

# Final Project Report

Assessing the Use of Mini-fridges in Traditional Style Residences on Studley Campus



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## **Abstract**

The use of fossil fuels to power the every day life of people living in Nova Scotia has many implications including contributions to the Greenhouse Effect. In order to meet the requirements of the recently ratified Kyoto Protocol, industry, institutions, as well as individuals must become responsible for their energy consumption. As an institution of higher learning, Dalhousie University has a leading role to play when it comes to energy conservation. Thus this project aimed to explore the energy consumption practices in traditional style residences at Dalhousie University, with respect to the use of mini-fridges by students. The study was carried out by a series of interviews with managerial staff, questionnaires in the form of student surveys and archival research using websites. It was found that mini-fridges are extensively present in traditional style residences, but are not being used to their full capacity. Further more, when compared to a normal size refrigerator, mini-fridges were found to be inefficient. Thus, it can be concluded that mini-fridges in residence are a source of energy waste. If mini-fridges were banned from residences, Dalhousie could stand to save approximately \$15 000 during the 8 month school year in energy payments. Several recommendations are provided regarding the use mini-fridges, however, it is concluded that the main cause of energy waste in residences is the residence's "all inclusive" set up and the resulting wasteful actions of students. Further research into this topic, as well as other sources of energy waste in residences is recommended in order for Dalhousie to live up to its role as a leader in life style changes and energy conservation.

# **Introduction**

## **Importance and Rationale**

Canada has recently ratified the Kyoto Protocol. If the agreement is accepted globally, (which means that 51% or more of the world's countries, producing over half of the world's emission) Canada will be bound to a 6% reduction of Green House Gas emissions from its levels in 1990. Green House gases, which include carbon, sulphur and nitrous oxides, among others, are gases in the atmosphere which contribute to the Greenhouse Effect. The Greenhouse Effect, in simplest terms, is a complicated process by which energy is re-radiated and delivered back to the Earth, causing an increase in the planet's overall energy and, thus, an increase in overall temperature. We are already beginning to see disastrous effects of this increase in temperature, commonly referred to as climate change, which includes sea-level rising and an increase in severe weather patterns (Freedman, 2001: 310-324), giving the issue global attention.

Bill Freedman (2000) maintains that about 97% of industrial carbon dioxide emissions (a Greenhouse Gas) are due to the combustion of fossil fuels, which includes 42% from liquid hydrocarbons (oil), 38% from coal and 17% from natural gas. According to Environment Canada (2002), "Reducing Green House Gas emissions requires major changes to the way energy is produced [and] used".

So where does Nova Scotia fall into place? According to Larry Hughes (2001), a professor of Electrical Engineering at Dalhousie University, "[a]t some 19.8 tones of CO<sub>2</sub>/person/year, Nova Scotians are amongst the world's top emitters of Green House Gas emissions." The Nova Scotia government, in response to global and national initiatives like Kyoto, has created a Statement of Principle, which maintains that: "Nova Scotia intends to respond to environmental concerns about air quality in the province, by reducing air emissions of harmful pollutant that result from combustion of fossil fuel".

While Nova Scotia Power, the main supplier of electricity to the Halifax Regional Municipality (HRM), has implemented some forms of “Green” or renewable energy, an astonishing 75% of our electricity still comes from coal or pet coke, two of the dirtiest burning fuels, which add tremendously to poor air quality in the region. This coal-burning majority is apparently due to the conversion that NS Power underwent from oil to coal in the 1970s during the OPEC oil crisis (Nova Scotia Power, 2004).

As Environment Canada stated earlier, changes need to be made not only in the way energy is produced, but also in the way it is used. The members of the research group feel that the conservation of electricity is the responsibility of all citizens and institutions, like Dalhousie, and can be made through small, yet effective, lifestyle changes. Conservation may also be considered a more fundamental solution to our global energy crisis. Until renewable energy sources are fully implemented, reducing total energy use can lessen environmental impacts. By understanding more about the way Dalhousie operates with concern to electricity, the research team has developed possible alternatives with the potential to save money and “Green the Campus”, all at the same time.

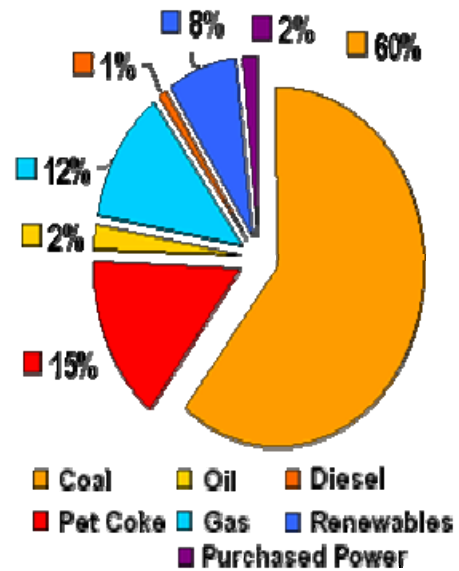


Chart courtesy of Nova Scotia Power, 2004

### **Research Problem**

Initially, the research team chose to examine energy use practices in residences on the Studley Campus of Dalhousie University on a general-use basis. As research and brainstorming progressed, however, the group decided to narrow the focus of the study to exploring the use of mini-fridges, a common electrical appliance in residence rooms, and their consequential energy consumption.

Preliminary research indicated that mini-fridges might be as much as 4 or 5 times as inefficient as their full-size refrigerating counterparts (Danby, 2004). This leads us to the conclusion that the

current use of mini-fridges is a source of energy drain in residences at Dalhousie. The following report will outline the project definition, discuss the systems involved, and consider data gathered during the research study.

### **Project Definition**

We have explored several research topics, including the following: Who uses mini-fridges at Dalhousie? Are they are rented or purchased? Who are they rented or purchased from? What are some alternative to mini-fridges? How efficient in a mini-fridge compared to a large-size refrigerator? How much are mini-fridges costing Dalhousie? These questions, and others, were answered by the research group through a series of interviews, questionnaires (in the form of surveys) and archival research, which will be discussed in this report.

### **Research Methods**

An exploratory study was conducted on Studley campus to gather information on the use of mini-fridges in traditional residences and how costly they are in terms of energy consumption (refer to Appendix I for a map of Studley campus). All interviews and surveys conducted used non-probabilistic, purposive sampling. Students interviewed were known to have the needed information for mini-fridge use in residences and experiential experts were be able to tell us needed information regarding the Studley campus and its traditional style residences.

### **Facilities Management and Residence Life Management Interviews**

A phone interview was conducted with Peter Howitt, the Assistant Director of Facilities Management at Dalhousie University, and face-to-face interviews were conducted with Residence Life Managers Jeremy Eastwood and Christine Squire. A letter containing information pertaining to the project was given to each interviewee and permission to carry out the survey in the residences was

obtained (Appendix II). The information needed to be gathered from Peter Howitt included, the energy consumption (kWh) by Studley campus, the amount paid per kilowatt-hour of electricity Dalhousie uses and any measures in place to conserve energy on Dalhousie's Studley campus (Appendix II). From the Residence Life Managers we needed to determine the number of students in residence, the accessibility of communal fridges and the main suppliers of rental mini-fridges (Appendix II). The interviews with the Residence Life Managers also allowed for clarifications and answers to be obtained regarding the survey.

Using the snowballing technique during the interviews with the Residence Life Managers, it was determined that Campus Coolers were the main rental mini-fridge suppliers. Information collected from the Campus Coolers' and the Danby (brand of mini-fridges used) websites provided the kilowatt-hours consumed by various sized mini-fridges rented to Dalhousie students.

### **Student Surveys**

Face-to-face interviews, in the form of survey questionnaires, with 170 residence students were conducted on a voluntary basis outside the cafeterias of Shirreff Hall and Howe Hall from 4-6:30 PM. This represents approximately 13% of the total students in traditional style residences on the Studley campus. The face-to-face interviews were appropriate because an interviewer was present to answer any questions the students had regarding the survey. It also allowed for a high level of participation than other methods, like mail out surveys, therefore less volunteer bias occurred and it allowed us to ensure that the appropriate person completed the survey (Palys, 2003). Students were approached by one of the five members of the research team and were asked both closed and open-ended questions regarding their use or non-use of mini-fridges (refer to Appendix II for the Survey Questionnaire). Information gathered included the number of mini-fridges in residence rooms, the size, the average fullness, and attitudes of student towards alternatives. Participants were ensured complete anonymity and were presented with an information sheet containing a description of the project and contact

information for the research team and project supervisor (Appendix II). Information was given after the interviews were conducted to minimize any bias that may occur in their responses.

### **Analysis**

Information gathered from the student interviews was entered into a database and was analyzed using descriptive statistics including frequency distributions. Information to analyze included the percentage of students using mini-fridges, comparisons between the males and females, the average fullness of each sized mini-fridge, how students obtained their mini-fridge, student opinion on using safe communal mini-fridges and student opinion a mini-fridge ban in residences.

The cost of operating mini-fridges in residence was determined by using simple ratios gathered from the survey results. The number of surveyed students with each sized fridge was converted into the number of residence students that would have these mini-fridges across the Studley campus. The total numbers of small, medium and large mini-fridges were multiplied by the kilowatt-hour usage by each size, which was determined from information gathered from Campus Coolers. The cost associated with using mini-fridges for the 8 month school year could be obtained by multiplying the kilowatt-hours used by all the mini-fridges and the cost per kilowatt-hour provided by Facilities Management.

### **Validity and Reliability**

In order to ensure that the data collected was accurate and reliable, triangulation was used. By speaking to the Dalhousie management staff and the students, as well as gathering information from the mini-fridge industry, it was ensured that the answers were reasonable for all parties. Equally, by performing purposive sampling, it was ensured that the information gathered was from the group the study intended to understand. During the survey the research team was present to answer any problems and/or questions students may have regarding the survey, thus ensuring that the students were able to give valid answers. Also to ensure that the information gathered was reliable we have included a copy



of our interview and survey questions so that the research can easily be repeated in the future (Appendix II).

With respect to catalytic validity, the research empowers the people surveyed by enhancing “self-understanding” and may facilitate social transformation (Palys, 2003). For example the student survey itself will force individuals to think about the way in which they use their mini-fridge. The contact information provided during each interview was given so that the students could ask any questions they may have about the survey and could obtain a copy of the final report if interested. By doing this, students are allowed to review the results and think about how their activities contribute to energy consumption and waste. Presenting our findings to Facilities Management will allow them to see where savings can be made and will directly provide them with some recommendations for the use of mini-fridges on the Studley campus.

Also completing a pilot test of the student survey prior to carrying out the full surveying process increased the reliability and validity of this study. By interviewing 5 students we were able to identify problems associated with our questionnaires and make changes accordingly to ensure that the questions would be clear and could be easily answered.

### **Limitations**

There were many limitations encountered over the course of this study, which were beyond our control and have affected our study in many ways. Numerous problems were encountered during the student surveys.

The most important limitation was encountered early in our study after interviewing the Residence Life Managers, whom informed us that administering the student survey door to door as initially planned could not be done due to privacy and soliciting issues. As a result of this unforeseen circumstance, it was impossible to directly access the mini-fridges and therefore collecting information on the model, the size and the kilowatt-hours used by the device was either impossible or limited to

what the students could remember. Without this information the calculations for campus wide electricity consumption by mini-fridges may be inaccurate.

More females answered the survey than males possibly due to surveying more individuals using the Shirreff Hall cafeteria than the Howe Hall cafeteria. Although there are more females living in residence than males, the proportions of each sex surveyed were not accurate and therefore comparisons made between them may not be significant. The inability to make accurate comparisons limited our study with respect to our recommendations. If we were able to determine the gender more commonly using mini-fridges we may be able to put more focus on educating this group on mini-fridge use. There was also unequal representation from each residence as well as each residence house, making comparisons between residences with or without a cafeteria and with or without communal fridges difficult. Also, because the survey was voluntary, not all students approached were willing to complete the survey.

Problems were encountered within the student survey due to the lack of operationalizing certain terms. Most confusion centered on “secure” and what was meant by this term.

Other limitations occurring throughout the study include the unresponsiveness of Campus Coolers and the absence of a key individual from Facilities Management. This limited the amount of information we were actually able to collect with regards to our actual interview questions. For Campus Coolers we were only able to gather information regarding their products by consulting their website and for Facilities Management only information on the average amount Dalhousie pays per kilowatt-hour could be collected.

Finally, the amount of time for the study was restricted to 4 months and the survey distribution was limited to the operation hours of the cafeteria.

## **Delimitations**

Prior to carrying out various aspects of the study, restrictions were set by the research group as a way of limiting the scope of the study. First the student surveys were restricted to students who were living in traditional style residences on the Studley campus. These surveys were conducted outside of the cafeteria rather than the entrance of the residences to ensure that those approached were more than likely residence students. They were conducted during the suppertime hours of operation because at this time most students are finished classes for the day and would hopefully have more time to complete a survey. Finally, information on mini-fridge energy consumption and the brand of mini-fridges they rent to students at Dalhousie was gathered from Campus Coolers only.

## **Results**

### **Interviews**

The interview with Peter Howitt, Assistant Director of Building and Utility Services at Dalhousie, revealed that Dalhousie pays approximately 7¢/ kWh of energy used.

Interviews with Jeremy Eastwood, Howe Hall Residence Life Manager and Christine Squire, Shirreff and Eliza Ritchie Hall Residence Life Manager, revealed that there is a total of 1275 students in residence this year, 731 students at Howe Hall, 452 students at Shirreff Hall and 92 students at Eliza Ritchie Hall. It was also found that only Fountain Hall (a house in Howe Hall), Newcome House and the Annex (in Sheriff Hall) and Eliza Ritchie have access to communal fridges. Both Residence Life Managers were of the opinion that mini-fridges are widely used in the residences and that the majority of students use them to keep their drinks cold. A small amount of students may use their mini-fridges to keep important medications or special food due to diet restrictions. From the Residence Life Managers it was discovered that Campus Coolers were the main rental mini-fridge providers and that \$10.00 from every rented fridge goes to the university. It was also found that two years ago, Campus Coolers had to replace all of their mini-fridge stock with new fridges, so most mini-fridges rented out to students are

relatively new. Finally, both of the Residence Life Managers were of the opinion that a mini-fridge ban would be unrealistic and difficult to implement. It would be likely to expect a big backlash from the students, because a vast majority of them would think that they have a right to have a mini-fridge in their room. If a ban was to take place, they suggested that a gradual phase out might work better.

### **Campus Coolers Information**

From the Campus Coolers website (2004) it was determined that the mini-fridges being rented out to students were all from Danby. Campus Coolers offers three sizes of mini-fridges for students to rent, small (2 cu.ft.), medium (3 cu.ft.) and large (5 cu. ft.). Subsequently, the Danby website was accessed and information on the efficiency of Danby mini-fridges was gathered in terms of energy consumption. It was found that the small mini-fridges use 298-318 kWh/y, the medium mini-fridges use 315-330 kWh/y, and the large mini-fridges use 340-381 kWh/y. Similarly, from the Danby website, it was found that a 12 cu. ft. regular refrigerator consumes approximately 408 kWh/year (Danby, 2003).

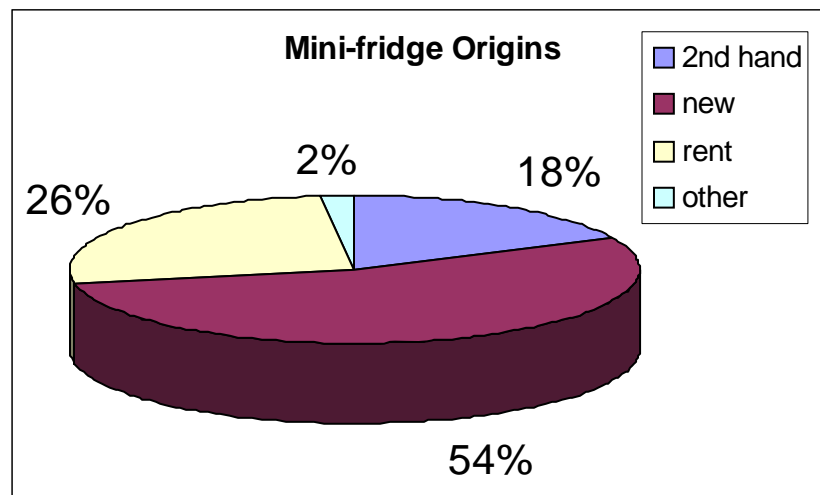
### **Survey**

A total of 170 students living in traditional residences on the Studley campus were surveyed regarding the use of mini-fridges. The results of the survey indicated that 84% of students had at least one mini-fridge in their room, and that more male residence students (95%) had a mini-fridge in their room, than female residence students (80%) (Table 1).

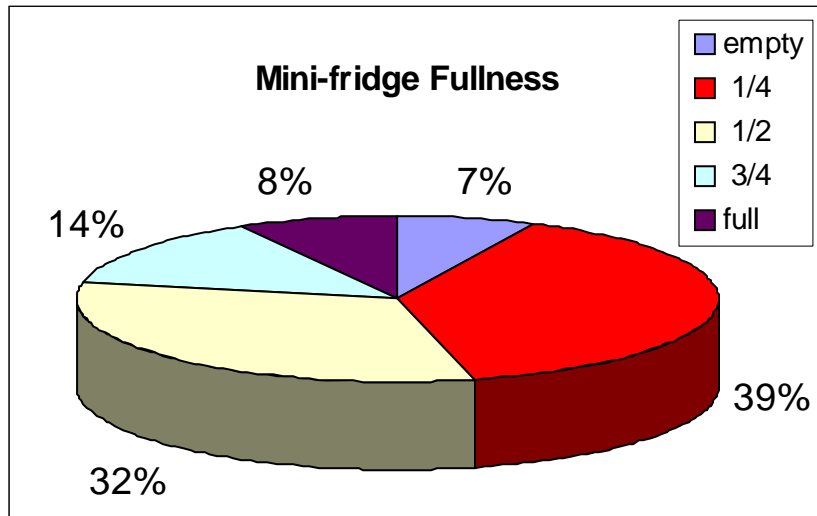
**Table 1.** Total number of students surveyed, number of mini-fridges and average fullness of each fridge.

	Males	Females	Total
Students Surveyed	38	132	170
# of mini-fridges	36	106	142
Have a Mini-fridge	95%	80%	84%

Students had the option of renting mini-fridges from Campus Coolers or bringing their own by purchasing new or second hand mini-fridges. The proportion of students that chose either option is depicted in Figure 1, where 54% of students purchased new mini-fridges and 26% rented them. Students that purchased second-hand mini-fridges comprised 18% of those that used mini-fridges. Students were asked to report the average fullness of their mini-fridges over the entire school year (Figure 2). It was found that 39% of mini-fridges in residence were kept a  $\frac{1}{4}$  full, 32% were kept half full and only 22% were kept  $\frac{3}{4}$  to completely full. Thus 53% of students surveyed had mini-fridges that were empty or only  $\frac{1}{4}$  full, while only 8% of all students actually kept their mini-fridges full. A closer look at Eliza Ritchie reveals that the vast majority of students living there (94%) had mini-fridges in their rooms. It was also found that Eliza Ritchie students kept their mini-fridges more than  $\frac{1}{2}$  full.

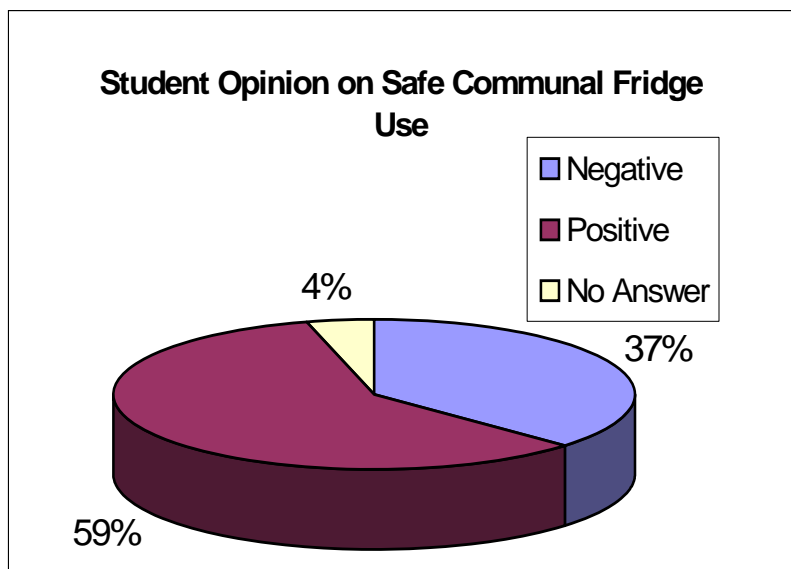


**Figure 1.** Proportions of mini-fridge origins reported by students in traditional residences at Dalhousie University

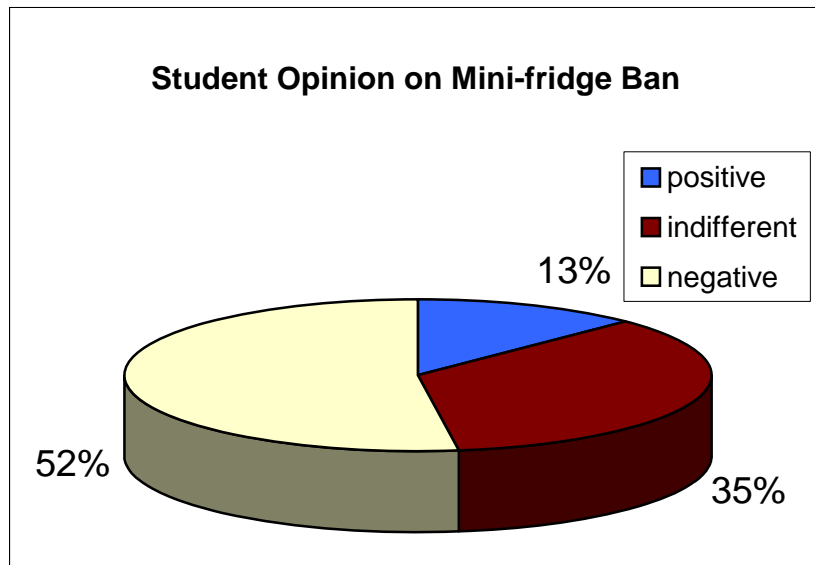


**Figure 2.** Proportions of mini-fridge fullness reported by students in traditional residences at Dalhousie University.

When students were asked if they would use a communal fridge if its security were guaranteed, 59% had a positive answer, while 37% had a negative answer (Figure 3). Even though more than half the students would be willing to use a safe communal fridge, when asked about their opinions on a mini-fridge ban in residence negative reactions were reported by 52% of students while 35% reacted positively and 13% were indifferent (Figure 4). Interestingly, most male residence students (89%) had a negative reaction towards a mini-fridge ban (only 48% of females had a negative reaction).



**Figure 3.** Proportions of traditional residence student opinions regarding the use of communal fridges if safety was guaranteed.



**Figure 4.** Proportions of student reactions concerning a mini-fridge ban in traditional residences at Dalhousie University.

Students were finally asked to suggest alternatives to using mini-fridges in residence, thus the following ideas were reported: longer cafeteria hours, access to communal fridges, using ice buckets or coolers and using window sills in the winter time.

## Discussion

Since the transition from non-renewable resources to renewable resources in Nova Scotia is still a long way off, it is the responsibility of institutions and individuals living in the province to reduce their energy consumption. Individuals may reduce their energy consumption by making small, yet effective life style changes. In order to change a life style, people require information on how their life style contributes to energy waste. By taking a closer look at the student use of mini-fridges in traditional style residences on the university campus, this study explored some of the life style practices that contribute to the waste of energy in Nova Scotia.

The use of mini-fridges on campus is extensive, with about 84% of students living in traditional style residences having one. When comparing the energy use of a full size fridge to a mini-fridge it is evident that mini-fridges are an energy drain. For example, a new, approximately 12 cu.ft. fridge, tends to use approximately 408 kWh/year, where as, a new mini-fridge that is 1/6 the size, uses over ½ the energy (298 kWh). The majority of the mini-fridges in the residences were kept less than half full, no matter what their size. Speaking with many students and with the Residence Life Managers it was revealed that most students that have mini-fridges use them mainly to keep drinks cold. This finding reveals that students don't truly require a mini-fridge; it is more of a convenience than an actual need. However, upon examination of the use of mini-fridges at Eliza Ritchie Hall, the only residence with out a cafeteria in the building, it was found that the vast majority of students living there (94%) had mini-fridges in their rooms. Contrary to the other two residence Halls, Eliza Ritchie Hall students tended to keep their mini-fridges more than ½ full. This exception is probably a result of those people not having immediate access to a cafeteria and actually using their mini-fridges to keep more than just drinks.

Dalhousie pays approximately 7¢ per kWh. As the majority (80%) of mini-fridges in residences are relatively new (both bought and rented) and keeping in mind the different sizes and respective energy consumptions it is estimated that Dalhousie pays \$15 712.39 for 8 months of energy consumed by mini-fridges alone. Even if the smallest and most efficient mini-fridges were used, the University would only save \$999. This small difference in the amount of money saved contributes to our argument that mini-fridges of any size are inefficient and costly. Taking a look at the outcome of a hypothetical mini-fridges ban from the traditional style residences during this school year (8 months), further supports our argument. If the latest efficient communal fridge were put in place on every floor in each residence, Dalhousie would need to purchase a total of 45, approximately 12 cu. ft. fridges at a cost of \$535.33/fridge (total cost of \$24,089.85) (Shopping.com, 2004). This would mean that Dalhousie would save approximately 224,463 kWh/ 8 months, which would convert to a savings cost of \$ 14 855.59. However, since Dalhousie would have to purchase the new communal fridges, it would take



approximately 13 school months for Dalhousie to make this money back from the savings it may procure.

Results from the student surveys revealed that more male students had mini-fridges (95%) than female students (85%). Consequently it was found that more females rented mini-fridges than males. When asked on their opinions on a mini-fridge ban, the majority of males (89%) had a negative reaction, while the majority of females (52%) either had a positive reaction or were indifferent. Though the proportion of males to females when the survey was conducted was not equal (78% of students surveyed were female), this finding may still have some important consequences when it comes to implementing possible solutions. The reason why more males reject a mini-fridge ban might be a result of more males having mini-fridges. This in turn, leads to more males being opposed to a mini-fridge ban because they feel inconvenienced. Thus, in order to affect change in the use of mini-fridges on campus and consequently reduce the energy consumption in traditional style residences, it might be important to consider the “male factor” when thinking of recommendations. For example, one might explore the reasons why males use mini-fridges and use these to shape some of the recommendations. In other words, bringing awareness and implementing recommendations could include several incentives (based on findings from the exploration of male mini-fridge use) for males to not use mini-fridges.

### **Recommendations**

The most fundamental barrier to changes in mini-fridge use in residence is the attitude of students. Many students recognize their mini-fridge as a necessity and not a luxury. Parents commonly purchase mini-fridges as graduation gifts from high school and whether or not a student really wants a mini-fridge, they tend to have one when arriving at university. The recommendations proposed by this research group are based on the opinion of students living in residence at Dalhousie University and upon suggestions from actors such as residence life managers and facilities management. The

successful implementation of these recommendations depends on the cost to the university and more so the attitudes of students towards improving energy efficiency in residence.

This research group recommends that mini-fridges should not be allowed in residence rooms at Dalhousie University. This policy has been implemented successfully at other universities such as Mount Saint Vincent. The application of this policy would likely be more successful if combined with other changes such as secure communal fridges and longer cafeteria hours. Students surveyed for this study indicated that there would be opposition to a mini-fridge ban but this opposition may only be short-lived. Since many students were open to using communal fridges and having longer cafeteria hours, those changes may mitigate the opposition to a mini fridge ban. Resident life managers felt negatively about a mini-fridge ban as they anticipated opposition from students. Due to the attitude among students that fridges are a necessity, the resident life managers presupposed that a mini-fridge ban would be unsuccessful without considering its utility objectively of student opinion.

If a residence-wide mini-fridge ban is not implemented then there is still room to improve the efficiency of mini-fridges used on campus. Just over half of students reported that their fridges were either empty or 1/4 full for the school year. To improve the efficiency of mini-fridge use, it is necessary to reduce the number of students that have fridges but don't use them. Many of those students with empty fridges indicated that they were indifferent to a mini-fridge ban on campus. We recommend that Dalhousie University implement an application process whereby students who want a mini-fridge must apply for a permit through the university. The object of this application would not be to exclude any students from using fridges; in fact there would be no restrictions as to who would be awarded a permit. Those students who use mini-fridges could still apply and get a fridge but those students who now have empty fridges may be less likely to go through the application process. It would be an obstacle that would reduce the number of students having empty fridges, which are needlessly consuming electricity. The application process may create incentive for students to share mini-fridges and could be the initial step towards changing mini-fridges from a necessity to a luxury. For this system

to work, Dalhousie would need to provide the mini-fridges to students or use an exclusive provider. Many students only have mini-fridges because their parents purchased them prior to attending school. If students arrive at Dalhousie with mini-fridges, as many do now, then they would probably go through the application process anyway, thereby defeating its purpose. But if they had to apply and then rent fridges then the application process may be successful. This application process would allow the University to monitor the quality and efficiency of mini-fridges on campus thereby decreasing electricity use and possibly creating savings.

The results from the student survey indicated that medium and large fridges were more likely to be empty or  $\frac{1}{4}$  full than small fridges. If the university allowed only small fridges in residence, then the efficiency of mini-fridges may be improved. If this were the case, it would be important to be sure that prohibiting larger fridges doesn't cause students to stop sharing fridges with other students. Theoretically, few large fridges would use less energy than more numerous small fridges. This change could be complemented by a limit of one fridge per double room. This change would certainly help, but its utility is limited as only 5 of the 170 students surveyed indicated that they were in a double room with two mini-fridges and two of those students were in the same room.

As mentioned earlier, many students were interested in extended cafeteria hours. Longer meal hours would increase flexibility for students and possibly reduce the need for mini-fridges in residence. Relatively few students indicated that they store food in their mini-fridges. Most just like to have cold drinks, ice and snacks in their rooms. Alternatives to having the cafeteria open longer, perhaps a drink and snack counter could be open at night and during morning and afternoon hours. Students could then have access to drinks during most of the day. The commercial coolers used at these drink counters would be much more energy-efficient than the status quo where most students have their own personal fridge. Along with this change, the installation of communal fridges in residences may reduce the use of mini-fridges. Most students surveyed indicated that theft and cleanliness are the main drawbacks of communal fridge use in residence. If the communal fridges were cleaned regularly then the cleanliness

may not be a problem. This is interesting because we know from experience that most students do not keep their personal fridges particularly clean but they have a problem with unclean communal fridges. This tragedy of the commons may improve as students become accustomed to sharing communal fridges. To resolve the issue of theft from communal fridges we hypothesized that secure personal compartments for each student was a potential solution. The resident life managers dismissed this idea as they presupposed that fridges with smaller compartments are not available or easily implemented. Our group is not so sure that this is truly the case but we didn't have the scope or time to investigate such fridge modifications. A compartmentalized fridge is commonly used for commercial coin vending purposes. These machines have a number of rotating carousels that have individual compartments with different snacks. The consumer simply inserts a coin and can then open which ever particular compartment he/she wants. It's not hard to imagine a similar machine in residence with key or combination locks instead of a coin operated system. While this may seem slightly unorthodox, it is the sort of proximate change that is needed to improve energy efficiency in residence.

Some houses in Howe hall have communal fridges and students indicated that they are not widely used. This is likely due to the fact that most students use mini-fridges in their rooms. We recommend that the university make a decision to ban mini-fridges and use communal fridges or remove the communal fridges that are present but not be used currently.

### **Further Research**

We have several suggestions for further research; obviously we would expect someone to continue with the research that we have begun. Another survey of students living in traditional style residences with a larger sample size and more accurate ratios of males to females, and of student numbers in each residence house be carried out. This suggestion would provide a more accurate sample of the population and would give more reliable information that could be consulted for possible

solutions. We would also suggest that the study be expanded to include all housing operations maintained by Dalhousie University.

Another important aspect that goes hand and hand with the decrease in the mini fridges is the need to make the communal fridges more secure. More research should be undertaken in order to come up with methods of increasing the security of the large fridges. Finally, we would suggest that other studies be carried out to look at other sources of energy drain in the residences, such as the use of the computers, heat, and hot water, and lighting systems.

## **Conclusions**

Students at Dalhousie and most universities pay fixed, all-inclusive residence fees. This means they pay up front and then have unlimited electricity and hot water for the rest of the year. This system creates an attitude of wastefulness among students. Students feel that they have the right to maximize their residence fees by using as much electricity as possible. University is a training institution where young adults are provided with the education necessary to be successful in life. The residence billing system currently used is not suitable for adults; it only encourages students to ignore the cost of living and promotes wasteful consumption of energy. Everyone will eventually graduate and move into accommodations where they manage their own utility bills. There is no reason why students shouldn't undertake that responsibility now. Perhaps the only obstacle is that old residence buildings aren't set up for utility billing by room. It is presupposed that it is cheaper to provide electricity to the entire residence building than to do so for each room. Large apartment buildings are comparable in size and occupancy to residences and most of them do not include utilities as university residences do. If students were responsible for their own power bill, then their residence fees would be lower and the university would need to provide less electricity because students would be more conservative in their energy use. This is relevant to the use of mini-fridges because those students, who have mini-fridges but don't use them, would be less likely to continue using them if they knew what they were paying. If

students managed their own power bill then they would also benefit by gaining experience and would almost certainly be more responsible upon leaving the university. This is an important recommendation for Dalhousie because it will better prepare students for life when they graduate from the university.

In the future, to promote both environmentally conscious and resource sustainable practices, the university should look further into areas of this nature in order to maintain and promote the good living practice that will allow us to continue to live and prosper in this environment.

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