the findings reported in Part A. Very few individuals are aware of how much electricity they consume on a daily basis. In a study by Baird and Brier (1980), respondents’ ability to sort appliances into energy use categories suggested that “people are not normally aware of energy requirements” (96). They state that conservation will be difficult if people do not have this information. Because of this, “Stop it Here” will first work to publicize the average consumption of different appliances based on the findings of the electricity use survey. An ad campaign will be developed over the Winter Study term, and will be tested with selected groups of individuals.

McKenzie-Mohr and Smith (1999) state that information must follow three criteria: it must be vivid, tailored to the audience, and well-framed. Information about energy consumption thus must be presented to the student body in a way that increases their knowledge and encourages them to act. In order to grab their attention, “Stop it Here” will use media such as public art projects, public performances, door hangers, and personal postcards instead of posters or fliers. The messages presented will combine negative motivations with suggestions for action. While it may seem counterintuitive to promote negative messages, McKenzie-Mohr and Smith state that “messages which emphasize losses...are consistently more persuasive than messages that emphasize savings” (90).

A paper by Bator and Cialdini (2000) offers guidelines for crafting effective pro-environmental public service announcements. In line with McKenzie-Mohr and Smith, they argue that messages should be extensively pre-tested with a sample group. These messages should be incredibly specific and explain exactly how behavior changes should occur,

providing encoding cues that will be triggered in the area where the action is to occur. As an example, messages meant to get respondents to turn off their computers when they're not in use should include images of a dorm room or of a computer's power button.

These messages, in combination with general circulation of a "Stop it Here: The Williams Climate Initiative" logo will go greatly toward raising student awareness of their daily electricity consumption.

### *9.2 Gathering Commitment*

Simply raising awareness of electricity consumption will not cause reductions. In a study of master-metered apartments in 10 large cities by the Midwest Research Institute, those buildings consumed 35% more energy than individually-metered buildings (Walker, 1979). Because individuals do not have a visual reminder of their energy consumption nor any incentive to reduce, they typically consume more. Students living in dorms likely reflect this trend. Several studies have suggested that gathering commitments from dorm residents is an effective means of inspiring reductions. Goals are particularly effective when combined with feedback. This feedback should follow on the model of the campus-wide "Do it in the Dark" energy-saving competition, but should be wider-publicized using the methods outlined above. By committing to a target and then being constantly reminded of their progress, students will be pushed to reduce. In one study, families who committed to reduce electricity consumption by 20% and were provided with feedback three times a week were able to reduce their consumption significantly—by over 15%.

"Stop it Here" will create a campus-wide pledge campaign that will promote three easy behaviors: turning off computers when not in use, using CFL's, and unplugging unused items/plugging them into a power strip. Once commitments are gathered, these individuals

will be targeted as examples of energy-smart behavior. Members of Greensense, the Thursday Night Group, or future Eco-reps will provide plaques or stickers to be put on individual's doors. These stickers will serve both as a visual reminder of their commitment, as well as a public symbol of their commitment. Several studies have shown that public commitments are much more likely to be followed than private or verbal ones. Once individuals commit to making easy changes in habits, McKenzie-Mohr and Smith suggest that they are often more likely to commit to making more difficult ones. This foot-in-the-door technique (small commitments leading to larger ones) will be a central part of the "Stop it Here" campaign.

Geller (1981) states that these commitments must be combined with "behavioral checks on self-report" in order to be most effective. These checks could be as simple as room visits by Eco-reps, Greensense or TNG members, or representatives from CEAC. They could also be combined with small monetary incentives. Walker (1979) got apartment residents to significantly reduce energy use by rewarding individuals who passed a random inspection with \$5. Given the savings projected by overall student energy reduction, a small incentive such as this could be used effectively at Williams without significant net costs.

### *9.3 The problem of refrigerators*

Refrigerators are a huge consumer of electricity on campus. They are also one of the most firmly entrenched appliances that students own—students are simply unwilling to give them up. "Stop it Here" will work to raise awareness about refrigerator energy consumption and try to address the barriers that keep these devices in student dorm rooms. I hope to work with the administration to decrease the number of large refrigerators on campus, instead replacing these appliances with smaller communal refrigerators in more locations. By decreasing the average number of people who use each of these refrigerators and promoting

them as an alternative to individual refrigerators, I hope to overcome the stigma which common refrigerators hold. I also hope to work to discourage first year students from bringing a refrigerator to school, using mailings that go home before school begins.

Shot of this, though, “Stop it Here” will encourage students to share their refrigerator with their friends. One potential project will inventory all campus refrigerators and set up “sharing networks”—individuals who have space in their refrigerator that others can use. Given their consumption, limiting the number of refrigerators on campus can have a significant impact on overall consumption in student dormitories.

#### *9.4 “Stop it Here” and existing initiatives*

“Stop it Here” is by no means meant to compete with the bi-annual “Do it in the Dark” energy-saving competition. In fact, I hope for DIITD to be incorporated into the semester-long “Stop it Here” program. The month of DIITD will be a time to capitalize on pledges, increase publicity, and highlight individuals who are engaging in energy-smart behavior. In short, it will be a jump-start period and a time to recruit more environmentally-conscious campus residents.

As we work to make Williams a more environmentally-conscious place, we must take advantage of all of the resources and events available to us. The coming semester, with the announcement of the CAC’s final recommendations, will be a momentous time in Williams’ history. We must confront this time prepared, motivated, and ready for action. Together, we can make the Purple Valley green.

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