Energy Star in Residences

A Comparison of Energy Star vs. non-Energy Star appliances in three Dalhousie University Student Residences

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Executive Summary

The purpose of this report is to provide Dalhousie University with information about the number of Energy Star appliances within the common rooms of three residences, Howe Hall, Risley Hall, and Shirreff Hall and how the number of Energy Star appliances can be increased. We conducted interviews, surveys of common rooms, and intercept surveys to assess student's awareness of Energy Star. The limited number of student responses led us to an inaccurate representation of the student population. We were able to calculate the amount of greenhouse gas emissions, money, and energy saved when non-Energy Star appliances are replaced with Energy Star appliances. Future research into this field should encompass major stakeholders in residences, the students. This would provide a more accurate representation of how effectively and efficiently decrease plug-load capacities.

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1.0 Introduction

1.1 Project Definition

A university residence can symbolize many things for a student. It is conveniently close to campus, comfortable enough to call home, and can form a community of relationships that students may carry out for years to come. The advantages of residences result in a high demand for residences thus requiring numerous demands for residence buildings on campus. Dalhousie has 2,550 rooms in various types of residences across campus (Dalhousie University, n.d.). The large numbers of students living in residence have the potential to consume massive amounts of energy. For example, there are appliances that individual students use in common areas such as kitchens, laundry rooms, and lounges. Students are also invited to bring their own appliances into their dorm rooms such as mini fridges, printers, and computers. As a result, the total plug load for a residence building can be quite high. The plug load is one of the key contributors to energy consumption in a specific building (Wilkins et al., 2011, p.30). With numerous residences on a university campus, the energy consumption of these buildings can become very costly to the university. Furthermore, consuming massive amounts of energy can contribute to climate change (Raupach et al., 2007, p.10288). Since 2000 the global emission growth has largely been driven by the carbon intensity of energy, increases in population, and increase in per-capita GDP (Raupach et al., 2007, p.10288).

In order to help reduce energy consumption in residential, commercial, and industrial buildings (EPA, 2011, p.4), the U.S. Environmental Protection Agency and the U.S. Department of Energy have created a government certification called Energy Star (Barkenbus, 2006, p.11). Energy Star strives to provide consumers of products with honest and fair information regarding energy efficiency to promote the use of energy efficient appliances (EPA, 2011, p.4). Energy Star appliances that have been certified by Energy Star can also help with the reduction of the plug load in a building (Moran et al., 2004, p.35). In 2011, through the use of Energy Star appliances, 277 billion kilowatt hours (kWH) of energy were saved, which prevented 221 million tons of greenhouse gases being released into the environment (EPA, 2011, p.4).

Dalhousie University is becoming increasingly involved in sustainability practices and has already implemented many strategies to increase their efforts. In terms of appliances, they have partnered with Energy Efficiency Nova Scotia on a Fridge Exchange Energy Efficiency Program (Dal Office of Sustainability, 2012). A total of 491 fridges and freezers were replaced in the Tupper and LSC buildings at Dalhousie University, saving 265,565 kWH and 220 tonnes of carbon dioxide (CO_2) (Dal Office of Sustainability, 2012). The result of our project, which focuses on residences, may bring some insight to decisions being made concerning the future purchase and policies around allowable appliances in the building of future residences. It could also help create policies establishing what future students are allowed to bring into residences.

1.2 Background & Rationale

Universities are huge complexes that consume massive amounts of energy. In previous years Dalhousie has emitted more than 109,000 metric tonnes of CO_2 emissions, most of which were released from heating and cooling systems, and electric technology (Metzger, Kandt, & VanGeet, 2009). Similarly, a study done by Riddell *et al.* (2009) found that at a university in the United States, emissions totaled to 4 tonnes of carbon per student per year, around 38,000 tonnes per year in total. The amount of energy that is being consumed by universities requires funds that could be used elsewhere thus having a negative impact to the university's budget. Universities may be considered the leaders in sustainability, because they are able to research and study it in great depths. Leading sustainable practices is important for universities, this allows them to attract environmentally conscious students, and be a role model for the university's community and to other academic institutions.

Many universities have launched sustainability initiatives related to energy-efficient appliances. For example, New Mexico State University installed almost 300 energy efficient air conditioners in the student housing facilities, and approximately 3000 energy-efficient appliances were installed throughout the campus (US Fed News Service, 2009). Tulane University in New Orleans showcased a room that was completely outfitted with Energy Star appliances (Kahler, 2003, p.230). This room was shown to students, in an effort to educate them about the amount of energy they consume daily (Kahler, 2003, p. 230). As a result of this room, Tulane University's uptown campus reduced their greenhouse gas (GHG) emissions by 7% (Kahler, 2003, p.230). As mentioned above, the Office of Sustainability at Dalhousie University is geared toward promoting sustainable development across the entire campus including student residences and the corresponding operations that occur in all of these categories: transportation; built environment; natural environment; procurement and waste; energy, water & climate change; and sustainable foods (Smulders, 2011). In 2009 Dalhousie's President, Tom Traves, signed the University and College President's Climate Change Statement of Action. This is a document that binds Dalhousie to an agreement that they will impressively reduce their GHG emissions (Smulders, 2011) to 54,755 tonnes of greenhouse gas emissions by 2020 (Office of Sustainability, 2010).

As previously mentioned, Energy Star is a certification created by the government, and granted to appliances that are deemed energy efficient. Energy Star has a wide array of programs that promote Energy Star with a “money isn’t all you are saving” attitude. They have several programs and partnerships with businesses and schools that are best known for covering wide areas of consumer electronics, most of which have energy saving modes that save between 50-75% of energy while not in use (Banerjee & Solomon, 2003). Energy Star has qualified appliances in over 60 categories, and has sold over 4 billion products since 2000 (EPA, 2011). The Environmental Protection Agency along with Energy Star has established criteria for multi-family, high-rise complexes to receive the Energy Star certification (EPA, 2011). This criteria could be a requirement for Energy Star certified residences at Dalhousie University.

It has previously been shown that a well-designed energy saving policy can result in massive energy savings (Geller, Harrington, Rosenfeld, & Tanishima, 2006). As stated previously, Energy Star appliances can reduce plug loads, however residents of the dorm rooms may have other electronic accessories that draw out the energy that is being saved in the first place. In order to fully benefit from this project a complete evaluation system of all the plug loads would have to be implemented and monitored so that there could be no possible overlap between the reduced energy saved and the energy consumed by non energy star appliances. The sample that we took will account for energy consumed and saved providing us an estimated region to work with.

Our expectation for this research project was that by installing Energy Star appliances in residence common rooms, the plug load can be reduced accordingly, which will reduce the total amount of energy consumed by the entire building. This could potentially reduce Dalhousie’s overall GHG emissions resulting in the achievement of goals set by the President’s Climate Change Statement of Action (2009). The following sections discusses the research of the baseline assessment allowing us to determine whether or not Energy Star appliances in common areas within residences will successfully reduce plug load capacities.

<u>2.0 Research Methods</u>

The objective of this project is to compare the appliances present in three Dalhousie University residences; Risley Hall, Shirreff Hall, and Howe Hall (Figure 1), and to determine if the replacement of non-Energy Star appliances with certified Energy Star appliances will help to reduce the plug load of the university, thus reducing the ecological footprint of the residences on campus.

The research involves both qualitative and quantitative approaches. Both approaches suggest a way to provide residences with all Energy Star appliances, helping residences decrease their plug load, and Dalhousie University to reduce their CO_2 emissions to meet their GHG emission goals. The following section reviews the three forms of data collection for the project: face-to-face interviews with the building managers of the residences, intercept surveys with Dalhousie students, and the calculation of savings if all permanent, plug-in appliances in residences were Energy Star, followed by an analysis of the data. The following data collection is a tool developed by this research team because of the lack of available academic methods surrounding data collection of infrastructure and the replacement of appliances with applicable Energy Star replacements.

Figure 1 The location of Risley Hall (red), Shirreff Hall (orange) and Howe Hall (orange) at Studley Campus of Dalhousie University, Halifax.

A semi-structured interview with Mateo Yorke, the building facilities manager of Risley Hall and Shirreff Hall was conducted (Appendix A). The objective of the interview was to collect information about the plug-load of residences, the manager's knowledge of Energy Star, the number of Dalhousie-owned appliances in the building (whether the appliances are Energy Star or not) and how the Mr. Yorke might encourage students to purchase Energy Star appliances. A semi-structured face-to-face interview provides numerous advantages, allowing us to clarify any unclear questions, enabling us to ask the participant to expand on the questions asked, and permitting us to ask questions that are related to the topic being discussed in the interview (Palys & Atchinson, 2008, 157). This gave us the opportunity to obtain more relevant information that might not be collected if we would have asked written questions. An ethics form was approved by the ethics review board before the interview took place and the interview was recorded and transcribed.

Due to Rochelle Owen's schedule, she was only available to respond to e-mailed questions. Rochelle Owen responded to the e-mailed questions about plug loads and Dalhousie's purchasing policy about Energy Star appliances (Appendix B).

After receiving permission from the facilities managers, Mateo Yorke and Maryanne Barkley, we entered three of Dalhousie's residences, Howe Hall, Shirreff Hall, and Risley Hall to assess the appliances in three different types of common areas: lounge, kitchen, and laundry areas. We audited each plug-in appliance that was present in the common areas like the TVs, fridges, stoves, microwaves, washing and drying machines to see whether the appliances were Energy Star or not and the amount of energy that these appliances used. The data collected was recorded on a chart like the one found in appendix C and later transcribed into an excel sheet. We went into all of the common areas in all of the three residences to ensure that we were collecting accurate data about the number of appliances within the residences and whether or not the appliances were Energy Star certified.

After the information about the appliances was collected, we separated the Energy Star appliances from the non-Energy Star appliances. We then assessed the potential financial savings and the reductions in CO_2 emissions if a non-Energy Star appliance was replaced with the complementary Energy Star appliance.

Raw data concerning the number of Energy Star and non-Energy Star appliances from each of the three residences was inserted into a spreadsheet on excel and then used the following calculations described below. We then estimated daily power consumption of each residence was calculated by using the sum of the power consumption of the individual appliances in each residence (Appendix D). The power consumption was calculated by taking the Watts posted on the appliances, multiplying by the number of hours a day that the appliance is used, and dividing by one thousand to obtain the kilowatt hours per day (kWh/day). Then each of the appliance power consumptions (kWh/day) were multiplied by the corresponding number of appliances of that type in each residence and the sums taken to obtain total residence appliance power consumption. Daily power consumption was then multiplied by the number of days per academic year (240 days) to obtain the power consumptions per academic year in kWh (Appendix E).

The cost of running all the surveyed appliances was then calculated by multiplying the total power consumption of each residence by the cost per kWh for electricity supplied by Nova Scotia Power (NSP) to obtain the cost per academic year (Appendix E). The figure used was 13.79 cents per kWh for residential power consumers (Nova Scotia Power, 2013).

Greenhouse gas emissions were calculated by determining the product of the total power consumption of each residence and the GHG emissions associated with the production of electricity by using coal. Coal is the fuel for electricity production used by NSP in Halifax; the figure used in this analysis is 2.03 lbs of CO_2 per kWh (U.S. Energy Information Administration, n.d.). These calculations can be seen in appendix E.

The maximum possible number of Energy Star appliances that could be installed in each residence was found by replacing any non-Energy Star appliances with their Energy Star equivalents. The appliances that could be replaced with Energy Star appliances were determined through looking at the Energy Star website (2013). This new ratio of Energy Star appliances and non-Energy Star appliances were then used to calculate total residence power consumption, GHG emissions, and cost per academic year. Using the same method outlined in the paragraphs above.

The current and maximum Energy Star appliance usage was compared within individual residences also as a total. Included in this comparison is the percent reduction in GHG emissions, cost and consumption across the three residences as well as the total reduction from all three residences. This was calculated by the current consumption minus consumption when using the maximum number of energy star appliances divided by the current consumption multiplied by one hundred (% reduction = ((Current – Max ES)/Current)*100).

The last piece of the puzzle was the major stakeholders, the students. Due to privacy issues, we were denied permission to assess the student's rooms in residence. At first, we tried sending an email out to the students in the residences to ask permission to enter their rooms while they were present to do a count of what appliances they owned and if the appliances were Energy Star. We planned to use a survey sheet to do this however, we only got two responses for this so again had to change our surveying technique.

We conducted an intercept survey. We created a questionnaire and asked students outside of residences about their knowledge and interest in Energy Star (Appendix F). We selected an intercept survey because intercept surveys can collect accurate data, the respondent can remain anonymous, and it provides the ability to clarify ambiguous questions (Palys & Atchinson, p.156, 2008). The procedure for the intercept survey was to ask as many people as possible if they were interested in answering a few questions regarding Energy Star.

The reliability and validity of the research is not strong due to the limited research and the fact that there are no studies done like the research we have conducted.

3.0 Results

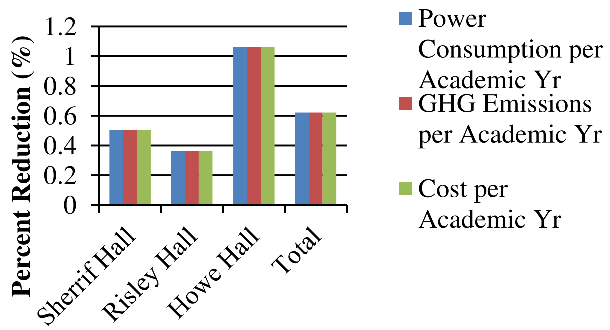

Figure 2 The amount of savings in power, GHG emissions, and cost per academic year in percentage (%) for Shirreff Hall, Risley Hall, Howe Hall, and all three residences together.

3.1 Common Room Audits

In Risley Hall, it was found that there are 21 Energy Star appliances, and 48 non-Energy Star appliances (Figure 2). We also found that it was possible to raise the number of Energy Star appliances to 32 by looking at how many appliances have an Energy Star alternative, making the number of non-Energy Star appliances 37 (Figure 2). This would contribute to a 0.36% reduction in

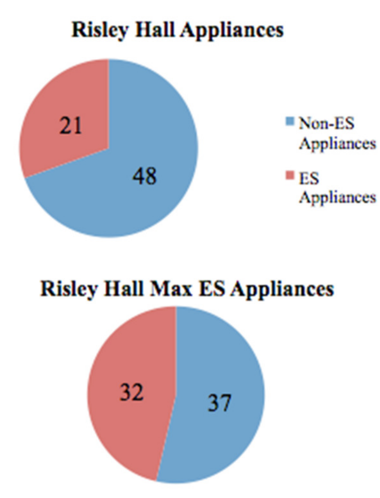

Figure 3 The current number of Energy-Star (ES) vs. non-ES appliances (top picture) and the number of potential ES vs. non-ES appliances (bottom picture) in Risley Hall.

power consumption, GHG emissions, and cost per academic year (Figure 3).

In Shirreff Hall, only 10 Energy Star appliances were found in the common areas of the building, while 35 appliances were not Energy Star (Figure 4). We could maximize the number of Energy Star appliances to 20, reducing the number of non-Energy Star appliances to 25. This would lead to a 0.5% reduction in power consumption, GHG emissions, and cost per academic year (Figure 3).

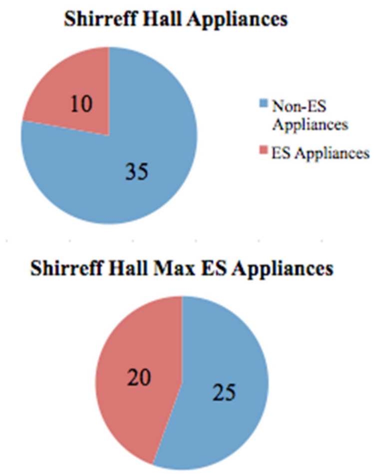

Figure 4 The amount of savings in power, GHG emissions, and cost per academic year in percentage (%) for Shirreff Hall, Risley Hall, Howe Hall, and all three residences together.

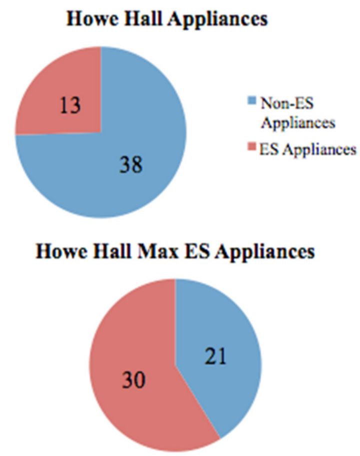

Figure 5 The current number of Energy-Star (ES) vs. non-ES appliances (top picture) and the number of potential ES vs. non-ES appliances (bottom picture) in Howe Hall

In Howe Hall, 13 appliances were found to be Energy Star, while 38 were found to be non-Energy Star (Figure 5). We found that we could bring the number of Energy Star appliances to 30, thus decreasing the amount of non-Energy Star appliances to 21. This would lead to a 1.06% reduction in power consumption, GHG emissions, and cost per academic year (Figure 3).

In total, we found 44 Energy Star appliances and 121 non-Energy Star appliances (Figure 6). Raising the amount of Energy Star appliances to 82 will reduce the number of non-Energy Star appliances to 83. This means that just under half of the appliances in the common areas of these three buildings would be Energy Star certified. These changes would result in a total 0.62% reduction in power consumption, GHG emissions, and cost per academic year (Figure 3). This is a saving of 3388 kWh of power consumption, 6877 pounds of GHG emissions and $468 per academic year.

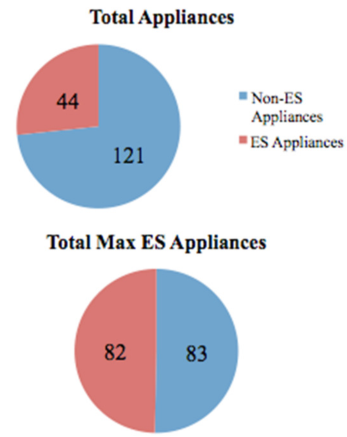

Figure 6 The current number of Energy-Star (ES) vs. non-ES appliances (top picture) and the number of potential ES vs. non-ES appliances (bottom picture) in all three residences.

3.2 Interviews with Faculty

Initially, we wanted to interview Mateo Yorke, Maryanne Barkley, and Rochelle Owen in person and discuss the questions we created. However, we were only able to meet with Mateo in person, Rochelle preferred to email her responses, and Maryanne Barkley expressed that she did not have enough time to meet with us, as this was a very busy time for her.

Rochelle Owen explained that when purchasing an appliance for a building, if it is a larger purchase the Office of Sustainability will work with departments and strive to see if there is an Energy Star equivalent available. If it is a smaller purchase, the Office of Sustainability aims to educate about the benefits of Energy Star, however they have no way of tracking the purchases. Rochelle also feels strongly that Energy Star appliances help to conserve energy in her work place. She states that depending on the item, an Energy Star appliance can save between 5-60% of energy consumed.

Mateo Yorke stated that he did not have an accurate list of the appliances under his management, however it is something they keep themselves updated on. Mateo also explained that the University’s procurement policy is to go with Energy Star where it is available or when it makes sense to do so. He explained that they would actually save money by pulling out current appliances that are not Energy Star and replacing them with Energy Star. However, this would also create unnecessary waste, which is why they do not follow through with this option. Mateo also estimated that around 480 of the 490 students in Risley have a mini fridge, which he says is probably the biggest plug load. Mateo stated that parents make bad decisions when outfitting their child's dorm room and go for the cheapest fridge. He thinks there needs to be more education to both students and parents, and also considers the idea of supplying Energy Star fridges in the dorms.

3.3 Intercept Surveys

Through various attempts at conducting intercept surveys, we were only able to achieve 15 responses, and they were not willing to discuss residence rooms, or did not live in residence. When asked if they knew what Energy Star was, only 5 out of 15 knew what it was (Figure 7). Four people stated that they owned an Energy Star appliance, and six said they actively search for Energy Star when purchasing an appliance (Figure 7). When ranking the importance of Energy Star on a scale of 1 to 5 (1 being most important and 5 being least important), 2 people ranked the importance at 5, six people said 1, 3 people ranked it at a 2, and 4 people gave it a 4 (Figure 7).

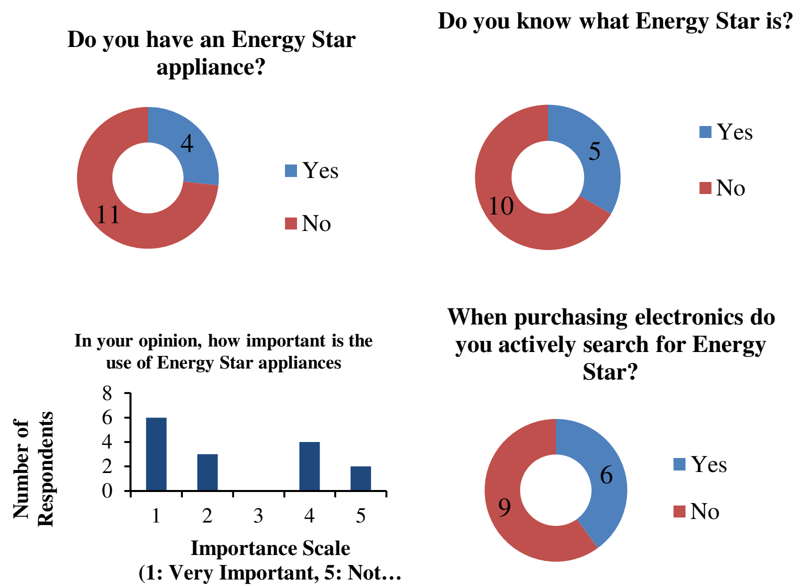

Figure 7 The responses from intercept surveys.

4.0 Discussion

The purpose of our project was to assess the number of Energy Star appliances in common areas of three Dalhousie University residences: Howe Hall, Shirreff Hall, and Risley Hall. We also calculated the current energy consumption. Using this information, we wanted to see how much we could reduce the amount of energy consumed, GHG emitted and cost if all possible appliances were replaced with Energy Star appliances. We had hopes that this information could be passed on to the Dalhousie Office of Sustainability and they could use our data when building future residences or implementing policies on what appliances students can bring to residence.

4.1 Common Room Audits

Our common room audit data showed that over the three residences, we could replace 38 existing appliances with Energy Star equivalents, raising the total of Energy Star appliances to 82, or just under half of all the common room appliances in the 3 buildings. This would reduce the total power consumption, GHG emissions and cost by 0.62%. This is not a significant reduction amount. This is because the list of appliances we have collected for these three residences are not an accurate representation of the total appliances in the building as the number of student rooms outweighs the number of common rooms. Furthermore, our sample size of residences may have been a limitation because we only surveyed the three largest residences out of ten residences found on Dalhousie's Halifax campus. If we had surveyed the smaller residences, we may have found a higher saving rate and reduction in GHGs.

4.2 Dormitory Audits

We were unable to accurately get a representation of the students' rooms for various reasons, Dalhousie's policies on the privacy of student's in residence prevented us from assessing student's rooms. We sent out an e-mail for students to help us with our research by allowing us to assess their rooms, and there were only two students that responded. This was a failure to room audits, and we also had a failure in response rate of the intercept surveys. Therefore, there are a large amount of rooms in each building we do not have data for. Due to this lack of data, our results are not significant. A study done by Mertz *et al.* (2005) found that a typical campus house at the University of Dayton with non-energy efficient appliances totaled 4,930 kWh/yr, and when the appliances were replaced with energy efficient appliances the amount dropped to 4,063 kWh/yr. This is a 17.6% reduction, which is much larger than the reduction that we obtained. Mertz *et al.* also emphasized the need for student consciousness of energy consumption. If students are more aware of the energy they are using, it is hoped that they will use less (Mertz et al., 2005).

4.3 Interviews with Faculty

Through our interviews with the faculty, we learned that they are very interested in bringing Energy Star appliances into the buildings. However, they have not yet come up with an effective way of doing this. Suggestions were made that education is important for both the students and the parents to ensure they understand what Energy Star is and the benefits it can have on a university residence. It was considered that this would be implemented as part of the acceptance package that prospective students receive. A further suggestion was that Dalhousie purchase mini fridges that were Energy Star certified, and increase the residence fee slightly to compensate for the supply of the fridge. This way Dalhousie could ensure that, at least, all the mini fridges present in the residence were Energy Star thus potentially reducing the plug load significantly. Recent research has also brought some ideas on how to encourage students to choose Energy Star products. As mentioned above, Tulane University in New Orleans has developed an Energy Star showroom (Kahler, 2003). This room is shown to anyone who wishes to see it, and learn about the efficiency of Energy Star. The original goals for the project were to demonstrate the energy savings that can happen when replacing appliances with Energy Star ones, to educate the students about how their personal choices affect the earth on a grand scale, and to reduce GHG emissions, to name a few (Kahler, 2003). Tulane University reached these goals through this Energy Star show room (Kahler, 2003). In the interview with Mateo Yorke he said he would be open to showing potential students and parents a room like the one shown in Tulane University. However, the Dalhousie students that are showing the room have little or no knowledge of Energy Star and ways to save energy. Therefore, ensuring that the tour guides have sufficient knowledge to address the participant's questions is important if the Energy Star showroom was to be successful.

4.4 Intercept Surveys

Our intercept surveys had a very low response rate, with only 15 individuals participating. This in no way gives us an accurate representation of the Dalhousie University population, or even the students living in residence. Our intercept surveys may have worked better if we had an initiative for students to do the surveys, such as a treat of some sort. However, last minute changes to the methodology made it very difficult for us to get funding. Because of the very low number of participants, we cannot infer much in terms of results. However, we did notice that out of the 15 people we sampled, only 5 knew what Energy Star was. Although this works out to one third of our sample, there is room for increasing the awareness of Energy Star through education of what Energy Star is, and how you can make your home or residence room more energy efficient. Similarly, in research done recently, they had found that students did not have a well-developed sense of the direct impacts they could have on climate change (Marcell et al., 2004; DeWaters et al., 2011). A study conducted by DeWaters and Powers (2011) in New York found that while 73% of student subjects indicated that they are concerned about environmental problems, only they had very low cognitive (43%) and behavioral (65%) scores to indicate that they understand and demonstrate this (DeWaters et al., 2011).

A study conducted by Marcell et al (2004) at Tufts University recognized that their students were lacking the knowledge needed to conserve energy in residences (Marcell et al., 2004). They decided to try to educate the students with two approaches: a regular education program, and an education program supplemented with a social marketing strategy (Marcell et al., 2004). They found that the group of students who learned with an education program supplemented with a social marketing strategy were more apt to change their behaviors to help conserve energy (Marcell et al., 2004). The examples discussed above are something that Dalhousie should consider when trying to encourage the students to purchase Energy Star products.

5.0 Conclusion

5.1 Major Contributions of the Project

Although our study did not produce the results we may have hoped, as our sample sizes were quite low and we faces some challenges along the way, there are still some contributions that our project may be able to make. Our project could form a baseline for a project for next year. They could build off of what we tried to complete, and perhaps come up with new ideas on how to collect more data. We also have found out that students we sampled do not know what Energy Star is or have really limited knowledge of Energy Star. Knowing this may help future researchers to first educate about Energy Star.

5.2 Recommendations for Future Research

Future research should encompass students and their willingness to purchase Energy Star products. Research into the feasibility of Dalhousie purchasing Energy Star mini-fridges to put in the residences as a part of the student's dormitory rooms is possible. As stated by Mateo Yorke, the students sometimes bring in mini fridges that are energy intensive. There are many more students in dorm rooms than there are common areas with fridges therefore, implementing an Energy Star mini-fridge in each room would most likely reduce plug load by a significantly larger amount than implementing Energy-Star appliances in common areas.

5.3 Recommendations for Action

Based upon our research, we recommend that Dalhousie seriously considers and implements ways to encourage students to use Energy Star appliances in their dorm rooms or the implementation of an Energy Star mini-fridge only policy. We also suggest that Dalhousie start educating students about the positive outcomes of Energy Star appliances, and how they can help reduce the energy consumption at Dalhousie University. By making the students aware and involved, Dalhousie can reduce their energy consumption.

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Appendices

Appendix A: Interview questions for Mateo Yorke

We are conducting a project for ENVS 3502- Campus as a Living Lab, and we are researching how much energy a building could save by using all Energy Star appliances. We would like to ask you some questions on the building that you manage. The information that you provide us will help us quantify the amount of Energy Star appliances there are in some of the larger residences at Dalhousie.

1. Are you aware of the term "Energy Star"?
2. Do you have an accurate list of the appliances that are under your management?
3. Would you consider replacing existing appliances that aren't Energy Star with Energy Star appliances?
4. Would you consider implementing restrictions on what the students could bring in for their appliances?
5. Do you have any information about the plug load in the residences?

Appendix B: Interview questions for Rochelle Owen

We are conducting a project for ENVS 3502- Campus as a Living Lab, and we are researching how much energy a building could save by using all Energy Star appliances. We would like to ask you some questions about Dalhousie's residences, and some generally on sustainability.. The information that you provide us will help us understand the plug loads, and compare them to a plug load that is only Energy Star appliances.

Rochelle Owen:

1. What is the hot water fuel type in each residence?
2. Are there any guidelines that must be followed when purchasing a new appliance for the building?
3. What and when are the projected plug loads of the building under construction?
4. What is the number of proposed Energy Star appliances for the under construction building?
5. Which building is considered the leading LEED building?
6. Do you feel that Energy Star appliances help to conserve energy in your place of work?

Do you have data on the plug loads?

Appendix C: Assessment sheet for appliances in common areas

Residence:						
Appliance	**Energy Star Compliant (Y/N)**	**Is there an energy star alternative (Y/N)**	**Quantity**	**Power Consumption**	**Typical Use (hrs/day)**	**Cycle Time (% of time actually on)**
T.V.						
DVD Player						
Desktop Computer						
Laptop Computer						
Sound System						
Printer						
Refrigerator						
Coffee Maker						
Kettle						
Microwave						
Toaster/Toaster Oven						
Lamp						
Space Heater						
Fan						
Vacuum Cleaner						
Personal Care Products (Razors, trimmers, hair driers, etc.))						
Others:						

<u>**Appendix D: Calculation of Power Consumption in Shirreff, Howe, and Risley**</u>

Sherriff						max ES			
	Energy Star	Consumption	Non-Energy Star	Consumption		Energy Star	Consumption	Non-Energy Star	Consumption
Television	1	0.36	6	2.7		7	2.52	0	0
Stove	0		1	3.6		0		1	3.6
Refrigerator	0	0	4	10.752		4	8.6016	0	0
Microwave	0		7	7.7		0		7	7.7
Fan	0		2	1.6		0		2	1.6
Sound System	0	0	0	0		0	0	0	0
Dryer	0		9	450		0		9	450
Washer	9	36	0	0		9	36	0	0
Iron	0		6	21.6		0		6	21.6
DVD Player	0	0	0	0		0	0	0	0
Kettle	0		0	0		0		0	0
Coffee Maker	0		0	0		0		0	0
Total	10		35			20		25	
		Total Consumption	534.312				Total Consumption	531.6216	

Risley						max ES			
	Energy Star	Consumption	Non-Energy Star	Consumption		Energy Star	Consumption	Non-Energy Star	Consumption
Television	3	1.08	3	1.35		6	2.16	0	0
Stove			6	21.6		0		6	21.6
Refrigerator		0	6	16.128		6	12.9024	0	0
Microwave			6	6.6		0		6	6.6
Fan	0		0	0		0		0	0
Sound System	1	0.18	0	0		1	0.18	0	0
Dryer	0		17	850		0		17	850
Washer	17	68	0	0		17	68	0	0
Iron	0		6	21.6		0		6	21.6
DVD Player	0	0	2	0.15		2	0.06	0	0
Kettle	0		1	0.525		0		1	0.525
Coffee Maker	0		1	0.42		0		1	0.42
Total	21		48			32		37	
		Total Consumption	987.633				Total Consumption	984.0474	

Howe						max ES			
	Energy Star	Consumption	Non-Energy Star	Consumption		Energy Star	Consumption	Non-Energy Star	Consumption
Television	2	0.72	6	2.7		8	2.88	0	0
Stove	0		2	7.2		0		2	7.2
Refrigerator	0	0	8	21.504		8	17.2032	0	0
Microwave	0		6	6.6		0		6	6.6
Fan	0		0	0		0		0	0
Sound System	0	0	0	0		0	0	0	0
Dryer	0		13	650		0		13	650
Washer	11	44	3	15		14	56	0	0
Iron	0		0	0		0		0	0
DVD Player	0	0	0	0		0	0	0	0
Kettle	0		0	0		0		0	0
Coffee Maker	0		0	0		0		0	0
Total	13		38			30		21	
		Total Consumption	747.724				Total Consumption	739.8832	

Appendix E: Power Consumption and Savings per Academic Year

	Power Consumption per Day (kWh)	Power Consumption per Academic Year (kWh)			GHG per Acad Yr (lbs CO2)			Cost per Acad Yr ($)
Sherrif Hall				Sherrif Hall			Sherrif Hall	
Current Consumption	534.312	128234.88		Current Output	260316.8064		Current Cost	17683.58995
Max ES Consumption	531.6216	127589.184		Max ES Output	259006.0435		Max ES Cost	17594.54847
Risley Hall				Risley Hall			Risley Hall	
Current Consumption	987.633	237031.92		Current Output	481174.7976		Current Cost	32686.70177
Max ES Consumption	984.0474	236171.376		Max ES Output	479427.8933		Max ES Cost	32568.03275
Howe Hall				Howe Hall			Howe Hall	
Current Consumption	747.724	179453.76		Current Output	364291.1328		Current Cost	24746.6735
Max ES Consumption	739.8832	177571.968		Max ES Output	360471.095		Max ES Cost	24487.17439
Total				Total			Total	
Current Consumption	2269.669	544720.56		Current Output	1105782.737		Current Cost	75116.96522
Max ES Consumption	2255.5522	541332.528		Max ES Output	1098905.032		Max ES Cost	74649.75561

Appendix F: Intercept Survey Questions

1. Do you know what Energy Star is?
2. Do you have an Energy Star appliance?
3. When purchasing electronics, do you actively search for Energy Star?
4. In your opinion, how important is the use of Energy Star appliances on a scale of 1 to 5? (1 being very important, 5 being not very important)

Appendix G: Ethics Review

ENVIRONMENTAL SCIENCE PROGRAM
FACULTY OF SCIENCE
DALHOUSIE UNIVERSITY
(version 2010)

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

GENERAL INFORMATION

1. Title of Project: Energy Star in Residence

2. Faculty Supervisor(s) Rebecca McNeil Department e-mail: ph:

3. Student Investigator(s) Department ENVS e-mail: kylehambly@dal.ca ph:
Kyle Hambly, Ece Gonul, Tessa Woodford, Paige Jenkins, Tyler Travers
4. Level of Project: Non-thesis Course Project [Y] Undergraduate [ ] Graduate [ ]
Specify course and number: 3502 ENVS/SUST Campus as a Living Lab

5. a. Indicate the anticipated commencement date for this project: March 15th 2013
b. Indicate the anticipated completion date for this project: March 25th 2013

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*

Our expectation for this research project is that by installing energy star appliances in residence rooms, the plug load can be reduced accordingly, which will reduce the total amount of energy consumed by the entire building. This could potentially reduce Dalhousie's overall greenhouse gas emissions resulting in more goals attained under the President's Climate Change Statement of Action. In order to complete this research, a baseline assessment will need to be conducted of the overall energy exerted on a comparable scale, and then establish the difference between plug load capacities. If all goes according to plan, we expect that by researching and conducting the baseline assessment we will then be provided with enough information that will determine whether or not energy star appliances will successfully reduce plug load capacities.

2. Methodology/Procedures
a. ***Which of the following procedures will be used? Provide a copy of all materials to be used in this study.***
[Y] Survey(s) or questionnaire(s) (mail-back)
[Y] Survey(s) or questionnaire(s) (in person)
[ ] Computer-administered task(s) or survey(s)]
[Y] Interview(s) (in person)
[ ] Interview(s) (by telephone)

[ ] Focus group(s)
[ ] Audio taping
[ ] Videotaping
[Y] 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.***

Appendix E: Consent Form

I volunteer to participate in a room survey conducted by Tyler Travers, Tessa Woodford, Ece Gonul, Kyle Hambly and Paige Jenkins. I understand that this survey is prepared to collect information about the appliances that I have in my room.

1. My participation in this project is voluntary. I understand that I will not be paid for my participation.

2. I understand that the researcher will not identify me by name in any reports using information obtained from this room survey, and that my confidentiality as a participant in this study will remain secure.

3. I have gotten all of my questions answered about the research, and I voluntarily agree to participate in this study.

_________*4. I have been given a copy of the consent form.*

______________________________ *My Signature*

______________________________ *My Printed Name*

______________________________ *Date*

______________________________ *Signature of the Investigator*

3. Participants Involved in the Study: ***Indicate who will be recruited as potential participants in this study****.*

Dalhousie Participants:
[ ] Undergraduate students
[ ] Graduate students
[Y] Faculty and/or staff

Non-Dal Participants:
[ ] Adolescents
[ ] Adults
[ ] Seniors
[ ] Vulnerable population* (e.g. Nursing Homes, Correctional Facilities)

** Applicant will be required to submit ethics application to appropriate Dalhousie Research Ethics Board*

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****.*
Resident Managers, Residence Facilities Managers, Office of Sustainability Staff/Management

c. ***How many participants are expected to be involved in this study?*** *Potentially 5*

4. Recruitment Process and Study Location
a*.* ***From what source(s) will the potential participants be recruited?***
[ ] Dalhousie University undergraduate and/or graduate classes
[y] Other Dalhousie sources (specify) Staff of Dalhousie Residence Team/Facilities Management and Office of Sustainability___
[ ] Local School Boards*
[ ] Halifax Community
[ ] Agencies
[ ] Businesses, Industries, Professions
[ ] Health care settings*
[ ] Other, specify (e.g. mailing lists) ________________________ ** Applicant may also require ethics approval from relevant authority, e.g. school board, hospital administration, etc.*

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 in the appendices section.
We do not have any scripts, we are contacting residence management teams, explaining our project and asking if we can speak with them regarding our work that we are doing.

5. Compensation of Participants*:* **Will participants receive compensation (financial or otherwise) for participation?**
Yes [ ] No [N] If **Yes**, provide details:

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.

"Our team will provide the people we interview with a thank-you letter regarding the information that we collected and its purpose. Provided with that letter will be our contact information, and when the study is complete we will email copies of our report."

POTENTIAL BENEFITS FROM THE STUDY

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

- *Awareness of energy consumption so they can personally decrease their carbon footprint.*
- *Understand the importance of energy savings and reduced consumption*

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

Decrease in Dalhousie's overall energy consumption, cleaner, greener, campus affecting Dalhousie neighbors and Halifax as a Municipality.

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 and burdens.**

   [N] No known or anticipated risks Explain why no risks are anticipated:
   [ ] Minimal risk * Description of risks:
   [ ] Greater than minimal risk** Description of risks:

   * *This is the level of risk associated with everyday life. ** This level of risk will require ethics review by appropriate Dalhousie Research Ethics Board*

   There is no risk involved because this is a complete voluntary study and we are only collecting data pertaining to energy appliances, quantity per room, and efficiency rating. Our interviews are not directed as personal questions but merely questions of efficiency applicability and operation.

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) ____

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

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.
Our project is not designed to affiliate personal feelings with our conclusion. We are simply conducting questions regarding energy usage, and therefore we do not require individual names, or location of each individual but merely answers to questions regarding appliances used in Dalhousie dorm rooms.
We will not be taking any notes on personal names, nor will personal names be used in our results and findings.

2. Describe the procedures for securing written records, questionnaires, video/audio tapes and electronic data, etc.
Our data is going to be saved on a personal computer and will not be distributed or connected to any public sharing networks. The data will not have any personal connections and simply just answers to the questions we have. When the results are complete the data will be erased off the computer.
3. Indicate how long the data will be securely stored as well as the storage location over the duration of the study. Also indicate the method to be used for final disposition of the data.
[ ] Paper Records
[ ] Confidential shredding after ____
[ ] Data will be retained until completion of specific course.
[ ] Audio/Video Recordings
[ ] Erasing of audio/video tapes after ____
[ ] Data will be retained until completion of specific course.
[Y] Electronic
[Y] Erasing of electronic data after ____
[Y] Data will be retained until completion of specific course.
[ ] Other ____
(Provide details on type, retention period and final disposition, if applicable)

Specify storage location: Personal computers which belong to a group member.

Appendices: 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.

[ ] **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.

SIGNATURES OF RESEARCHERS ______________________ ______________

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

____ Signature Date

____ Signature Date

Appendix H: Proposal

Energy Star in Residences

Comparison of Energy Star vs. non-Energy Star appliances in three Dalhousie Residences

Paige Jenkins
Theresa Woodford
Kyle Hambly
Tyler Travers
Ece Gonul

Table of Contents

Project Definition

A university residence can symbolize many things for a student. It is conveniently close to campus, comfortable enough to call home, and can form a community of relationships that students may carry out for years to come. Because of the appeal of residences, many students take advantage of them. The large numbers of students living in these buildings can in turn use massive amounts of energy. There are appliances for the common areas such as kitchens, laundry rooms, and lounges. Every student in the building will also be bringing in their own appliances such as mini fridges, printers, and computers. As a result of the numerous appliances, the total plug load for the specific building can be quite high. The plug load is one of the key contributors to energy consumption in a specific building (Wilkins et al., 2011, p.30). With numerous residences on a university campus, the energy consumption of these buildings can become very costly to the university. Furthermore, consuming massive amounts of energy can contribute to climate change (Raupach et al., 2007, p.10288). Global emission growth since 2000 has largely been driven by the carbon intensity of energy, increases in population, and increase in per-capita GDP (Raupach et al., 2007, p.10288).

In order to help reduce energy consumption in residential commercial and industrial buildings (EPA, 2011, p.4), the U.S. Environmental Protection Agency and the U.S. Department of Energy have created a government certification called Energy Star (Barkenbus, 2006, p.11). Energy Star strives to provide consumers of products with honest and fair information regarding energy efficiency to promote the use of energy efficient appliances (EPA, 2011, p.4). Energy Star Appliances that have been certified by Energy Star can also help with the reduction of the plug load in a building (Moran et al., 2004, p.35). In 2011, through the use of Energy Star appliances, 277 billion kilowatt hours (kWH) of energy were saved, which prevented 221 million tons of greenhouse gases being released into the environment (EPA, 2011, p.4)

The objective of this project is to compare the appliances present in three Dalhousie University residences; Risley Hall, Shirreff Hall, and Howe Hall (Appendix A), in order to see if implementing Energy Star appliances can help reduce plug load. Interviews will be conducted with the building managers of respective residences, as well as the Director of Sustainability at Dalhousie University regarding the appliances present in the residences, and their opinions on the feasibility of implementing Energy Star appliances into the residences. A sample of residence rooms will also be taken to get a representation of the types of appliances students are bringing to residence, and whether or not they are Energy Star. Once a sample has been established in all three residences, the plug load of each building will be compared to a plug load made up of all Energy Star products. This could show the building managers how much energy they would save if their building only contained Energy Star appliances.

Dalhousie University is becoming increasingly involved in sustainability practices and has already implemented many strategies to increase their efforts. In terms of appliances, they have partnered with Energy Efficiency Nova Scotia on a Fridge Exchange Energy Efficiency Program (Dal Office of Sustainability, 2012). A total of 491 fridges and freezers were replaced in the Tupper and LSC buildings at Dalhousie University, saving 265,565 kWH and 220 tonnes of carbon dioxide (Dal Office of Sustainability, 2012). The result of our project may bring some insight to decisions being made concerning Dalhousie University's new LEED multipurpose building that is currently in the process of being built. If Energy Star appliances are found to reduce plug load in the building significantly, perhaps when choosing appliances for the new building, they will choose Energy Star, and encourage students living in residences to do the same.

Background & Rationale

Universities are huge complexes that consume massive amounts of energy. In previous years Dalhousie has emitted more than 109,000 metric tonnes of carbon dioxide emissions, most of which were released from heating and cooling systems, and electric technology (Metzger, Kandt, & VanGeet, 2009). Similarly, a study done by Riddell et al found that at a university in the United States, emissions totaled to 4 tonnes of carbon per student per year, around 38,000 tonnes per year (Riddell et al., 2009, p.266). The amount of energy that is being consumed by these universities can be costly, which can be a negative impact to the university because it requires funds that could be used elsewhere. Universities may be considered the leaders in sustainability, because they are able to research and study it in great depths. It is important that universities maintain an image of striving for sustainability, so as to lead by example and perhaps other institutions will follow suite.

Many universities have already launched sustainability initiatives. New Mexico State University installed almost 300 energy efficient air conditioners in the student housing facilities, with a total of about 3000 energy-efficient appliances installed (US Fed News Service, 2009). Tulane University in New Orleans showcased a room that was completely outfitted with Energy Star appliances (Kahler, 2003, p.230). This room was shown to students, in an effort to educate them about the amount of energy they consume daily (Kahler, 2003, p. 230). As a result of this room, Tulane University's uptown campus reduced their greenhouse emissions by 7% (Kahler, 2003, p.230). As mentioned above, the Office of Sustainability at Dalhousie University is geared toward promoting sustainable development across the entire campus including student residences and the corresponding operations that occur in all of these categories: transportation, built environment, natural environment, procurement & waste, energy, water & climate change, and sustainable foods (Smulders, 2011). In 2009 Dalhousie's President, Tom Traves, signed the University and College President's Climate Change Statement of Action, which is a document that binds Dalhousie to an agreement that they will impressively reduce their greenhouse gas emissions (Smulders, 2011).

As previously mentioned, Energy Star is a certification created by the government, and applied to appliances that are deemed energy efficient. They have a wide array of programs that promote Energy Star with the "money isn't all you are saving" attitude. They have several programs and partnerships with businesses and schools that are best known for covering wide areas of consumer electronics, most of which have energy saving modes that save between 50-75 percent of energy while not in use (Banerjee & Solomon, 2003). Energy Star has qualified appliances in over 60 categories, and has sold over 4 billion products since 2000 (EPA, 2011). The Environmental Protection Agency along with Energy Star has established criteria for multi-family high-rise complexes to receive the Energy Star certification (EPA, 2011). Perhaps this could foreshadow to an Energy Star certified residence.

The research that we are going to conduct could achieve many results. One of the major implications that we could be facing is that although Energy Star Appliances do reduce plug loads, residents of the dorm rooms may have other electronic accessories that draw out the energy that is being saved in the first place. In order to fully benefit from this project a complete evaluation system of all the plug loads would have to be implemented and monitored so that there could be no possible overlap between the reduced energy saved and the energy consumed by non energy star appliances. However, the sample that we will take will be able to account for energy consumed and saved giving us an estimated region to work with. It has previously been shown that a well-designed energy saving policy can result in massive energy savings (Geller, Harrington, Rosenfeld, & Tanishima, 2006).

Our expectation for this research project is that by installing energy star appliances in residence rooms, the plug load can be reduced accordingly, which will reduce the total amount of energy consumed by the entire building. This could potentially reduce Dalhousie's overall greenhouse gas emissions resulting in more goals attained under the President's Climate Change Statement of Action. In order to complete this research, a baseline assessment will need to be conducted of the overall energy exerted on a comparable scale, and then establish the difference between plug load capacities. If all goes according to plan, we expect that by researching and conducting the baseline assessment we will then be provided with enough information that will determine whether or not energy star appliances will successfully reduce plug load capacities.

Research Methods

This project involves both qualitative and quantitative approaches. Both approaches will be used to suggest a way to provide residences with all Energy Star appliances, helping residences decrease their plug load, and Dalhousie University to reduce their CO2 emissions to meet their emission goals. The following section reviews the three forms of data collection for the project: face-to-face interviews with the building managers of the residences, the calculation of savings if all permanent, plug-in appliances in residences were Energy Star, and assessing the number of Energy Star appliances in residence assistant rooms in residences, followed by an analysis of the data. The following data collection is a tool developed by this research team because of the lack of available academic methods surrounding data collection of infrastructure and the replacement of appliances with applicable Energy Star replacements.

An interview will be conducted with the residences' facilities managers, Maryanne

Barkley, Mateo Yorke, and Sarah Ready to collect information about the plug-load of residences, the manager's knowledge of Energy Star, and the number of appliances in the building (whether the appliances are Energy Star or not) and additional questions that can be found in appendix B. Furthermore, another interview with Rochelle Owen will allow us to obtain data about the energy consumption of the three residences. A semi-structured face-to-face interview provides numerous advantages, including allowing the potential to clarify any unclear questions (Palys & Atchinson, 2008, 157). The interview is semi-structured; enabling us to ask the participant to expand on the questions asked and permits us to ask questions that are related to the topic being discussed in the interview. This ability lets us obtain more relevant information that might not be collected if we could only ask written questions. An ethics form will be submitted to the ethics review board before the interviews take place and the interviews will be recorded and transcribed.

In each interview we will ask if the residence's building manager has the energy consumption rates of each residence and if he or she has a list of the plug-in appliances that are property of Dalhousie, such as TVs, fridges, stoves, microwaves, washing and drying machines, and whether these appliances are Energy Star or not. If this data is not available, we will obtain permission from the respective residence life managers to enter the residence. We will then go to one lounge room and one kitchen area in each residence and collect information about the appliances that are property of Dalhousie. For a full list of data to be collected, see appendix C. We are only surveying one lounge and kitchen area in each residence under the assumption that all appliances found in every kitchen and lounge area in each residence are the same.

After the information about the appliances is collected, we will separate the Energy Star appliances from the non-Energy Star appliances. Once the appliances are categorized, we will use the provided Energy Star appliance calculator, office equipment calculator, and consumer electronics calculator (Energy Star, n.d.) to estimate the potential savings if the non-Energy Star appliances were replaced with certified Energy Star. Appendix D provides a snapshot of the appearance of the Energy Star calculators.

The last piece of the puzzle is a major stakeholder, which are the students. Residence assistants (RAs) live in residences and there is at least one on each floor of the buildings. RAs are students that enforce rules and provide support to the other students that are living in the RA's designated section of the residence. The research group will receive permission from the residence life manager for each residence to go and ask the RAs if we can inspect what Energy Star appliances there are in the RA's room. Once the RA provides consent by signing a consent form (Appendix E), we will inspect the designated appliances in the RA's rooms (Appendix F) and record if the appliances are labeled Energy Star or not.

RAs are usually very approachable, social, and easily available. We chose to approach RAs instead of students, because we felt that there will be a more accurate response rate. In Risley Hall, we will be approaching 17 RAs (6 floors, with 3 RAs on each floor except the first), in Howe Hall we will be approaching 25 RAs, and in Shirreff Hall we will be approaching 19 RAs.

We will use the results collected from the RAs' rooms to infer the proportion of students that have Energy Star appliances in each residence and analyze the potential savings if the appliances in RA's rooms were Energy Star. Furthermore, we will be using differential statistics to analyze the results, which will include the potential financial savings Energy Star appliances can have, and the plug load amount that is reduced through replacing non-Energy Star appliances with Energy Star appliances. The possible reduction in carbon emissions, which will be calculated using an excel spreadsheet calculator (appendix D) obtained from the National Energy Education Development Project (2011). This spreadsheet uses the annual energy consumption of appliances in kWh and the approximate CO_2 emissions per kWh produced. This is dependent upon the fuel used to produce the electricity that is consumed on campus.

Schedule

What	Who	When
Background research and proposal	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	February 1 - 18
Have our proposal edited as a group	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	February 21
Have our proposal edited by the Writing Centre at Killam Library	Kyle Hambly	February 22
Email Residence Life Manager Lyndsay Anderson (Howe Hall), Nicole Cross (Sheriff Hall), Sarah Rady (Risley Hall)	Tessa Woodford	February 20
Preparation of Interview Questions for Mateo Yorke	Paige Jenkins Tessa Woodford Ece Gonul	March 5
E-mail interview: Mateo Yorke	Paige Jenkins Tessa Woodford Ece Gonul	March 7
Preparation of Interview Questions for Maryanne Barkley	Kyle Hambly Tyler Travers	March 7
E-mail interview: Maryanne Barkley	Kyle Hambly Tyler Travers	March 8
Preparation of Interview Questions for Rochelle Owen	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	March 10
E-mail Interview: Rochelle Owen	Paige Jenkins Tessa Woodford	March 11-15

	Kyle Hambly Tyler Travers Ece Gonul	
Visit Residences to check Energy Star Appliances	Paige Jenkins Tessa Woodford Ece Gonul	March 15 - 20
Intercept Surveys for students living in residence	Kyle Hambly Tyler Travers	March 20 -22
Compile and analyze data	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	March 15 - 24
Preparation of Pecha Kucha Presentation	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	March 25 - 30
Write Report	Paige Jenkins Tessa Woodford Kyle Hambly Tyler Travers Ece Gonul	April 3 - 12

Deliverables and Communication Plan

The goal of this project is to contribute to the sustainability and to introduce new data on energy efficiency at Dalhousie. Furthermore, our insights on Energy Star appliances will help to make decisions on the implementation of appliances in the new multipurpose building located across from the Student Union Building at Dalhousie University. After finishing our project, we will provide our data to the Office of Sustainability at Dalhousie University. Perhaps the Sustainability Office will take our research project to the next step and ensure that all future appliances implemented at Dalhousie will be Energy Star, when possible. Our target audience is the building managers as they make the decisions on what permanent appliances are present in the residences. Moreover, we will target students, and encourage them to purchase Energy Star appliances, as they are the main contributors to appliances present in residences. Perhaps, if they see the potential savings of the Energy Star appliances, they will ensure that the future appliances that are purchased for Dalhousie residences will be Energy Star. The communication tools that we will be using are interviews, room surveys, and emails to contact the participants in the study. We aim to have the interviews and room surveys completed by March 21. Our group will work closely together and be most efficient. By working collectively, we will achieve our goal to construct a proposal that corroborates the possible reduction of energy consumption with the use of Energy Star appliances at the new Dalhousie University residence.

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Appendix A


Larch St
Payzant Ave
Lilac St
Walnut St
Coburg Rd
Coburg Rd
Lemarchant St
Robie St
Oxford St
Castine Way
University Ave
South St
South St
South St
Davis St
Fraser St
Carlaret St
Map data ©2013 Google
LeMarchant Street Mixed Use Building (NEW)
Risley Hall, Shirreff Hall, and Howe Hall
All other campus residences
Campus buildings
Kings University
Parking spaces on campus

Appendix B

1. What is the hot water fuel type in each residence?
2. How do you feel about trying to conserve energy?
3. Are you aware of the term "Energy Star"?
4. Are there any guidelines that must be followed when purchasing a new appliance for the building?
5. Do you have an accurate list of appliances that are under your management?
6. Do you know if any of the appliances you mentioned above are considered Energy Star appliances?
7. Do you feel that Energy Star appliances help to conserve energy in your place of work? Or in general?
8. Would you consider replacing existing appliances with Energy Star appliances?
9. Would you consider implementing restrictions on what the students could bring in for their appliances?
10. Would this be a feasible option?
11. In the future, would you consider only purchasing Energy Star appliances?
12. If not, why?
13. Which building is considered the leading LEED building?
14. Do you have data on the plug loads?
15. What and when are the projected plug loads of the building under construction?
16. What is the number of proposed Energy Star appliances for the under construction building?

Appendix C

Appliance Type	Number in Residence	Energy-Star Certified	Appliance Size	Rated electricity consumption (kWh/Year)		
T.V.						
Clothing Washing Machine						
Clothing Dryer						
Refrigerator						
					Number turned off at night	**Number with sleep setting**
Desktop computer						
Printers						
Coffee Maker						
Microwave						

<u>Appendix D</u>

Appliance Calculator:

Where will your appliances be used?

Commercial or residential use	Residential	*U.S. average residential rates are $0.1151/kWh and $1.079/therm. If you know your own rates, enter them below.*
Location	U.S. average	
Electric rate ($/kWh)	$0.1151	
Gas rate ($/therm)	$1.08	
Water rate ($/thousand gallons)	$8.37	*U.S. average residential water and sewer rate is $8.37/thousand gallons. If you know your own rate, enter it here.*

What appliances are you planning to purchase? Enter quantities below, then either fill in product information or use the defaults.

	Quantity	Capacity - clean air delivery rate (CADR)	Efficiency (Dust CADR/Watt)	Average annual days of operation (days/year)	Average daily operation (hours/day)	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Air Purifier (Cleaner)	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Quantity	Average number of loads per week	Building hot water fuel type	Type of dryer	Capacity (cubic feet)	Modified energy factor (MEF)	Water factor (WF)	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Clothes Washer	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Quantity	Capacity (pints/day)	Energy factor (l/kWh)	Average annual days of operation (days/year)	Average daily operation (hours/day)	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Dehumidifier	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Quantity	Type of dishwasher	Average number of cycles per week	Building hot water fuel type	Rated electricity consumption (kWh/year)	Rated water consumption (gallons/cycle)	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Dishwasher	0	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

	Quantity	Type	Total volume (cubic feet)	Rated electricity consumption (kWh/year)	Additional cost per unit for ENERGY STAR model	Optional: utility incentive amount
Refrigerator	0	Side-by-side (automatic defrost)	[illegible]	[illegible]	[illegible]	[illegible]
Refrigerator - Compact	0	Compact refrigerator or compact refrigerator-freezer (manual defrost)	[illegible]	[illegible]	[illegible]	[illegible]
Freezer	0	Chest	[illegible]	[illegible]	[illegible]	[illegible]

<u>Click here to go to the RESULTS tab and see your savings.</u>

Office Equipment Calculator:

Where will your equipment be used?

Commercial or residential use	Commercial	
Location	U.S. average	*U.S. average commercial electric rate is $0.1/kWh. If you know your own rate, enter it below.*
Electric Rate ($/kWh)	$0.100	

What office equipment are you planning to purchase? Enter quantities below, then either fill in product information or use the defaults.

	Quantity	Portion of units turned off at night	Portion of units with sleep settings / low power mode enabled	Speed (images per minute)	Additional cost per unit for ENERGY STAR qualified model
Desktop Computer	0	[illegible]	[illegible]	N/A	[illegible]
Laptop Computer	0	[illegible]	[illegible]	N/A	$0
Computer Monitor	0	[illegible]	[illegible]	N/A	$0
Scanner	0	N/A	N/A	N/A	$0
Copier					
Laser - Monochrome	0	N/A	N/A	[illegible]	$0
Laser - Color	0	N/A	N/A	[illegible]	$0
FAX Machine					
Ink Jet	0	N/A	N/A	N/A	[illegible]
Laser	0	N/A	N/A	N/A	$0
Multifunction Device					
Ink Jet	0	N/A	N/A	N/A	$0
Laser - Monochrome	0	N/A	N/A	[illegible]	[illegible]
Laser - Color	0	N/A	N/A	[illegible]	$0
Printer					
Ink Jet	0	N/A	N/A	N/A	$0
Laser - Monochrome	0	N/A	N/A	[illegible]	[illegible]
Laser - Color	0	N/A	N/A	[illegible]	$0

Consumer Electronics:

What equipment are you planning to purchase? Enter quantities below, then either fill in product information or use the defaults.

	Quantity	Screen size (diagonal inches)	Average hours on per day	Additional cost per unit for ENERGY STAR qualified model
Television	0	[illegible]	[illegible]	$0

Audio/Video	Quantity	Average hours on per day	Additional cost per unit for ENERGY STAR qualified model
Blu-Ray player	0	[illegible]	$0
DVD player	0	[illegible]	$0

Telephony	Quantity	Spread Spectrum Technology	Additional cost per unit for ENERGY STAR qualified model
Cordless phone	0	[illegible]	$0
Additional handset for cordless phone	0	N/A	$0
Combination phone & answering machine	0	[illegible]	$0
Answering machine	0	N/A	$0

Carbon Emissions reduction Calculator:

Average Electricity Cost = per kWh
Average CO2 emmision per kWh= lbs/kWh

Equipment/Appliance	Quantity In Use[1]	Typical Use, Hours/Day	Average Running Wattage	Cycle Time[3]	Monthly kWh	Months/ Year	Yearly kWh	Annual Cost Each	Total Annual Cost	Annual CO2 emissions (lbs)
Coffee Maker					-		-	#DIV/0!	$0	-
Desktop Computer & Monitor[4]					-		-	#DIV/0!	$0	-
Fan					-		-	#DIV/0!	$0	-
Desk Lamp					-		-	#DIV/0!	$0	-
Microwave					-		-	#DIV/0!	$0	-
Tabletop Fridge (<2.5 cu.ft.)[2]				—	-		-	#DIV/0!	$0	-
Small Fridge (2.5-6.4 cu.ft.)[2]					-		-	#DIV/0!	$0	-
Television					-		-	#DIV/0!	$0	-
VCR					-		-	#DIV/0!	$0	-
Space Heater					-		-	#DIV/0!	$0	-
Window AC (9,000 Btu/hr)					-		-	#DIV/0!	$0	-
Window AC (12,000 Btu/hr)					-		-	#DIV/0!	$0	-
Cold Drink Vending Machine					-		-	#DIV/0!	$0	-
Unrefrigerated Snack Machine					-		-	#DIV/0!	$0	-
Other?					-		-			
TOTAL					-		-		$0	-

Appendix E: Consent Form

I volunteer to participate in a room survey conducted by Tyler Travers, Tessa Woodford, Ece Gonul, Kyle Hambly and Paige Jenkins. I understand that this survey is prepared to collect information about the appliances that I have in my room.

1. My participation in this project is voluntary. I understand that I will not be paid for my participation.
2. I understand that the researcher will not identify me by name in any reports using information obtained from this room survey, and that my confidentiality as a participant in this study will remain secure.
3. I have gotten all of my questions answered about the research, and I voluntarily agree to participate in this study.
4. I have been given a copy of the consent form.

____ My Signature

____ My Printed Name

____ Date

____ Signature of the Investigator

For further information please contact:
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gonulece1@gmail.com
tessa.j.woodford@gmail.com
paigeljenkins7@gmail.com
khambly.wfg@gmail.com

Appendix F

Appliance Type	**Energy-Star Certified**	**Appliance Size**	**Rated electricity consumption (kWh/Year)**				
T.V.							
DVD Player							
Blu-Ray Player							
Refrigerator							
				Turned off at night	**Have a sleep setting**	**Average hours on per day**	**Inkjet, Laser (indicate whether it is monochrome or colour)**
Desktop computer							
Printers							
Laptop computers							