

**ENVS 3502: Term Project**

**Wednesday April 9, 2008**

**Assessment of Support for Solar Hot  
Water Heating Systems on the Studley  
Campus of Dalhousie University**

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# **Table of Contents**

Acknowledgments

1.0 Introduction

2.0 Methods

2.1 Setting Description

2.2 Interviews

2.3 Survey

2.4 Document Analysis

3.0 Results

4.0 Discussion

4.1 The Research Process: Limitations and Benefits

4.2 Surveys

4.3 Interviews

5.0 References

Appendices

APPENDIX 1: Survey

APPENDIX 2: List of Disciplines

APPENDIX 3: Responses to Question 8

## **Acknowledgements**

We would like to thank Rochelle Owen, Dr. Ben-Abdallah, Darrell Boutillier and Peter Weiss; as well as Karen Harper and the Dal students who participated in our survey.

## **1.0 Introduction**

The threat of global warming is becoming an increasing reality. Anthropogenic greenhouse gas emissions are causing irreversible changes to the globe, threatening the survival of many species –including humans. In order to stop our current path to destruction, action must be taken. Since human habits are the source of the problem, they must also be part of the solution. In light of this knowledge, there is a campus wide sustainability movement underway at Dalhousie. There are currently efforts to adopt sustainability into the curriculum, to increase efficiency and to reduce consumption; yet Dalhousie’s energy supply is derived from very polluting sources of energy such as bunker “c” oil. According to facilities management, last year Dalhousie purchased 13,800,000 L of this non-renewable fossil fuel. There has not yet been any commitment to integrate renewable sources of energy into our system. Several other institutions and universities worldwide (including Canada) and have already implemented renewable energies; it is time for Dalhousie to jump onboard. There are priceless environmental contributions as well as financial benefits associated to the use of renewable energies. Incorporating renewable energies on campus would also make a statement about the severity of global climate change.

In addition to economic and environmental benefits, the sustainability movement may also gain social support. There are many projects attempting to educate the population about the need for conservation and efficiency. A physical structure that shows the source of our power might act as a symbolic representation, a reminder of sustainability, and as proof of Dalhousie's commitment to the health of the future.

The student support of renewable energies was unknown. **The purpose of this project was to assess the support and opinion of the student body regarding the implementation of renewable energies on campus, specifically solar hot water heating units.** Solar hot water heating was chosen because it is a renewable source of energy that does not require massive renovations to assure structural integrity and is easily maintained. Surplus energy can be fed back into Dalhousie's network during off-peak hours, and the university would need to buy less fuel and power from the province. The government would cover a percentage of the initial cost, helping Dalhousie's limited environmental budget, and the savings after the payback period could be used to fund other green initiatives.

The importance and contribution of this project will be realized on many levels. Firstly, it could be used as leverage for investors to provide support for renewable energies on campus. Secondly, the knowledge gained by this research will be given to Rochelle Owen so it could be applied to future projects. Thirdly, as we conduct our research, we will have brochures from other sources (such as Clean Nova Scotia and Solar Gain) and will also have extensive knowledge regarding renewable energies (questions from students will only be answered after the questionnaires are completed to reduce bias). Therefore we will act as educators for the participating students, spreading

the knowledge about renewable energies. Additionally, Dalhousie University belongs to the students as much as the faculty and administration, therefore the Dalhousie students should have their opinions heard concerning what should be implemented on campus.

The rationale behind our focus on solar hot water heating is purely practical; while it is a small step, we are aware of activities on other campuses such as St. Francis Xavier University and the University of Oregon who are working to promote this technology, and we believe that our research could help Dalhousie and other universities in their efforts. Furthermore, it is affordable, with many subsidies available to make it more competitive and visible, which we believe may make it an attractive option to policy makers. If we can show that this issue matters to students, it may serve to make use of sustainable energy sources on campus a reality.

There are many institutions that are investing in renewable energies. One such institution is the University of Oregon. They have already conducted their preliminary research and as of 2006 were in the process of applying for funding grants to move forward with a project to provide their campus recreation facility with a solar hot water heating system (UO, 2006). This building contains a swimming pool, locker room showers and regular hot water use as any building would (bathroom taps, etc) (UO, 2006). This project is estimated to be able to provide 50-60% of the pool's hot water needs throughout the year, which will save \$5,320 in energy costs and offset 33 tons of carbon dioxide emissions each year (UO, 2006). They stress that despite being a "rainy" city, this will still be an effective technology (UO, 2006).

Closer to home, there is a solar hot water heating project being implemented at St. Francis Xavier University. This project is not on a recreation facility, but on their Student

Union Building. They used the services of Solar Gain to have the buildings potential assessed for solar hot water heating potential.

Very recently Solar Gain performed an assessment on implementing a solar hot water heating system over the Dalplex parking lot. This project is similar to the project being carried out at the University of Oregon as the facility making use of the system is of the same nature. The Dalplex is Dalhousie University's recreation facility, which is home to a full sized competition pool, showers, and other hot water using facilities such as sinks in kitchens and bathrooms.

The Dalplex was seen as an optimal location for a solar hot water heating system due to its location and potential for a stand-alone structure to support panels, achieving an overall solar potential rating of "Excellent" (Ashworth and EAC, 2008). The roof of the Dalplex is supported by air pressure and therefore is unsuitable as a solar panel location. However, if a carport were constructed over the parking lot, the panels could be positioned to be at their maximum efficiency. A 250-panel solar water heating project has the potential to reduce energy consumption by 49%, to save 1,223,175 L of bunker C oil, \$15-20 thousand savings/year, as well as 2,800 tonnes of GHG emissions (Ashworth and EAC, 2008). This project is foreseen to have a simple payback period of 15-24 years, however when an 8% energy cost inflation is applied, the payback time is reduced to 10-13 years (Ashworth and EAC, 2008).

There are many benefits to the implementation of solar hot water heating at Dalhousie. These include having a visual symbol of sustainability, which is important for Dalhousie as it reflects our commitments to the Talloires Declaration and shows that it cares about the long-term health of its students as well as the environment. Also,

implementing renewable sources of energy could be a feature, which would attract new, environmentally conscious students to the university, as well as provide cost savings over time.

The question that this research aims to address is whether there is support and interest for renewable energy on Dalhousie Campus. A survey will be used to ascertain the opinion of the student population. In addition, the study will help spread awareness throughout the student body concerning their campus and its impact on the environment. Our research was based on the premise that student support for a renewable energy project could be a catalyst for action and therefore our objective was to determine the support for solar hot water heating on Dalhousie's Studley campus.

## **2.0 Methods**

### ***2.1 Setting Description***

Dalhousie University established a presence in Halifax, Nova Scotia, in 1818. The capital of Nova Scotia has always been used as a shipping hub since it was colonized because of its naturally deep and sheltered harbour. Goods can be imported or exported via small to massive container ships, the Canadian transcontinental highway, or the transcontinental railway. The university now has three main campuses, and an assortment of residential and faculty buildings scattered throughout Halifax. The Killam Memorial Library is in the middle of the Studley campus, across the street from the Student Union Building, and within walking distance of residences and faculty buildings.

Renewable energy sources are becoming increasingly popular, and if Dalhousie wants to accomplish its goal of being a sustainable leader in the community, it must show that it is serious. Solar water heating would be a proud symbol of sustainability, and is the most viable renewable energy source at this time.

## **2.2 Interviews**

The first step in our research was to conduct an interview with Rochelle Owen, Director of Dalhousie's new sustainability office. We revised the first draft of our survey to obtain information that she thought would be of use, adding an inductive approach to our methodology. We felt that her expertise contributed to the validity of our survey, and a face-to-face interview allowed us to clarify what and how we wanted to write the questions posed to the students.

Factual background information was gathered in three subsequent interviews with Nouredine Ben-Abdallah, an engineering professor; Darrell Boutilier from Facilities Management; and Peter Howitt, an associate planner with Facilities Management. Due to scheduling difficulties, the only face-to-face interview was with Professor Ben-Abdallah by one member of the team. The other two interviews were conducted through e-mails.

## **2.3 Survey**

We used a non-probabilistic, haphazard approach to survey students about their opinions on renewable energies (Palys, 2008). Although probabilistic sampling would have been ideal, the time and resources allotted for this project made a perfectly random sample model impossible; we felt that this was the best method for gathering a heterogeneous sample of the opinions of the student body. The team did not give students



any information prior to the completion of the survey and they approached the students in a formatted manner to prevent bias. An information pamphlet on different types of renewable energy sources was available upon request (NRCAN, 2006).

The surveys (APPENDIX 1) were distributed between 11 am and 3 pm, March 11th to March 14th . Because the Killam Memorial Library is used by a diverse array of students, most of whom pass by the atrium on their way in or out, the atrium was the focus of our effort. We also surveyed students sitting in the common area of the first two floors overlooking the atrium. The library is a place students visit regardless of their living situation (residence or off campus), their field of study (which may not bring them to buildings such as the Life Science Centre, the Computer Science building, or the Faculty of Arts and Social Sciences), their gender, age, or income, and as such, it was chosen to diminish bias. Any other building on campus may prove to contain various biases which we do not want contaminating our sample. For example, the Student Union Building (SUB) was considered but ruled out due to the fact that the survey will be administered during Green Week, which may make it more prone to generating environmental bias. We also considered the fact that many students visit the SUB for the food services offered, which may reduce the number of students who live on or near campus who could fill out the survey.

The majority of the questions (1-7) were closed-ended, in order to promote ease of analysis and clarity, but we also provided the respondents with space for commentary in the last open ended question (Question 8). Answers from Question 8 were not used for

statistical analysis, but treated as an opportunity to provide new insights or suggestions for further research.

Issues we investigated in Questions 1-7 included: the interest level of the student population surrounding renewable energy sources on campus, what kind of renewable energy sources students would like to see at Dalhousie, whether or not renewable energy makes a school more “attractive” to the potential student and which type would be preferred, how the implementation of a renewable system should be funded, which type of renewable energy source would be the most potent symbol of sustainability, which would be the most aesthetically pleasing, and why students would want Dalhousie to invest in renewables. Renewable energy sources covered in the survey included: solar, wind, tidal, hydro, geothermal, and bio-mass. It was noted within the survey that solar, geothermal, bio-mass, and to a lesser extent wind could be utilized directly on campus. Dalhousie could potentially purchase all forms of renewable energy credits from an energy supplier, or install its own system.

For demographics, we asked for the responders’ age, gender, year of study, and program of study. A future study could determine if there was a correlation between program and the type of answers given.

The information from all surveys were entered into Microsoft Excel for analysis and graphical processing.

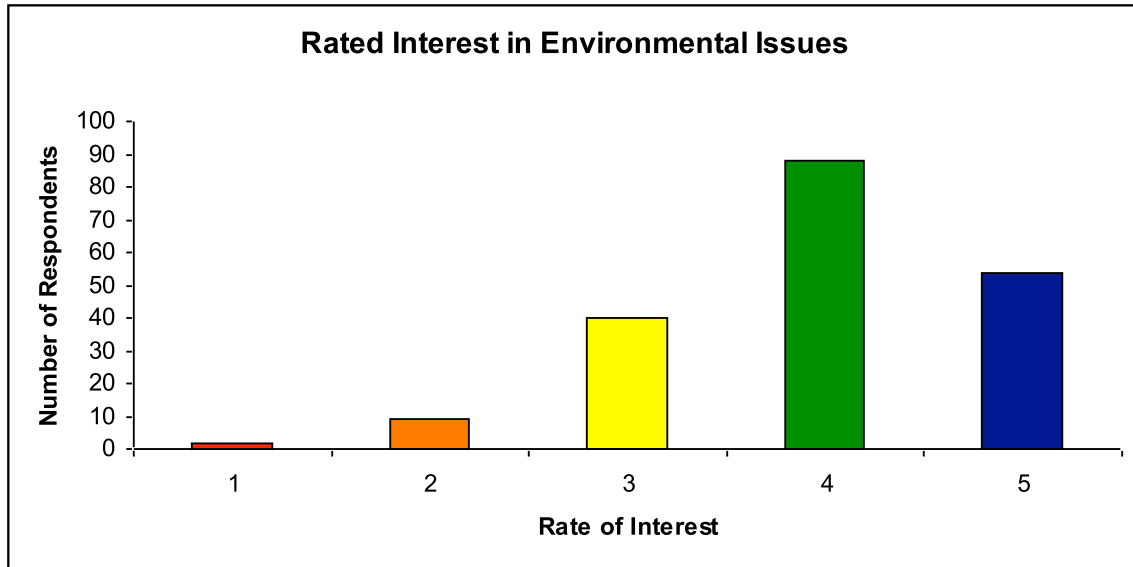
## **2.4 Document Analysis**

An assessment for the installation of a solar hot water heating system for Daalplex was released on March 18th, 2008 by Janice Ashworth and the Ecology Action Centre. This document was analyzed for background information, to determine the feasibility of installation, and run a cost-benefit analysis.

## **3.0 RESULTS**

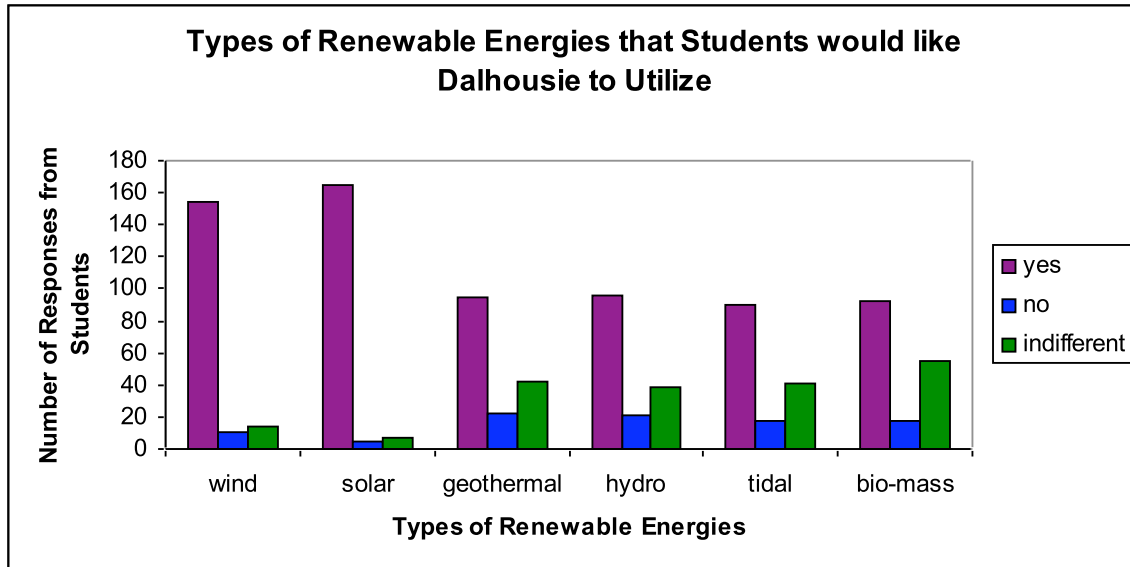
The sample of the Dalhousie student population from the Killam atrium consisted of 200 individuals. Due to incomplete or incorrectly completed surveys, the information from only 195 surveys out of the 200 collected surveys was processed for analysis. The respondents were from 39 different disciplines. The sample of returned surveys was widely varied across disciplines as the Killam is a hub for students from all areas of interests. (APPENDIX 2)

From the surveys analyzed, when asked to rate their interest in environmental issues, the majority of the respondents rated their interest as a 4 out of 5, where 1 was not at all interested and 5 was extremely interested. The next most frequently chosen rating was 5, proceeded by 3, showing a high level of interest among the respondents towards environmental issues. (Fig. 3.1)



**Fig. 3.1** Graph shows the level of interest in environmental issues among the respondents on a scale between 1 (being not at all interested) and 5 (being extremely interested). The displayed results are the total responses for each rate collected from all 195 surveys.

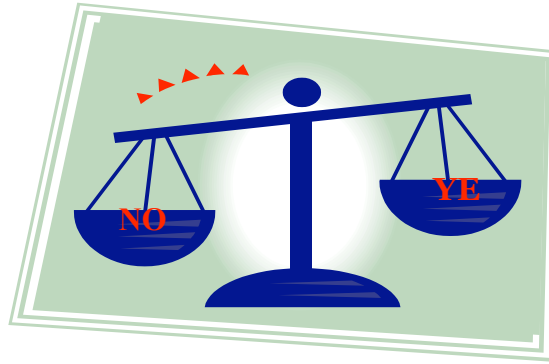
When asked which types of renewable resources of energy they would like to see Dalhousie utilize, the students were most in favour of solar energy, followed by wind. The four remaining types of energies listed all received approximately the same amount of support. (Fig. 3.2)



**Fig. 3.2** The graph shows the types of renewable energies to which the respondents prefer Dalhousie utilize. For each renewable the respondents were asked to reply yes, no or indifferent to show their preference. The displayed results are the total of responses for each of the types of energies from all the surveys analyzed.

The third question on the survey requested their opinion to whether renewable energies would be a feature would be a feature that would attract them to Dalhousie. 60% of the students responded that renewable energies would be an attraction to Dalhousie

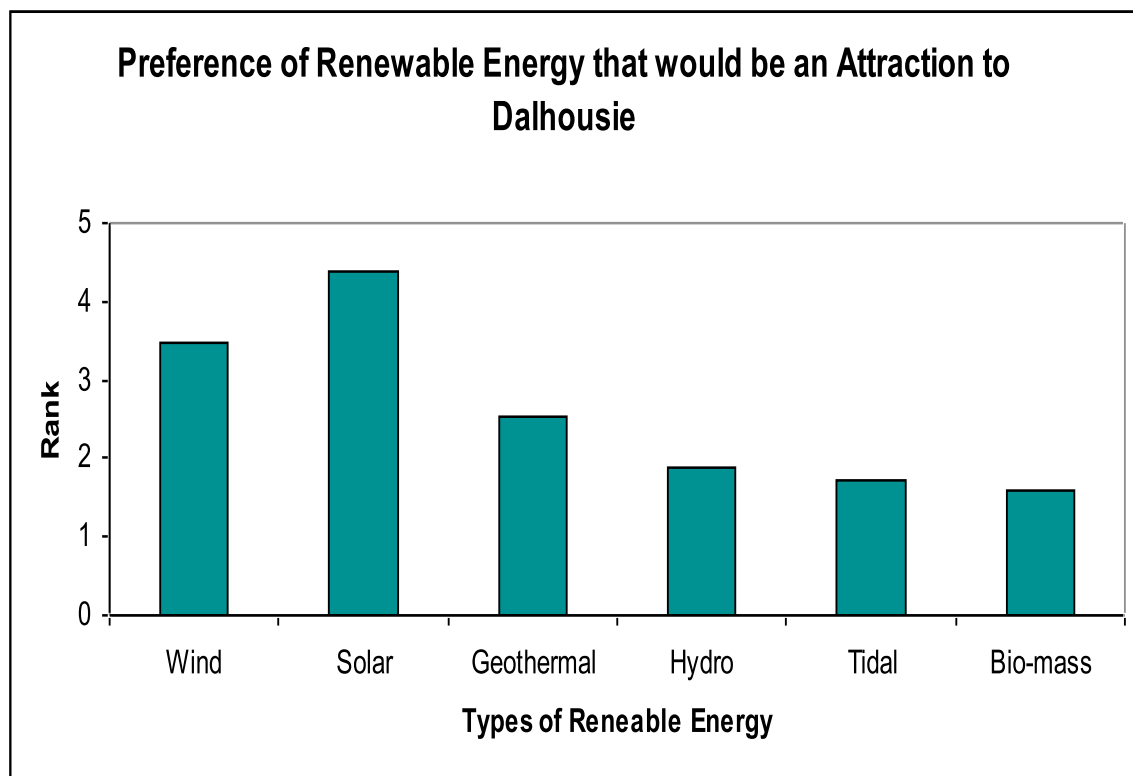
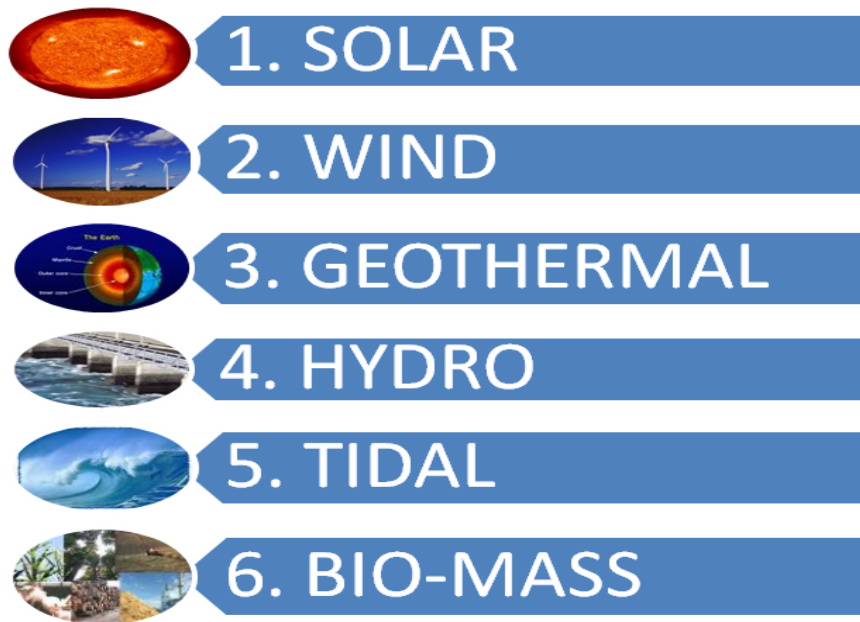
(Fig. 3.3)



<b>YES</b>	<b>NO</b>
115	78

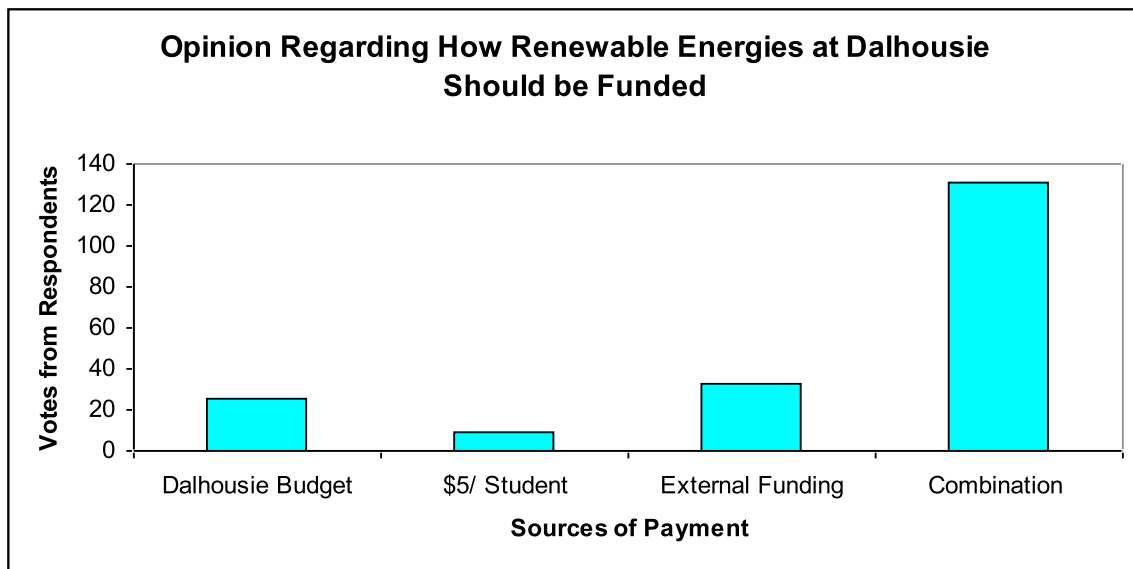
**Fig. 3.3** Table shows the total number of responses “yes” or “no” to whether renewable energies would be features of attraction to Dalhousie.

In addition, we requested those who responded that renewables would be an attracting feature to rank their preference of renewables that would attract them to Dalhousie. The majority of students responded that solar would be their number one choice followed with wind, then geothermal. Hydro, tidal and bio-mass all received the same approximate overall rank of preference. (Fig. 3.4)



**Fig. 3.4.** The ranks from the all the surveys were averaged. On the questionnaire 1 was the highest preference and 6 represented the lowest preference. For the purpose of this visual representation, the total averages were all subtracted from 6 for a more accurate representation of the results.

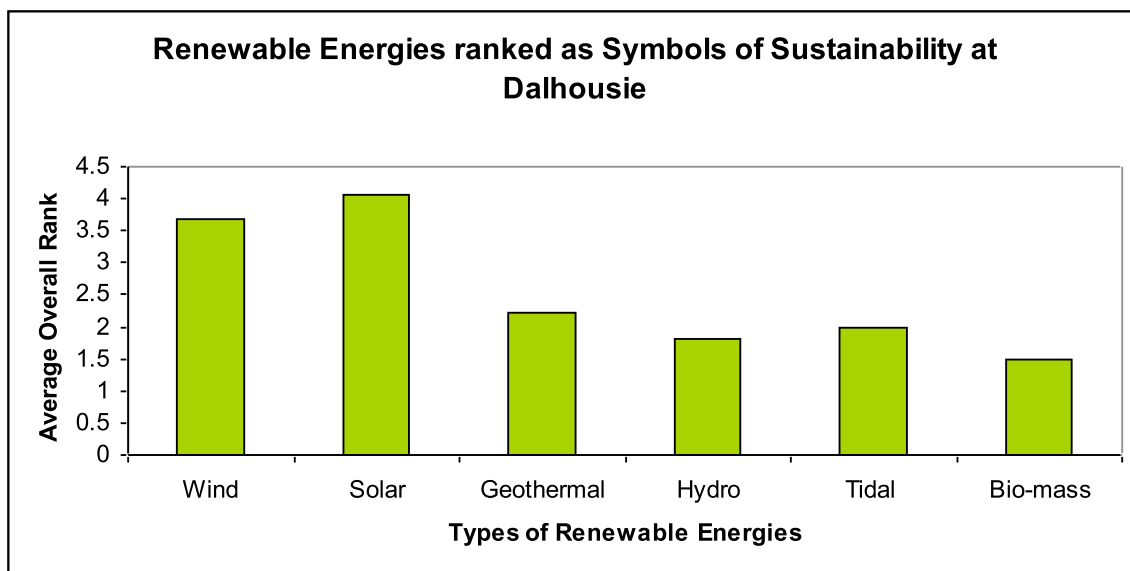
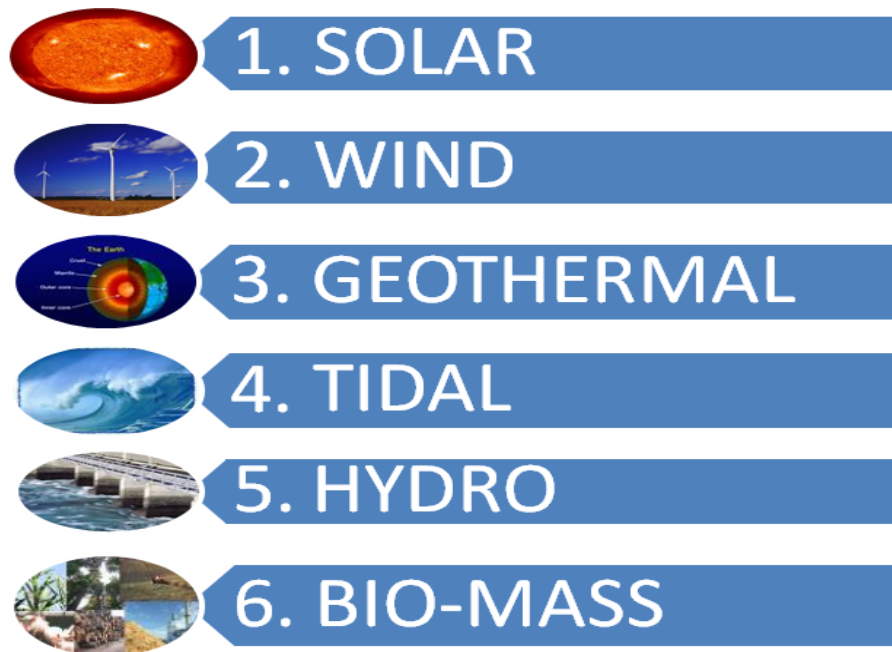
The survey posed to question of how renewable energies on campus should be paid for. The majority of students indicated that they believe that a renewable project should be paid for using a combination of the Dal budget, students paying \$5 and external funding. Payment from the Dalhousie budget and external funding were almost equally chosen and very few students thought that students should have to pay for the implementation of renewable energies. (Fig. 3.5)



**Fig. 3.5.** The graph shows the opinions of respondents regarding how they believe renewable energies at Dalhousie should be paid for. The displayed results are the total of responses for each of the option given in the questionnaire from all the surveys analyzed.

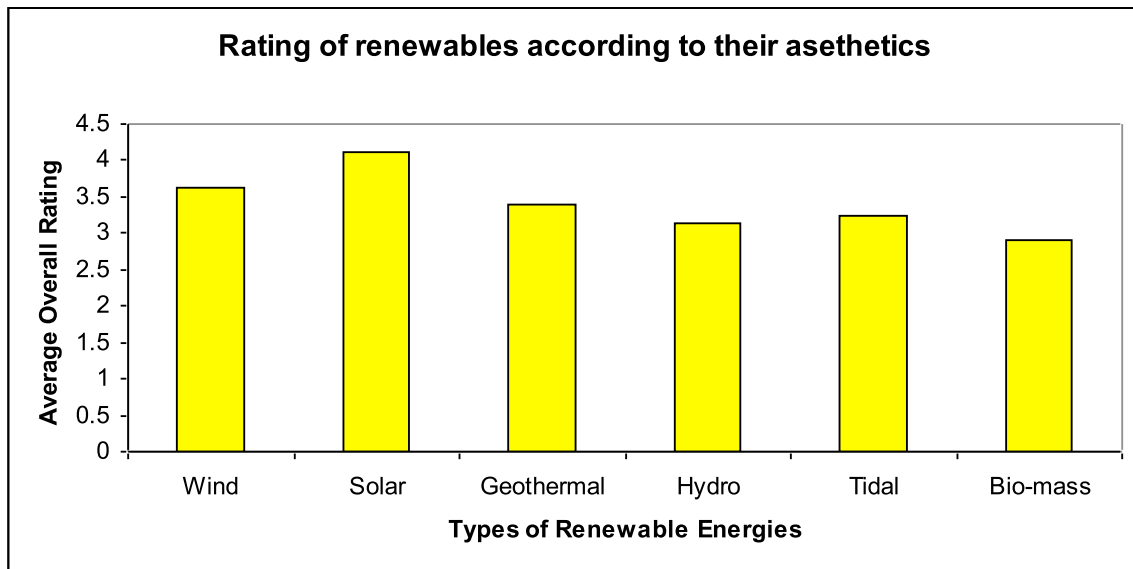
Another question asked the students to rate the listed renewable energies as symbols of sustainability. The students rated solar as the highest symbol of sustainability at Dalhousie campus, wind second; and geothermal, tidal, hydro and bio-mass were all in close third, fourth, fifth and sixth place. (Fig. 3.6)





**Fig. 3.6.** Graph shows which renewable energies are thought to be the most potent symbols of sustainability if at Dalhousie. The ranks from the all the surveys were averaged. On the questionnaire 1 stood for the strongest symbol of sustainability and 6 represented the weakest. For the purpose of this visual representation, the total averages were all subtracted from 6 for a more accurate representation of the results.

To gauge student preference according to the look of renewables, question 6 asked the respondents to rate the aesthetics of each renewable energy on a scale between 1 being not pleasing and 5 being extremely pleasing. This question received very little variance. Solar was seen as the most aesthetically pleasing energy (Fig. 3.7). The remainder of the energies listed had quite similar ratings.

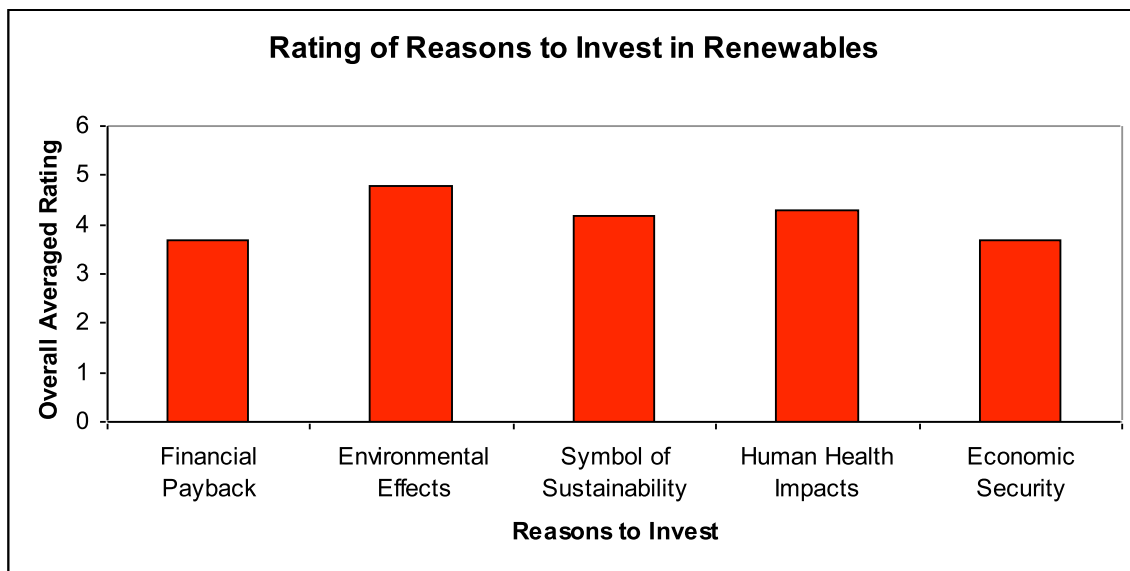


**Fig. 3.7.** Graph shows the response to which renewable energies are considered more aesthetically pleasing. Each renewable energy was rated on a scale between 1 (least pleasing) and 5 (most pleasing). The results from all the surveys were compiled for each energy and averaged.

The final close ended question on the survey asked the respondents why they think it is important to invest in renewable energies. They saw all of the reasons quite important, however the environmental impact followed by human health impacts were the two reasons that received the highest rating (Fig. 3.8). Renewable energies being a

symbol of sustainability closely followed behind. Economic security and financial payback and economic security were rating the least important out of the options given.

-  1. Environmental Effect
-  2. Health
-  3. Symbol of Sustainability
-  4. Payback
-  5. Economics



**Fig. 3.8.** Graph shows the response to reasons why respondents believe it is important to invest in renewable energies. Each reason was rated on a scale between 1 (least important) and 5 (most important). The results from all the surveys were compiled for each energy and averaged.

The final question posed was open ended, and asked whether implementing a renewable energy would be physical proof of Dalhousie's commitment to the sustainability movement. The responses consisted of 69 individuals simply responding "yes", 70 students responding with positive supporting response to the question such as: *"Yes, Universities are not necessarily relied upon to be leaders in environmental sustainability. Implementation of renewable energy sources would solidify Dal's commitment to decrease its carbon footprint."*(Commerce) There were only 9 responses that were not in support of the idea. An example of the type of response was as follows: *"No, could be seen as political positioning or simply an attempt to attract students who are becoming more environmentally conscious."* (Microbiology and Immunology)

(APPENDIX 3)

Overall results from the analysis of the surveys suggest that the student body is in favour of Dalhousie utilizing renewable energies. Solar energy was the energy that was most commonly favoured across all of the questions posed.

## **4.0 Discussion**

### ***4.1 The Research Process: Limitations and Benefits***

Although care was taken when planning the methodology, some limitations exist. Time being the most significant. The project was to be completed by the end of the winter semester of 2008, and most of the work was done out of class time. The team's schedules were therefore an important limiting factor, especially when administering the surveys. Initially, a desired quota of 300 was planned in order to ensure a statistically significant sample; unfortunately, this proved impractical when the time came to administer the

surveys. There were approximately four days in which to collect data and scheduling conflicts proved too difficult to overcome. The research method was then reconsidered, and a new quota of 200 was set and reached within the allotted time. Although the new quota was lower than ideal, it still is accurate to +/- 7%, based on a population size of 8,000 on the Studley campus and a 95% confidence interval.

Seasonal issues may also have played a role in the research. While the survey design was not biased toward solar energy or solar hot water heating systems, the solar option was consistently favoured over all other renewables. The fact that the questionnaires were administered in the early spring may have influenced the results, as students may have been mindful of the changing weather conditions and thus more considerate of the benefits of the sun. Conversely, it could be argued that the spring weather was working against the solar energy option, as the sporadic presence of the sun in spring may have reminded students that Nova Scotia is not always sunny. While weather and seasonal issues are important to consider, the required timing and short duration of the research meant that we were unable to fully explore their potentially complicated effects. Taking weather effects into consideration would have required that it be consistently monitored throughout the duration of the surveying, and that results from rainy days be compared with results from sunny days. Clearly this kind of consideration was beyond the reach of our survey, but this does present a potential direction for future research.

Overall, the three tiered approach used to research solar hot water heating on campus proved to be a fruitful one. Our document analysis was an essential tool, as it

functioned as both a motivating force and a measure of feasibility. Knowing that St. Francis Xavier had already done such a project was crucial in the beginning, as it pointed not only to action in a similar institution, but also in a similar climate. Any issues St. Francis Xavier encounters may make staying on course easier for Dalhousie should they decide to implement solar hot water, thus reducing unexpected risk. The Dalplex solar assessment was another document which was essential to our project, as it provides tangible proof that implementation is possible on Studley campus. The comprehensive nature of the assessment accounts for the feasibility, the costs and the benefits; Our questionnaire complemented this nicely, providing the evidence for student support. The third method used, interviews, was done in order to further probe feasibility as well as to investigate what, if anything, could prevent a solar hot water system on campus.

#### **4.2 Surveys**

Overall, students displayed a high level of interest in environmental issues, as was illustrated by the response to question number one on the questionnaire. This was the anticipated result, as environmental issues have been a focus of intense media scrutiny and an emerging social issue in recent years. Events such as Live Earth and movies such as "An Inconvenient Truth" and "The Eleventh Hour" have brought environmental issues into the realm of pop culture and educated the masses, and there has been a notable emphasis on climate change in particular. A strong positive response toward Dalhousie's use of renewable technology gave the impression that students feel Dalhousie should be contributing to finding environmental solutions.

The overall preference for solar energy shown in questions two, three, five and six

was a positive and somewhat unexpected outcome of the questionnaire. While the research was carried out in order to explore the attitudes of students toward solar hot water heating, the approach taken was intentionally broad. Including all forms of renewable energy in the survey options was meant to both decrease bias and provide a broader overview of student opinion for use in future projects. While we expected wind and solar to dominate due to the fact that they are well known energy sources, the consistent dominance of solar, even in questions of aesthetic appeal, was unexpected. Wind received responses that were more polarized; some indicated that it was preferable, while others disagreed strongly with its use, indicating reasons such as vibrations, noise and avian kills; this strong distaste for wind among some individuals may account for the overall domination of solar in the results.

Question number four was asked in order to gain an understanding of how students believe renewable energy should be funded on campus. Despite the fact that renewable systems pay back the cost of installation over their lifetime, the initial expense involved in installing these systems can be a deterrent. Funding is an essential issue when it comes to implementing renewable energy on campus, so this question was of great interest. Students were asked to check one of four responses, including the options such as funding from the Dalhousie budget, external funding, a five dollar student levy, and a combination of more than one of the aforementioned. Not all students restricted themselves to checking just one option, and while this did complicate the analysis of this question, it also worked in our favour by making preferences more clear. Overall, students chose a combination of the available options, but it was clear from the responses

that the preferred combination did not include a student levy. Only 4% of students who responded were in favour of a student levy, and when people chose more than one option, student levies were overwhelmingly ignored. Thus, it appears that students would prefer a funding combination from Dalhousie's budget and outside sources. There could be any number of reasons for this result; it may be a reflection of the burden of student debt, or it could indicate that students feel that Dalhousie should be creating a sustainable campus for students, as opposed to students creating a sustainable campus for Dalhousie. Regardless of the reasons, this result sends a very clear message that students do not believe that they should pay more for renewable energy on campus.

In order to further probe the funding issue, we asked students for the reasons why they believe that investing in renewable energy is important. Options listed in the survey included environmental effects, health benefits, symbol of sustainability, payback period, and economics. Environmental effects were the most frequently cited reason for investment. Since renewable energy is often marketed as an environmentally conscious choice this result was no surprise, but there was no further expectation for the remainder of the answers. Investing for environmental effects was followed closely by investing to gain health benefits. This was an interesting result, as it emphasized first the biocentric benefits followed by the anthropocentric benefits, indicating that students believe investment in the environment is important for its own sake. That said, the most significant implication of this question may be drawn from what students did not cite as an important reason for investing; monetary returns and economics were the least cited reasons for investing, which suggests that money issues are not as important to students



as maintaining overall health and well being and students regard renewable energy as being important at a values level more than an economic level.

It became apparent during the administration of the questionnaire that many people did not feel that their knowledge of renewable energy was sufficient to the task. While no numbers were recorded concerning the frequency of this type of response, all of the researchers met with reluctance and expressions of concern from respondents, with people citing lack of knowledge as their reason on several occasions. While it was acknowledged that the general student population may not have very much background in this subject area, the researchers were nonetheless surprised by the frequency of expressed discomfort. Despite this discomfort, most people responded favourably when given the explanation that the research was seeking student opinion regardless of background and previous knowledge. This negative reaction was in sharp contrast to the positive responses which our open question (number 8, see appendix) prompted, and this response coupled with the popularity of the educational literature offered was taken as a sign of interest among respondents. Due to the fact that our survey was relatively long (taking upwards of 15 minutes to complete), meaningful feedback on the open question was not necessarily expected; thus, it was a pleasant surprise when the majority of respondents (76%) replied, and a greater surprise when 42% left a sizeable commentary. When we considered the concern expressed by students in combination with the fact that our open question received overwhelmingly positive responses, we took this as a sign that people were highly interested in renewable energy despite a lack of knowledge. Bearing this in mind our **first recommendation** was formulated: **Dalhousie should offer an**

**accessible course on renewable energy.** Accessibility is key, as a course with no prerequisite can benefit all interested students, whether they have a background in science, the arts, or a profession such as nursing. Topics covered in the course could include the basic workings of different systems, the economics involved, and the suitability of different technologies to different environments; the outcome would be a raised awareness among students (even those who do not take the course would be reminded of renewable energy options), an enhancement of environmental programs, and a student body better equipped to make choices in the future.

### ***4.3 Interviews***

The interview process was an essential component of our research, allowing us to understand the current state of energy use at Dalhousie as well as the possibilities for future implementation of renewables. Interviews with facilities management were unable to provide precise information on how much bunker c oil is used specifically for hot water heating on campus, so an understanding of the exact impact of hot water heating was elusive. We deemed the research worthy despite this, reasoning that hot water heating still accounts for some portion of the bunker c oil used, and that the environmentally damaging qualities of this type of fuel make offsetting even a small portion of it a desirable goal.

Because our research was driven by the greening the campus movement, we were particularly interested in the idea of integrating education and renewable energy. Our interview with Dr. Ben-Abdallah was undertaken with the intention of finding out if an on campus solar hot water heating system could be a useful teaching tool within the

environmental engineering department. While this was a small component of our research, it was an important component; evidence that a solar system could be useful in an educational context would add to the incentive for the administration of Dalhousie to implement these technologies. We expected some issues with liability, especially in terms of rooftop systems, and Dr. Ben-Abdallah confirmed that this was in fact an issue.

However, it could be argued that liability issues could be overcome by signed waivers, and the installation of railings. Another issue which was discussed in this interview was feasibility; from a technical perspective, we wished to know what issues exist with installation in both new and old structures. While Dr. Ben-Abdallah was careful to specify that each building would need a proper evaluation to determine whether solar hot water heating was practical, he did point out that some buildings would likely never be suitable due to low hot water use or structural issues. He explained that retrofitting is a very costly and risky undertaking, and that unless a system is being replaced, it is unlikely that it should be converted. It was this insight, as well as feedback from facilities management, that led to the formulation of our second recommendation.

**Our second recommendation is the implementation of solar hot water heating systems on Studley campus.** While we recognize that installation is impossible in some cases, assessments of structure and placement can be done by non profit organizations at no cost to Dalhousie; Specifically, we recommend a practical strategy with a focus on the residences on Studley campus and Dalplex. In interviews with facilities management, it was found that the residences Sherriff Hall, Howe Hall, and Eliza Ritchie have water heating systems which are reaching the end of their life cycle within the next five years.

In preparation for this, assessments should be done in order of the date of expected system failure, and after feasibility is evaluated, a strategy for establishing solar hot water systems in residences deemed suitable should be planned. This stage in the planning process could create yet another learning opportunity. Students could be involved in researching funding options and writing proposals, working with Dalhousie and more specifically, staff such as director of sustainability Rochelle Owen to bring this project to fruition. As practical experience is often an aspect that is missing from university programs, this could be of benefit to Dalhousie both in terms of improving the learning opportunities of students and in offering a marketable quality within environmental programmes.

While this research is not a solution for all of the buildings on Studley campus, it is one option of many that Dalhousie can act on to offset its contribution to climate change. Students of Dalhousie are strongly in favour of the use of renewable energy sources on Studley campus, and have voiced their support for solar sources in particular. While they do not believe that they should be paying more for renewable energy, there are many sources of funding which can assist Dalhousie in taking this important step, and this research suggests that they should do so. In addition to having sources of funding, Dalhousie also has the unlimited resource that is student enthusiasm. With many variations on environmental programs, many students would be happy to work with Dalhousie to assist in any effort to implement a solar hot water heating system on campus. Solar hot water heating is both possible and wanted on Studley campus; Dalhousie can and should take action.

## 5.0 References

Ashworth J, Ecology Action Centre (2008). Solar Hot Water Assessment Report: For Service Hot Water. Also attached.

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Natural Resources Canada (2006). Quick Facts on Renewable Energy: It's Only Natural!  
[http://www2.nrcan.gc.ca/es/erb/CMFiles/qfacts\\_e164PCP-732002-6674.pdf](http://www2.nrcan.gc.ca/es/erb/CMFiles/qfacts_e164PCP-732002-6674.pdf)

Palys T, Atchison C (2008). Research Decisions: Quantitative and qualitative perspectives. Nelson, United States. 4th Edition.



5. Which of these sources of renewable energy would be the most potent symbol of sustainability at Dalhousie? (please rank: 1 being the strongest, 6 being the weakest)

- \_\_\_ Wind
- \_\_\_ Solar
- \_\_\_ Geothermal
- \_\_\_ Hydro
- \_\_\_ Tidal
- \_\_\_ Bio-mass

6. How aesthetically pleasing do you think these sources of renewable energy could be? (1 being not pleasing at all and 5 being extremely pleasing)

	Not at all			Extremely	
Wind	1	2	3	4	5
Solar	1	2	3	4	5
Geothermal	1	2	3	4	5
Hydro	1	2	3	4	5
Tidal	1	2	3	4	5
Bio-mass	1	2	3	4	5

7. Why invest in renewables? (1 being not at all important, 5 being extremely important)

	Not at all			Extremely	
Financial payback	1	2	3	4	5
Environmental effects	1	2	3	4	5
Symbolism of movement towards sustainability	1	2	3	4	5
Human health impacts	1	2	3	4	5
Economic security	1	2	3	4	5

Other: \_\_\_\_\_

8. Would implementing renewable energy be physical proof of Dalhousie's commitment to the sustainability movement? (please write as much as you would like)

**Thank you for your participation in our research.**

Age:

Program:

Year: Under Grad: 1 2 3 4 5

Graduate: 1 2 3 4 5

Gender: M or F

# APPENDIX 2

## LIST OF DISCIPLINES OF RESPONDENCES: 39 Disciplines

1. Bachelor of Arts
2. Bachelor of Sciences
3. Biology
4. Chemical Engineering
5. Classics
6. Clinical Research
7. Commerce
8. Community Design
9. Computer Science
10. Contemporary Studies
11. DISP
12. Engineering
13. Environmental and IDS
14. Environmental
15. English
16. French
17. Health Science
18. Health Promotion
19. Health and Human Performance
20. History
21. International Development Studies
22. Kinesiology
23. Law
24. Management
25. Marine Biology
26. Medicine
27. Medical Physics MSc
28. Microbiology and Immunology
29. MPA
30. Music
31. Neuroscience
32. Nursing
33. Political Science
34. Recreation Management
35. Social Anthropology
36. Social Work
37. Sociology PhD
38. Theatre
39. Therapeutic Recreation



# APPENDIX 3

## Survey Responses to QUESTION 8.

### **Simple YES/definitely/for sure responses:**

69 responses

Respondents were from the following disciplines:

Bachelor of Arts  
Bachelor of Sciences  
Biology  
Clinical Research  
Commerce  
Contemporary Studies  
DISP  
Engineering  
Environmental and IDS  
Environmental  
English  
French  
Health science  
History  
International Development Studies  
Kinesiology  
Law  
Management  
Marine Biology  
Medicine  
Microbiology and Immunology  
Neuroscience  
Political Science  
Recreation Management  
Social Anthropology  
Theatre  
Therapeutic Recreation

# **COMMENTS with disciplines:**

## **Supportive responses**

70 responses

"It depends upon how it's implemented and on what scale. If Dal just implements the minimum to say that they are becoming a green university, then I think it's a waste of money. I also think that Dal should look at implementing renewable energy as a unified plan, not in terms of a bits and pieces approach in order to save money."

- Bachelor of Arts

"Yes! It would mean a lot of restructuring and initial financial investment which would symbolize Dal's commitment."

- Bachelor of Arts

"Yes. It would also be an excellent on-campus opportunity to learn first hand and apply our knowledge about sustainability, and could be used in various departments and academic programs including: Management, Biology, International Development Studies, Environmental Programs, etc."

-Bachelor of Arts

"Of course! It seems as though everyone is "trying", but only to please the people who are really for it or to appease their own conscience. I really like hearing about institutions that are making real changes NOW (i.e. ->no plastic bags at Superstore, Quinpool!)"

-Bachelor of Arts

"It would probably offer some sort of commitment to sustainability. It would be excellent PR for the school and offer an opportunity for students to get a first hand view of renewable energy sources."

-Bachelor of Science

"Using renewable energy would give support to the idea of Dalhousie being part of the sustainability movement. This would show that Dalhousie is interested in not only educating individuals about sustainability but also in putting these ideas into practice."

-Bachelor of Science

"For sure, it would at least show some initiative."

-Bachelor of Science

"Absolutely- the campus is so large I'm sure it uses a ridiculous amount of energy. It would also set an example to other universities."

-Bachelor of Science

“Renewable energy seems to be moving in a very positive direction. Dalhousie would impress me if renewable energy were implemented into the university’s energy sources.”

- Bachelor of Science

“Of course, it would be something Dalhousie could be proud of and it would be nice to see some real initiative taken towards protecting the environment.”

- Bachelor of Science

“Yes, if it was upheld and supported”

-Bachelor of Science

“It would be good but if they are anything like the government it would probably be just talk.”

-Biology

“Absolutely. There is much talk at campuses all over Canada, but little action. Dal could potentially be a leader in this field if it chooses to take part.”

- Biology

“Yes. But I doubt they will, as they would balk at the up front costs of doing so.”

- Biology

“Yes. There are already companies such as pulp and paper, and plastics/food manufacturers that are using renewable energy. This allows the company to not be affected by the very high and rising price of gas. Also, running out of oil will not affect them. Dal would hopefully start a trend for other universities.”

-Chemical Engineering

"Sure. More than that, I think it would provide a direct connection (amongst students and the community) to the use of renewable energy, and in doing so prompt student members of the peninsular community to think (here) about how and by whom renewable energy sources could be use (sic). It would make Dartmouth jealous."

-Classics

"Yes. The more visible and promoted the better."

-Classics

"Yes- it's easy to sit back and say the changes would be good, it's another to actually implement them."

-Commerce

“Yes, Universities are not necessarily relied upon to be leaders in environmental sustainability. Implementation of renewable energy sources would solidify Dal’s commitment to decrease its carbon footprint.”

- Commerce

"I think it’s a step in the right direction, but more could be done."

-Commerce

"Yes, without implementing renewable energy Dalhousie wouldn't be doing its part in making a change to better the environment."

-Commerce

“Yes. If done for the right reasons I think it would be a great commitment.”

-Commerce

"Yes, Dalhousie could set an example for other universities."

-Community Design

“Yes- I believe that implementing renewable energy will prove to the city of Halifax and hopefully to other post-secondary institutions that Dalhousie is serious about taking environmental issues into our own hands and pushing for a change.”

-Community Design

“Absolutely. Wind turbines on our roof would be sick.”

-Computer Science

“Investing of new energies is being important nowadays as oil prices are getting rise and industrial grow. Yes it would.”

-Engineering

“If a country committed to renewable energy, it would be extremely respected from the other nations. Now if a university did so, I believe it would gain the respect of other academic institutions.”

-Engineering

"Yes, I then feel it would show Dalhousie's commitment to sustainability and global responsibility."

-English

“It will be very apparent.. In fact, Dalhousie’s Science & Engineering departments should be involved in the implementation, research, and the application of these processes to help with sustainability”

-English

"Yes, we need to be safe for future generations."

-English

"Yes, this would prove that Dalhousie is committed to becoming more sustainable/ a leading force in the greening the campus movement."

-Environmental

"Yes, it would send messages to Halifax and other universities that the students care about the environment and are taking action."

-Environmental

"Yes, it would set us apart from other universities and would get students and faculty thinking about environmental issues in general."

-Environmental

"It might HELP to prove that Dalhousie has sustainability in mind. It wouldn't convince me completely. A university is a business, and as such is concerned with profits. We should be of the frontrunners in environmentally friendly initiatives, and renewable energy would be a good start."

-Environmental

"Yes, Dal needs to start taking its environmental initiatives seriously. Visible symbols of sustainability remind current students and attract new ones by putting environmental stewardship at the forefront."

-Environmental

"Yes, just saying that Dal bucks the whole enviro-friendly wave isn't much unless people can see what is going on."

-Environmental/ International Development Studies

"Yes it would be, however I think Dal would use it more as a symbol and it may not actually be implemented properly."

-Health Promotion

"Yes, but right now they have no commitment, they really don't care."

-Health and Human Performance

"Yes, dal is not doing enough as it is, they should take a more progressive approach than what they are now. Even should focus on small things that could make a big difference (i.e. Make it mandatory to have double-sided printing). Even papers passed in to profs."

-International Development Studies

"Yes! Shows they practice what they preach."

-International Development Studies

"Absolutely! Being committed to a cause takes more than words, physical proof means that the school is serious about sustainability and is not simply saying it is."

-International Development Studies/ Environmental

"Yes, but (it) needs to be consistent with all practices on campus, or at least move toward this."

-International Development Studies Masters

"Yes. Even if only a small difference it can still set precedence for other schools."

-International Development Studies/Political Science

"Yes as well as possibly creating a unique aspect of Dal as a university and bringing more students to the campus."

- Kinesiology

"Yes, it shows how our students and faculty cares"

-Management

"Definitely. Energy is a huge use of non-renewable resources, so being run completely (or even mostly) by renewable energy sources would be a big step towards a sustainable campus."

- Management

"Yes it would, because it shows proof and symbolizes the new movement for change at Dal."

- Management

"Yes. Taking a step in this direction might also influence other universities as well."

-Management

"Of course- as a university that is so close to the ocean, showing that we want to use more environmentally friendly resources would be a inspiration to young and old students. And as a school known for sciences, such as enviro and bio, it would draw more students."

-Marine Biology

“Would help, Dal really needs to take steps to increase its sustainability.”

-Marine Biology

“Yes, they would set an example for other universities, encouraging and teaching the students at universities to have an environmentally stable future.”

-Math/ Bachelor of Science

“Yes- it’s also a viable advertising advantage as long as it’s committed to fully.”

-Medical Physics MSc

“Yes, as long as it was a legit attempt with good funding.”

- Microbiology and Immunology

"Yes. Specifically for the faculty of management which promotes sustainability through the "Management without Borders" initiative yet burns horrible fuel to heat the building ("bunker C fuel"). It is hypocrisy!"

-MPA

“Yes. We need all the commitment to (and visibility of) sustainability that we can get. If renewable energy was implemented in a way that was effective, visible, and aesthetically pleasing, Dal could end up sending a powerful message to ordinary citizens as well as becoming a leader among universities!”

-Music

“Yes!! IT will set an example for other universities and organization. As an educational institution, Dalhousie should lead by the morals it preaches in environmental issues.”

-Neuroscience

“Implementing renewable energy would be proof of Dal’s commitment to sustainability by showing their genuine concern about the environment, financial saving and overall health of the student body.”

-Nursing

“Yes, it would be an innovative and progressive step that would be an example for universities and people alike of the next generation’s motivation for environmental and human sustainability working hand in hand.”

-Political Science/ French

"Yes, clearly-what better way to commit to sustainability than to take action on such a grand scale? With the amount of resources a university of this size requires, even just a start in using such energy resources would be a huge difference."

-Social Anthropology

"Absolutely. How can they claim otherwise unless they are fully engaged? Furthermore, as an institution that is highly respected in the community they have a responsibility to take a leadership role."

-Sociology PhD.

"This is a "no brainer" Dal has the ability and the space to create, manufacture and even sell some of these products for home owners! For using geothermal in new homes Dal could create the tubes needed to harness the heat.

If Dal started to think about the atmosphere maybe other universities would follow – maybe Dal could pressure our government to think about these methods too!!"

-Sociology

"It might be a sign of tokenism in the sustainability movement, or less a move toward sustainability and more about long-term cost saving."

-Social Work

"I believe that Dalhousie as a leading University in the study of advanced science and scientific research owes a responsibility within its community to understanding, assessing and educating about renewable energy."

-N/A

"Yes, I definitely love such thing if Dalhousie can get these proof, which also an Environment campaign to advertise Dal as good technology research something like that."

-N/A

## **Questioning and non supportive response**

9 responses

"Depends on how they go about it, if they start renewing a source of energy they must continue hard with the project, and not just do it for financial reasons."

-Bachelor of Science/Bachelor of Arts

"It would indicate that Dal is aware of environmental concerns and taking steps towards a solution. Not proof on its own but in combination with other initiatives."

-Community Design



"Not important but it will be a good way to share the effort of saving the environment."

-Engineering

"Not entirely, but it is a good step."

-Engineering

"No, it depends on multiple commitments to multiple types of environmental issues. Energy is not the only sustainability issue at Dalhousie"

-Health Promotion: Policy and Research

"Not really because there are so many other things that could be done... More water fountains instead of vending machines."

-International Development Studies/Economic

"No, could be seen as political positioning or simply an attempt to attract students who are becoming more environmentally conscious."

-Microbiology and Immunology

"No, it'd be a good start though."

-Political Science

"Unless development can go to significantly supplement or replace existing dependency on energy, the action would face the criticism of being hollow and more PR oriented. It would be inauthentic, opportunising on media hype."

-Sociology and anthropology