

## INTRODUCTION

Global environmental issues are very prevalent today. Many countries are looking for more sustainable ways to accomplish what it is they want to do. University campuses are also hopping on the bandwagon, or so to speak, becoming part of the Greening the Campus movement. This movement works to increase environmental awareness and sustainability on university campuses throughout North America. Dalhousie University is one such campus involved in this initiative. Environmental science class 3502 works to educate and engage students in many research projects on ways in which to reduce the environmental footprint of the university. The project being presented here investigates the artificial lighting system in the Killam Library.

The Killam Library on the Dalhousie University Studley campus is overall an environmentally unfriendly building. It is structurally made of concrete with very few windows which makes lighting an obvious problem. Lighting accounts for approximately 30-50% of a building's energy use (Green Seal Environmental Partners, 1997). Because this proportion of energy usage in a typical Dalhousie University building is so substantial, decreasing lighting energy usage will have significant improvements in both energy costs and environmental impact. In terms of lighting, the library has undergone many minor transformations to lessen the environmental impacts of the building on fossil fuels through decreasing energy usages. Currently all of the lights above the book stacks and in many of the common areas are T-8 32 watt fluorescent bulbs. These bulbs are considered the best on the market for large scale buildings and reduced energy costs and impacts. Many other areas of the library have energy saving compound bulbs installed to further drive down costs. Overall the Killam is a large

building with few windows and therefore the inside needs to be constantly lit, which is the fundamental problem of the Killam Library.

In this study, we plan to present information to decision makers on the feasibility of an advanced motion sensor lighting project in the Killam Library book stacks, effectively contributing to an environmentally sustainable university by reducing needless energy waste. Furthermore, the implementation and success of this proposed project will provide incentive for other communities to carry out similar operations, allowing them to share the benefits of lowering expenses and lessening the environmental burden.

### **Problem Statement**

The fundamental reason for this project is energy conservation. As Brennan and Withgott describe, energy conservation is the practice of reducing energy use as a way of extending the lifetime of our fossil fuel supplies (Brennan and Withgott, 2004). Specifically, this report focuses on being less wasteful, and of reducing our environmental impact at the Killam Library at Dalhousie University.

This report will address light conservation in the Killam Library. Because of the building structure the lights are needed whenever the building is occupied. However, we believe that there are places within the Killam that are much less frequented and wasteful of the lighting resource than others, namely the bookshelves. Although motion censored lights are already installed in the book stacks of our library, they are not up to date with the modern technology that we see on other university campuses around North America. Our goal is to determine whether the current motion sensed technology will help to reduce energy costs as well as energy consumption in the book stacks of the Killam Library.

## **Scope of Problem**

The research conclusions of this proposed lighting project are widely applicable to all campus spaces at Dalhousie University and abroad. Many spaces on all of the Dalhousie campuses are lit all day, some are also lit all night, without great use. The results of this project will express the savings Dalhousie could gain from a more efficient lighting system. Updating lighting in the library could serve as a jumping off point for future campus sustainability projects. With less energy going towards lighting unused spaces Dalhousie could allocate the resources saved toward other projects. Saving energy is a step toward an environmentally sustainable campus and the commitments that Dalhousie as an institution has promised to uphold.

This research is also applicable outside of the university and the country. Many buildings and universities waste resources daily on lighting spaces that are periodically used, if at all, during the day and night. Changes to the Dalhousie Library could serve as an example for decreasing costs through lighting implementations for other projects being investigated. It could encourage awareness in building design so spaces that may or may not be used much, such as bathrooms, are built with motion-sensored lighting fixtures. In a worldly context, saving energy used to light usually unoccupied spaces would decrease demand for energy over all. Monetary resources could be put toward other green projects to reduce the overall footprint of universities and organizations.

## **Definition of Terms**

The following list of terms will be specified and clarified through the use of nominal and operational definitions. According to Ted Palys, a nominal definition (or constitutive definition) simply explains what a concept means to the researcher, similar to a dictionary definition (Palys,

2003). An operational definition will describe the variables of interest within the confines of the research project, explaining how you will capture what you are after (Palys, 2003).

**Nominal:**

*Artificial Lighting:* Lighting of a building through unnatural process. Rather than lighting an area with daylight entering through windows, lighting is provided through electrically-generated processes.

*Motion Sensor Lighting:* lighting system triggered by occupancy or motion in the localized area.

They will turn off after no motion is detected after a period of time, thus avoiding wasted energy loss and lowering energy costs.

*Library Book Stacks:* the book stacks on the second, third, and fourth floors of the Killam Memorial Library, *not* including other areas of the library.

*Environmental Sustainability:* the state of being sustainable in terms of providing the best outcomes for the natural environment both now and into the future. The environment will not diminish at a faster rate than it can be replenished through natural means.

*Environmental Impact:* having a negative influence on the environment. Artificial lighting creates an environmental impact through carbon emissions generated by power plants that are needed for their usage.

*Energy Costs:* financial expenses resulting from energy usage. The more energy consumed (i.e. artificial light usage), the more money required to pay for the energy.

**Operational:**

*Environmental Impact:* measured in terms of energy and carbon dioxide values produced through the use of an artificial lighting system. By calculating and comparing these

measurements of different lighting setups we can determine the varying environmental impact.

*Energy Costs:* measurement of energy costs will be quantified in kilowatt hours and in monetary values.

### **Systems Analysis**

Systems involved in this project are very simplistic in nature. The physical system is the lighting fixtures themselves. Currently florescent lights are active at all times of the day when the library is occupied by people, security, and custodial staff. This is roughly a half an hour before the library opens and a half an hour after the library closes, making it 17 hours a day. The lights are turned on by a switch and electricity is conducted within them along with many gases. What we propose is to outfit the lights with motion sensors so they are only active and using energy when people are present to use the light they give.

Socially, this project will be a stepping stone in the community. It will increase Dalhousie's reputation as an environmentally friendly university and contribute to the goals set out by the Talloires Declaration. This project could also easily be implemented in other schools to decrease energy usage on foreign campuses.

The actors in this system are core actors, supporting actors, and should be actors. Categories of participants depends upon their involvement in the project and to what degree they would be affected. Core actors are those directly involved and are people such as the group members. Supporting actors are less involved in the project but have a say and are affected by the outcome. They are library workers, officials, and custodial staff. Should be actors are silent parties but they have a stake in the final product. Students and energy producers as well as Dalhousie decision-makers are examples of should-be actors in this project.

## **METHODS**

In researching the feasibility of motion-sensored lighting in the book stacks we accomplish three objectives. Firstly, we assessed the impact that the current light usage has on costs and carbon dioxide emissions at the Dalhousie Killam Library. This will be heavily involved in whether or not Dalhousie could save money with different lighting means and reduce carbon dioxide emissions. Secondly, we will investigate new lighting technology that the Killam Library could take advantage of, primarily in motion sensor equipment. Another sector of our project would briefly look at how receptive people would be to motion sensors in the library book stacks. This would be based on usage of the book stacks as well as a survey. This information would add to the feasibility of the project and possibly its catalytic validity.

### **Sampling Methods**

Different methods are used to triangulate the data to increase the validity and reliability of our study results. Triangulation brings together information gathered from multiple methods. Blending information from separate sources assures the stability and usability of the information gotten. Our research is triangulated through the use of surveys, interviews, and literature reviews through case studies.

### **Surveys**

The purpose of the survey was to assess the usage of the library and in what capacity students use it. For a representative population we targeted thirty Dalhousie University students. It was a heterogeneous sample population because we were not targeting certain disciplines, year of study, or sex. The students were all located in the library at the time. Because our research focused on changes to the library we wanted a representative population that actually uses the library to some capacity. This would indicate whether or not changes to the library lighting in

the book stacks would effect those who use the library the most. This would also cut down on random responses if participants can actually find a response that fits them. Surveys were self-administered. Since a researcher was there the individual could ask questions while they completed the survey. This method discounted any interpretive ambiguity in the results because all of the participants understood all of the questions as they were intended. Giving surveys in person allowed for interaction with the participant as well.

## **Interviews**

### ***Employee from the Maricor Group***

Expert knowledge on green technology is necessary in a report such as this. An interview was conducted on March 15, 2007 with Andrew Bruce; an Electrical Design Engineer from the Maricor Group. One branch of this company is located in Halifax, Nova Scotia, and their objectives are to design energy efficient buildings in Nova Scotia.

The interview was conducted at 5:30 p.m. in the Atrium of the Dalhousie Killam Library. Qualitative information was gathered through a question period and a walk through of the second, third, and fourth floors of the Library. The walk-through was designed to help get an outsiders (not affiliated with Dalhousie University) perspective regarding the current lighting system in the Killam Library. The walk-through was also designed to see if Mr. Bruce thought a modern motion-sensored lighting system could be feasible in a facility such as the Killam book stacks.

Questions regarding current motion sensed technology and their useful applications were conducted. The information gathered from these questions helped give a broad outlook on available technologies and relevant models that are currently being used in modern development projects. We incorporated this information into our recommendations for suitable options in the book stacks and used resources that will compare and contrast projects that The Maricor Group

has conducted with regards to the current system installed at the Killam Library. This information assisted in addressing costs and savings that Dalhousie University would undergo if a motion-sensored lighting system development were proposed.

We began our walk-through on the second floor, thoroughly examining the lighting fixtures in the book stacks. We continued up to the third and fourth floors examining with the same thoroughness. Roughly 10 minutes was spent on each of the floors. At this point we were asking random questions regarding the feasibility of a modern motion-sensored system as well as questions about the current one. The interview ended after we investigated the fourth floor.

#### ***Circulation Department Supervisor at the Dalhousie University Libraries***

An interview was conducted in order to obtain data regarding the book loan system at the Dalhousie Killam Library. From this data we gained information concerning the times at which books were most frequently taken out from the Killam Library. We hoped to quantify the amount of usage of the book stacks to help us determine if energy is being wasted. We asked various questions regarding the current motion system and the possibility of upgraded technology use. A second objective of this interview was to gain information regarding safety and security concerns. An interview with the supervisor of the Circulation Department broadened our knowledge of the day to day operations of the Library. This interview was conducted in person at the circulation desk on March 16<sup>th</sup>, 2007.

#### ***A Lamping Representative from Facilities Management at Dalhousie University***

An interview was proposed with an employee of the Facilities Management Department at Dalhousie University. From this information we hoped to gain insight on the lighting system installed in the book stacks of the Killam Library. We had wanted to get a brief walk-through of the system to better understand the technology and its limitations.



*(note: this interview was proposed and desired but did not take place due to time conflicts. Contact with the department was made a month before the presentation date but a sufficient time could not be sorted out. The electrical problems in the library at the time also held up those who could hopefully be of service to us.)*

### **Limitations and Delimitations**

When a researcher is undertaking a study there are always variables to be accounted for. Variables are quite simply an attribute of the project which varies (Palys, 1992). These are usually such things as, but not limited to, sex, age, and beliefs of people. Limitations provide in some sense the framework of a study. A researcher wishes to conduct work with as few limits or variables as possible. Delimitations are those variables that can be controlled such as temperature, status of people within the study, and race if so desired.

In our lighting study we were limited by time, electrical compatibility, and the area being researched. This study had to be concluded within the semester and therefore little time was given to large ideas. This helped to pare down the area under observation to the second, third, and fourth floors of the library. These floors all have the out-dated motion system installed. We were very much limited by our electronics expertise. Many of the motion systems and lighting concepts involved with this project are suggested based upon our limited knowledge of the subject area. Many questions that we had were answered by the experts that we consulted. Much is still based on our knowledge. This project was also limited by the actual make up of the areas being researched. We assessed that the tall book stacks would pose a problem to much motion light technology. This would require many more sensors adding to the overall cost of a new sensor system and decreasing the catalytic validity of the project.

Limitations to which we have control over are delimitations, as stated before. A spatial delimitation in this study was only looking at the three floors of the Killam Library and only the book stack areas. The lighting audit did not include the offices in the building or the study areas,

computer labs, or the atrium. The lighting above the study desks along the outside walls in the book stack area was also not counted in our study. To assess the usage of the book stacks we looked at book usage patterns over the past year which vary from year to year and the current cost for power that Dalhousie pays; both are temporal delimitations being that they are not definite values. Current technology was also researched as potential solutions to save energy in the library. These figures were used to estimate the power and money that could potentially be saved by implementing the researched method of motion-sensored lighting above the book stacks.

## **RESULTS**

### **Interviews**

*Andrew Bruce, Maricor Group Representative*

An interview and a walk-through of the second, third, and fourth floors were conducted with Mr. Bruce of the Maricor Group at the Dalhousie Killam Library. Useful recommendations were obtained throughout this one hour meeting. Mr. Bruce has currently worked on projects such as Phase II of the Yarmouth Regional Hospital, Addition and Renovation, 2004, and the Kenneth C. Rowe Management Building at Dalhousie University, 2005. Mr. Bruce specializes in Efficient lighting in commercial buildings therefore questions regarding the potential for energy savings in the Killam book stacks were asked. He said that “control systems could be installed in the book stacks to ensure energy is not unnecessarily consumed because they regulate the supply of light based on minimal need”. When asked how much energy a control system could typically save, he replied “reduced by 30-50%”.

We asked Mr. Bruce how a control system differs from a motion-sensored one and he replied, “They essentially have the same function, but control systems can be structured to regulate the amount of delivered light to determine when lighting should be provided, and

control the task of lighting in a particular area”. During the walk-through an opinionated question was asked to see whether he thought a control system could be implemented in the book stacks; his reply was, “In a building that is this old, where the electrical components are about as old as the building, it may be too complex a system to install, and at too high of a cost. No technology of energy efficient design will be effective if it is too complex, and adding control system technology requires basically every fixture to be converted”. This means that in his opinion, a modern lighting system could be installed in the book stacks technically, but the practicality of such a system would be hindered by the lack of economic savings.

Later, a question was asked that was directed at the efficient conversion of energy to visible light. Mr. Bruce said that from what he’s seen in the book stacks, “Changing some of the luminaries could be a cost effective way of producing more light for less costs”. He noticed that there were reflector shields on roughly two-thirds of the lights in the book stacks, and said, “If Dalhousie converted all the luminaries in the book stacks to this reflective shield technology, it will make a significant contribution to the overall energy savings by optimizing the performance of each of its components”. The use of mirrors serves as a cheap technology that would serve to distribute, diffuse and direct light in the most efficient manner.

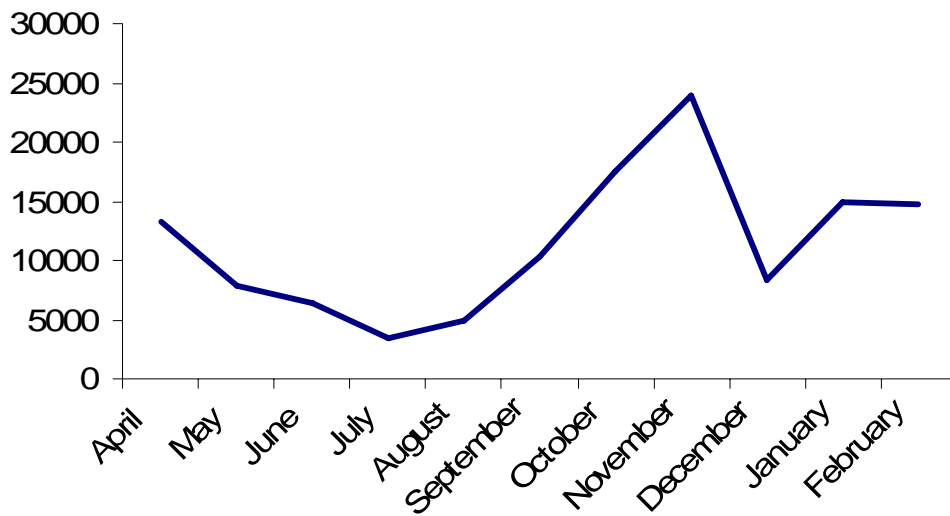
*Jim Kennedy, Weekend circulation director*

A short interview was conducted with Mr. Kennedy to gain background knowledge on the lighting in the Killam Library. He told us that the current motion system in the library should be in use. He noted that the system is installed on the second, third, and fourth floors and that it works by the push of a button. Each row of books has a black button on the end of the stack facing the aisle. When a person wanted to find a book in that aisle they would push the button and the lights would come on in that row. After a certain time the lights would go off again

requiring the person to push the button again if they still required the light. He also indicated that the system may have been deactivated because students felt isolated sitting at the desks in the book stack areas without any lights on above the books. This is defiantly a concern for many schools when proposing a motion sensor system.

Mr. Kennedy also noted the usage of the lights in the book stacks. He said that he arrives half an hour before the library opens to turn on the lights and prepare for the day. When the day is done the library closes and the lights are left on for approximately half an hour after close for safety reasons, in case anyone has missed the closing announcements and is coming down the stairs. He said that when turning the lights on in the morning also requires a little bit of time for the book stack florescent lights to warm up and become fully functional. This may pose a problem for a motion system due to the prolonged response time of the florescent lights.

The circulation desk provided us with the statistics of book loan frequencies through out the year (fig. 1). This data is for the current academic year starting in April of 2006 and ending

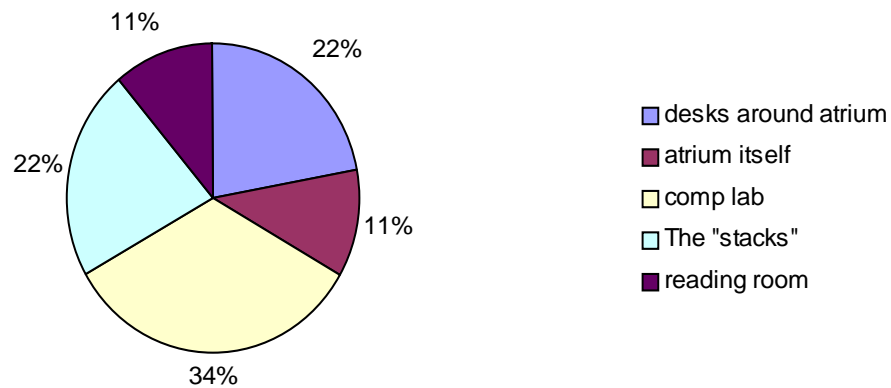


**Figure 1.** Relationship between the frequency of book loaning from the Killam Library and the time of the year by month

in February of 2007. Because the data was received in march, the last two months of the year are not included being that the statistics are not available. Discussion of the significance of this figure will be touched on in the conclusions section.

### Surveys

As stated above, the surveys were given to 30 Dalhousie students located in the library atrium. It asked many questions regarding their personal usage of the library spaces. All students said that they were undergraduates and in school full time, two were King's students

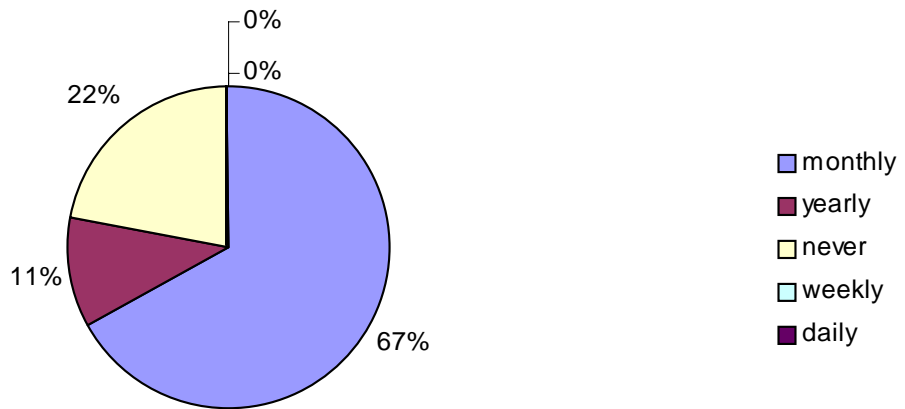


**Figure 2.** Replies of students when asked what area of the Killam Library they use most

who used the library for studying. When asked what area the student used the most, displayed in figure 2, many replied that they used the computer labs the most frequently. The book stacks were one of the second highest most frequently used spaces along with the desks around the atrium.

The next question of interest to this study asked how often the student borrowed a book from the library. although the student was given choices ranging from daily to never all of the student placed themselves in the upper half of this question aligning themselves closer to never

have. No student borrows a book from the library weekly or daily. Figure 3 below shows the distribution of book loan practices of the Dalhousie students surveyed.



**Figure 3.** Frequency of book loans by students when asked how frequently they take out a book from the Killam

Most students said that they would support a motion sensor system above the book stacks but then in the comment section they replied that it would not save energy. Many also said they did not know much about the systems and did not know if the upkeep and hassle of the motion activated element would be worth the saved energy costs. Ten students said that the lights could be off completely in the book stacks with little detriment to their own studying, meaning they never enter or make use of the book stack areas. In the comments section many students showed a concern for wasted energy for lighting in the Killam library. All replied that a more environmentally friendly campus could save money for the university showing that most students are open to the possibility of energy saving practices and a reduced footprint made by the university.

## **DISCUSSION**

The aim of this project initially was to investigate the feasibility of motion sensed lighting in the book stacks of the Killam library. Due to the above results the focus of our project changed direction to other recommendations for energy savings. The interview with Andrew Bruce was a large part of our decision that motion sensed systems in the library would not be a feasible option for lighting savings. He led us to believe that new technology in lighting motion systems is not suited for the design of the library itself. The tall book stacks pose a problem for a broad system requiring each row to have its own motion detector. Each detector has a high cost combined with the extensive need for the detectors in the library to have a functional system makes the cost benefit relationship unbalanced. The student survey further impacted our decision to switch focus.

Students overall would support a system to save energy through lighting. However the comments the students gave led us to believe that the knowledge of the systems they possess is quite lacking. The students worried about the distraction of the lights turning on and off. They also wondered if the hassle of the motion system would be worth the benefits of cut costs and saved energy. Many also did not care because they do not use the book stack area.

The direction of our project remained in the realm of lighting in the library seeing as it was still an area of concern. Therefore we began to investigate more efficient distribution of lighting elements, with an emphasis on reducing bulbs. All bulbs in the book stack areas of the Killam are T-8 florescent bulbs that use 32 watts.

The first lighting system in the Killam, which makes up the majority of the lighting in the book stacks, involves a row of 5 ballasts with 4 bulbs lit (fig. 4). Each bulb is uncovered and has a mirror behind it for added reflection efficiency. This system is found on all floors of the

library. Andrew Bruce and other sources have noted the efficiency of this system. To better cover the space desired and save energy, we recommend decreasing the number of bulbs from four to three. To keep the amount of light needed the bulbs would have to be evenly spread along the row, two lights on either end of the row would be on and the bulb space in the middle would also be occupied and functioning. This would save a single bulb from each row as well as a mirror to be redistributed throughout the building in our other recommendations following.



**Figure 4.** The most common lighting system found above the book stacks in the Killam Library

The second system that we assessed involved the same type of lighting setup (5 bulb ballasts per row) but with a covered bulb. The lights were recessed into the ceiling without mirrors and with opaque luminaires as seen in figure 5. To increase the efficiency of this system we propose to remove the coverings and add the mirrors saved from the previous recommendation. The coverings gather dust and hinder the effectiveness of the bulbs in use. The number of bulbs in this system could also be decreased from five to three bulbs per



**Figure 5.** A single covered T-8 32W bulb

row. Adding mirrors and removing covers increases the amount of light targeted to the area the light is needed in. These recommendations also do not involve the replacement of the existing ballasts reducing costs.

The third system installed in the Killam involves a double bulb recessed system. Some of the fixtures are covered with luminaries while others are not (fig. 6). This system also has 5



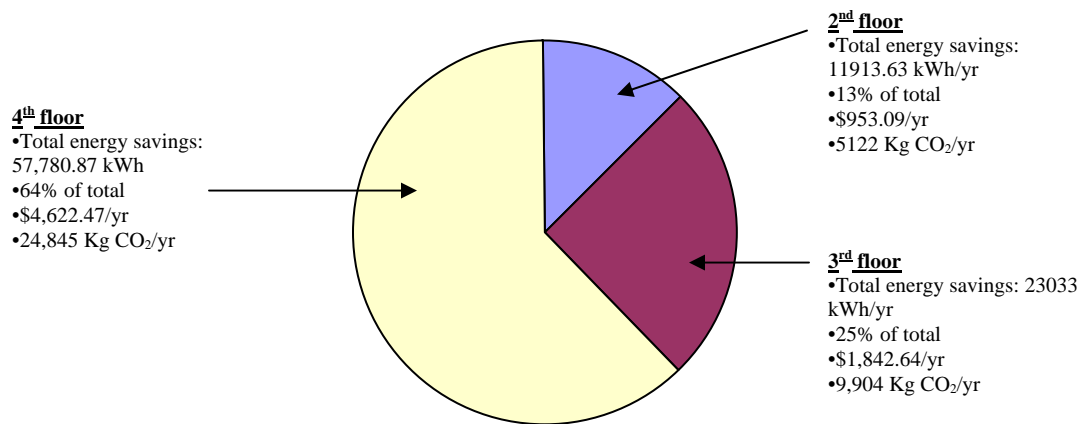
bulbs per row but because it is a double system it uses twice the amount of bulbs and therefore twice the amount of energy without a noticeable change in the amount of light given off. The recommendations for this system mimic those of the other systems given before. This involves reducing the total amount of bulbs by  $\frac{3}{4}$ , meaning removing half of the bulbs and then lighting every other bulb. Mirrors would also increase the lighting quality seen. This system also has the advantage of having little to no cost being that we are proposing bulb removal and using already existing mirrors.



**Figure 6.** Uncovered T-8 32W bulbs. This setup was also found covered in other parts of the Killam library

### Calculated savings of the recommendations

The calculation of savings involved computing the current energy usage by floor and comparing that to the figures totaled with our recommendations in place. Each floor varied by



**Figure 7.** Savings of carbon dioxide, kilowatt hours, and money in the book stack areas per floor with implemented recommendations.

lighting system structure. All light fixtures were noted to employ 32W florescent bulbs and it was assumed that the electricity rate is \$0.08 per kilowatt hour. The rate was obtained from a previous Greening the Campus project done in the winter of 2003. Sample calculations can be found in appendix A. A breakdown of our found savings is displayed below in figure 7.

If there was a reduction in the amount of light bulbs as well as a modification to the current lighting fixtures through the implementation of mirrors, annual savings could potentially add up to 39,873 kilograms of carbon dioxide, 92,727.52 kilowatt-hours of energy, and \$7,418.20 for Dalhousie University per year.

**Costs of our recommendations**

In terms of equipment, the costs of this project are very low. The ballasts and fixtures are already present within the building and would not need to be changed to the best of our knowledge. The mirrors needed in the covered lighting sections are provided for by the other floors and sections. As seen in table 1 the amount of mirrors needed is 188 while the amount that would be available is 250. This leaves 62 mirrors unneeded. Mirrors, fixtures, and bulbs would not need to be purchased.

Table 1. Determination of the amount of mirrors needed for the recommendations

		current bulbs (#)	recommended bulbs (#)	# of free mirrors	# of mirrors needed
Floor of the Killam Library	second	240	180	60	0
	third	190	120	64	70
	fourth	229	111	126	118
	<b>TOTAL</b>	659	411	250	188

The only costs associated with this project would be in labor and possibly wiring. Someone would have to spend the time to remove bulbs and install the saved mirrors. Storage of the saved bulbs and mirrors could also be an issue. Costs would also be saved in that there are

fewer bulbs in need of maintenance and the university would have a lengthy supply of extra T-8 florescent bulbs.

## **CONCLUSION**

This project aimed at investigating the potential for a modern motion sensor system in the book stacks of the Dalhousie Killam Library. After gathering student feedback and consultation with noted experts it was found that such a system would not be compatible in the desired area. The alternative recommendations would aim to use the existing lighting system more efficiently, while providing the same energy savings as a modern motion system with a lower initial cost.

Two recommendations for further research were investigated in this report in other areas of the Killam Library. The first one focused on a daylight harvesting technology in the study areas surrounding the atrium. This technology responds to the level of natural light in a particular area to determine the amount of artificial light emitted. This proposed method would be practical with respect to the amount of natural light received through the glass roof of the atrium. The second recommendation focused on the use of the current motion sensor system during the summer months in the book stacks. As illustrated in figure 1, the frequency of traffic in the book stacks is lower than during fall and winter semesters. Based on these observations, there appears to be more light that is potentially wasted during the summer months.

Artificial lighting is a major factor with respect to energy consumption on University Campuses. With respect to carbon emissions worldwide, artificial lighting generates approximately 1.9 billion tons of carbon in a single year, equivalent to almost three quarters of carbon released from all cars and light vehicles (McSmith, 2006). Accounting for nearly one-fifth of global electricity consumption, artificial lighting creates a greater output than all nuclear

power stations in the world combined (McSmith, 2006). With a current demand to reduce fossil fuel dependency, improvement in artificial lighting is a practical and worthwhile approach to combat the issue.

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## Sample Calculations

*Finding kilo-watt and monetary savings for the 2<sup>nd</sup> floor per year*

$$\frac{(60 \text{ rows of lights}) \times (4 \text{ lights/row}) \times (32 \text{ watts}) \times (17 \text{ hours/day}) \times (365 \text{ days a year})}{1000}$$

$$= 47,654.4 \text{ kWh/year currently}$$

$$(47,654.4 \text{ kWh/year}) \times (1/4 \text{ bulb reduction recommendations})$$

$$= \mathbf{11,913 \text{ kWh/year saved}}$$

$$(11,913 \text{ kWh/year saved}) \times (\$0.08/\text{kWh})$$

$$= \mathbf{\$953.09 \text{ saved on the second floor per year with recommendations}}$$

## Finding the mirrors saved on the third floor

$$(256 \text{ current lights with mirrors}) - (192 \text{ lights with mirrors after recommendations})$$

$$= \mathbf{64 \text{ total mirrors extra}}$$

$$(190 \text{ current bulbs without mirrors}) - (120 \text{ recommended bulbs})$$

$$= \mathbf{70 \text{ mirrors needed on the third floor}}$$

**ENVIRONMENTAL PROGRAMMES  
FACULTY OF SCIENCE  
DALHOUSIE UNIVERSITY**

**APPLICATION FOR ETHICS REVIEW OF RESEARCH INVOLVING HUMAN PARTICIPANTS  
UNDERGRADUATE THESES AND IN NON-THESIS COURSE PROJECTS**

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**GENERAL INFORMATION**

**1. Title of Project: Feasibility of Motion-sensored Lighting in the Book Stacks of the Killam Library**

<b>2. Faculty Supervisor(s)</b>	<b>Department</b>	<b>Ext:</b>	<b>e-mail:</b>
Dr. Tarah Wright tarah.wright@dal.ca	Environmental Programmes	3683	

<b>3. Student Investigator(s) Number:</b>	<b>Department</b>	<b>e-mail:</b>	<b>Local Telephone</b>
Kailee Mullen	Biology/ Envi. Sci.		
Donald Hartt	Biology/ Envi. Sci.		
Sean Butler	Environmental Sci.		

**4. Level of Project:**  
**Non-thesis Course Project** [ X ] Undergraduate [ ] Graduate Specify course and number:  
ENVS 3502.06

**5. a. Indicate the anticipated commencement date for this project: February 26<sup>th</sup>, 2007**

**b. Indicate the anticipated completion date for this project: April 9<sup>th</sup>, 2007**

## SUMMARY OF PROPOSED RESEARCH

### 1. Purpose and Rationale for Proposed Research

*Briefly describe the purpose (objectives) and rationale of the proposed project and include any hypothesis(es)/research questions to be investigated.*

This project is intended to investigate the energy consumed through lighting in the Killam Library book stacks on the Dalhousie University Studley campus. This will be done through computation of energy usage and the monetary funds that this energy costs Dalhousie. The use of motion-sensors in the book stacks will be researched as a possible way to save energy and money. We believe that a significant amount of savings could be found by implementation of a motion-sensor system above the book stacks. We will also be briefly looking into how the proposed system of motion sensor lights would be received here at Dalhousie to those who use the Killam Library. This research is important to further the commitments that Dalhousie has made to reduce its ecological footprint and also to cut costs.

### 2. Methodology/Procedures

#### a. Which of the following procedures will be used? Provide a copy of all materials to be used in this study..

- Survey(s) or questionnaire(s) (mail-back)
- Survey(s) or questionnaire(s) (in person)
- Computer-administered task(s) or survey(s)]
- Interview(s) (in person)
- Interview(s) (by telephone)
- Focus group(s)
- Audio taping
- Videotaping
- Analysis of secondary data (no involvement with human participants)
- Unobtrusive observations
- Other, specify \_\_\_\_\_

#### b. Provide a brief, sequential description of the procedures to be used in this study. For studies involving multiple procedures or sessions, the use of a flow chart is recommended.

**Computation of current energy and monetary usage:** this will involve counting the light fixtures in the research areas (the top four floors of the Killam Library where there are book stacks). The lights will be multiplied by energy used and money paid for that energy per kilowatt hour.

**Survey and circulation data:** students in the Library will be surveyed in person to assess for usage. Circulation data will be received from the circulation desk on the borrowing of books. This data is separated by floor and the usage of each floor will be tabulated assuming the person looked for the book for a limited time.

**Interviews:** the main goal of the interviews are to further probe the acceptability of this proposed system as well as to gather information about using motion-sensors in a building and the effectiveness of them.

**Computation of proposed motion-sensor savings:** the amount of fixtures will be multiplied by the approximate usage gotten from the surveys and the circulation desk data. Monetary output will also be calculated for the new usage estimation.

### 3. Participants Involved in the Study

#### a. *Indicate who will be recruited as potential participants in this study.*

- Dalhousie Participants:     Undergraduate students  
    Graduate students  
    Faculty and/or staff
- Non-Dal Participants:     Children  
    Adolescents  
    Adults  
    Seniors  
    Persons in Institutional Settings (e.g. Nursing Homes, Correctional Facilities)
- Other (specify) \_\_\_\_\_

#### b. *Describe the potential participants in this study including group affiliation, gender, age range and any other special characteristics. If only one gender is to be recruited, provide a justification for this.*

The survey participants to be used are going to be students currently enrolled at Dalhousie and found in the Killam Library. These are the only requirements. Because they are in the library they are known to use the library and therefore this study would mostly affect this group giving us a representative population of who would be using the space under research.

Interviews will be conducted with expert adults. One will be with Jim Kennedy who runs the Library circulation desk on the weekends. He will provide insight into library works as well as providing data on borrowed books. A second interview will be with Andrew Bruce who is employed designing “green” lighting concepts of buildings. We hope that this interview would educate us on new technology to save energy and costs as well as possible motion-sensor models to investigate for the Killam Library space.

#### c. *How many participants are expected to be involved in this study?* Survey: 30 Interviews: 2

### 4. Recruitment Process and Study Location

#### a. *From what source(s) will the potential participants be recruited?*

- Dalhousie University undergraduate and/or graduate classes  
 Other Dalhousie sources (specify) \_\_\_\_\_  
 Local School Boards  
 Halifax Community  
 Agencies  
 Businesses, Industries, Professions  
 Health care settings, nursing homes, correctional facilities, etc.  
 Other, specify (e.g. mailing lists) \_\_\_\_\_

#### b. *Identify who will recruit potential participants and describe the recruitment process.*

*Provide a copy of any materials to be used for recruitment (e.g. posters(s), flyers, advertisement(s), letter(s), telephone and other verbal scripts).*

Don Hartt will be contacting Mr. Bruce by telephone to set up a telephone interview. Mr. Kennedy will be contacted through e-mail. Don Hartt has already spoken to Mr. Kennedy who said he would be



more than happy to speak with us about the project. The survey will be handed out to random people sitting in the Killam atrium and throughout the study floors around the atrium inside of the library.

## 5. Compensation of Participants

Will participants receive compensation (financial or otherwise) for participation? Yes [ ] No [ X ]

## 6. Feedback to Participants

**Briefly describe the plans for provision of feedback and attach a copy of the feedback letter to be used.** Wherever possible, written feedback should be provided to study participants including a statement of appreciation, details about the purpose and predictions of the study, contact information for the researchers, and the ethics review and clearance statement.

Note: When available, a copy of an executive summary of the study outcomes also should be provided to participants.

A letter of appreciation will be mailed to the two men asked for interviews.

## **POTENTIAL BENEFITS FROM THE STUDY**

### **1. Identify and describe any known or anticipated direct benefits to the participants from their involvement in the project.**

The participant will benefit from the potentially reduced costs of the university from a new lighting system. Hopefully with a motion-sensor system Dalhousie can reroute the money that would be spent on energy to other projects to improve facilities on campus. The participant will not immediately benefit from being asked for their opinion and such.

### **2. Identify and describe any known or anticipated benefits to society from this study.**

Hopefully this study would serve as a jumping off point for the rest of campus and others abroad. The need for reduced energy consumption has become a pressing issue in the world today. If energy can be saved in very simple measures and the rest of society sees that then maybe consumption patterns will cease to grow.

## **POTENTIAL RISKS TO PARTICIPANTS FROM THE STUDY**

### **1. For each procedure used in this study, provide a description of any known or anticipated risks/stressors to the participants. Consider physiological, psychological, emotional, social, economic, legal, etc. risks/stressors**

No known or anticipated risks

Explain why no risks are anticipated:

The participants are being asked everyday usage questions and mild opinion questions. They will respond based on their usage patterns.

Minimal risk

Description of risks:

Greater than minimal risk

Description of risks:

### **2. Describe the procedures or safeguards in place to protect the physical and psychological health of the participants in light of the risks/stresses identified in Question 1.**

The questions posed are very simple and straight forward. No question is to be answered if it stresses the subject in any way. Confidentiality is also kept so that a subject does not feel his or her answer would be known to society.

## **INFORMED CONSENT PROCESS**

Refer to: <http://pre.ethics.gc.ca/english/policystatement/section2.cfm>

### **1. What process will be used to inform the potential participants about the study details and to obtain their consent for participation?**

- Information letter with written consent form; provide a copy
- Information letter with verbal consent; provide a copy
- Information/cover letter; provide a copy
- Other (specify): Subject will be verbally given study information and verbal consent will be asked for

### **2. If written consent cannot be obtained from the potential participants, provide a justification.**

The survey is meant to be quick and purposefully made without identifying or probing questions. If the subject feels they have been compromised or violated in any way they will be told that they do not have to continue with the survey and his or her results will not be accounted for.

## **ANONYMITY OF PARTICIPANTS AND CONFIDENTIALITY OF DATA**

### **1. Explain the procedures to be used to ensure anonymity of participants and confidentiality of data both during the research and in the release of the findings.**

The surveys will not have any identification information and the participants in the study will not be known to the researchers. The data used from the surveys is going to be general in nature to get an average opinion response.

Confidentiality will not be in place for the interviews and the participants are aware of that. If they did not want their name used as an expert adult in the topic questioned about then they would not consent to the interview.

### **2. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.**

Data gotten from the desk as well as the surveys will be kept secure and in control of a project participant. The paper sheets do not have any personal information on them and therefore an absolutely secure place is not a large priority.

### **3. Indicate how long the data will be securely stored, the storage location, and the method to be used for final disposition of the data.**

- Paper Records
  - Confidential shredding after \_\_\_\_\_ years
  - Data will be retained indefinitely in a secure location
  - Data will be retained until completion of specific course.
- Audio/Video Recordings
  - Erasing of audio/video tapes after \_\_\_\_\_ years
  - Data will be retained indefinitely in a secure location
  - Data will be retained until completion of specific course.

- Electronic Data
  - Erasing of electronic data after \_\_\_\_\_ years
  - Data will be retained indefinitely in a secure location
  - Data will be retained until completion of specific course.
- Other \_\_\_\_\_  
 (Provide details on type, retention period and final disposition, if applicable)

**Specify storage location:** A class folder of a group member.

## ATTACHMENTS

Please **check** below all appendices that are attached as part of your application package:

- Recruitment Materials:** A copy of any poster(s), flyer(s), advertisement(s), letter(s), telephone or other verbal script(s) used to recruit/gain access to participants.
- Information Letter and Consent Form(s).** Used in studies involving interaction with participants (e.g. interviews, testing, etc.)
- Information/Cover Letter(s).** Used in studies involving surveys or questionnaires.
- Parent Information Letter and Permission Form for studies involving minors.
- Materials:** A copy of all survey(s), questionnaire(s), interview questions, interview themes/sample questions for open-ended interviews, focus group questions, or any standardized tests used to collect data.

<b>SIGNATURES OF RESEARCHERS</b>	
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date
_____ Signature of Student Investigator(s)	_____ Date

**FOR ENVIRONMENTAL PROGRAMMES USE ONLY:**

Ethics proposal been checked for eligibility according to the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans

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Signature

Date

I am conducting a survey as part of my environmental problem solving class. The aim of my group is to gage the response of students who use the Killam Library to the idea of motion-sensored lighting above the book stacks. Your input will be used to assess what areas are used the most and which areas could benefit from updated lighting strategies. Thank you for taking a minute to fill out this survey. Please feel free to ask any questions you may have or if you need any clarification on any questions. Your confidentiality will be kept and names are not desired, sadly you will become part of a statistic but with a valued opinion.

**Are you an undergraduate or graduate student?** \_\_\_\_\_

**What year of study are you?** \_\_\_\_\_

**What program are you in?** \_\_\_\_\_

**For each of the activities below, check the box that indicates your use of the Killam Library:**

	Use Never	Use Sometimes	Use Often	Use all the time
For study				
For research				
Second cup/bistro				
To attend class				
Other - please specify:				

**What area of the library do you use the most? (circle one)**

	Use Never	Use Sometimes	Use Often	Use all the time
Bookstacks (taking out books)				
Bookstacks (study desks)				
Reading room (2 <sup>nd</sup> floor)				
Atrium				
Desks within the library around the atrium				
Computer Lab				
Other - please specify:				

**How often do you frequent the bookstacks to use its resources? (circle the most fitting answer)**

Never have      yearly      monthly      weekly      daily

**How often do you borrow a book from the library? (circle the most fitting answer)**

Never have      yearly      monthly      weekly      daily

**Are you concerned with potential waste of resources in lighting the book stacks in the Killam Library for the amount of time they are being used? (circle one)**

Yes      no      unsure

Please explain answer:

**How would you feel about motion-sensored lighting above the book stacks? (circle one)**

For it      against it      I don't know much about it

Please explain your answer:

**Do you feel like a modern motion-sensored lighting system in the book stacks would be a distraction for students studying?**

Yes      no      unsure

**A more environmentally friendly campus could save money for Dalhousie. (circle one)**

True      false      unsure

**Thank you again for your time!**